Relationship between Stock Market Index and Macroeconomic Indices: Empirical Evidence from Bangladesh

Dissertation submitted to the University of Dhaka

for the degree of Doctor of Philosophy in Business Administration

By

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Institute of Business Administration

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DECLARATION BY SUPERVISOR

This thesis has been submitted for the degree of Doctor of Philosophy of the University of Dhaka with my approval as the supervisor.

Dr. Md. Jawadur Rahim Zahid, Professor, Institute of Business Administration

Signature .... Date ....

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Abstract

Stock market is often believed to be a predictor of the economy in which it operates. We try to find empirical evidence defining the relationship between stock market index and macroeconomic indices of Bangladesh. Specifically, we investigate to see if there exists any relationship between Dhaka Stock Exchange General Index (DSEGEN) and some important macroeconomic variables which represent the economy of Bangladesh. Based on the objectives, following six specific research questions are investigated: (1) Does any significant long-run association exist between DSEGEN and six macroeconomic variables viz.; industrial production index, interest rate, inflation, exchange rate, money supply and gold price? (2) Is there any short-term relationship between DSEGEN and the macroeconomic variables? (3) Is there any causal relationship between DSEGEN and the macroeconomic variables? (4) Are the relationships same between DSEGEN and the macroeconomic variables in bubble, meltdown and recovery periods of the stock market? (5) Does any relationship exist between DSEGEN volatility and the macroeconomic volatility? (6) What is the relationship between DSEGEN and the real economy of Bangladesh?

This study has used the macroeconomic version of the semi strong EMH and macro variable model of the APT to investigate the aforesaid research questions using sophisticated econometric tools - such as Vector Autoregression, Granger Causality, Johansen and Juselius Cointegration, Autoregressive Distributed Lag (ARDL), and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The investigations on 25 years data, from January 1991 to December 2015, have revealed that there exists a long-run equilibrium relationship and a short-run disequilibrium between the stock market and the macroeconomic variables in Bangladesh. Also, the stock market has Granger caused only two macroeconomic variables - industrial production and exchange rate, but the opposite is not true.

Among the catastrophes of 1996 and 2010, structural instability is found around 1996. The findings have also indicated that the exchange rate and the interest rate are at least partially responsible for the bubble creation and bubble crash of 1996. The explanatory power of the macroeconomic variables to explain the stock market return varies across bubble, meltdown and recovery periods of 1996 indicating that the stock prices are sometimes partially driven by fad and fashions, which are not related to the economic factors. Furthermore, no leverage effect is seen in the stock market volatility, although a shock has persisted over many future periods. The market volatility has showed instability throughout the period revealing that the volatility of the market is a problem in Bangladesh. Moreover, the outcome of the study has also revealed that despite numerous reform measures and the automation initiatives being implemented since 1998, stock market in Bangladesh is not yet that much developed to play its due role in influencing the real economy.

Declaration

I hereby declare that this thesis, and the research underpinning it, is entirely my own work and that this thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree.

Singed: __________________ Dated: ________________

Md. Rafiqul Matin

To the memory of

my mother, who was constant source of inspiration of my life;

my father, who is consistently supporting all my endeavors; and

my wife, my son and daughter, who have encouraged me all the way.

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List of Abbreviation

ADF	Augmented Dickey-Fuller
APM	Arbitrage Pricing Model
APT	Arbitrage Pricing Model
AR	Autoregressive
ARCH	Autoregressive Conditional Heteroscedastic
ARDL	Autoregressive Distributed Lag
AR-GARCH	Autoregressive- Generalised Autoregressive Conditional Heteroscedastic
ARIMA	Autoregressive Integrated Moving Average
BDT	Bangladeshi Taka
BSE	Bombay Stock Exchange
CAPM	Capital Assets Pricing Model
CCH	Chan, Chen, and Hsieh
CMDP	Capital Market Development Program
CPI	Consumer Price Index
CRR	Chen, Roll and Ross
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum Squares
DDM	Dividend Discount Model
DMB	Deposit Money Bank
DSE	Dhaka Stock Exchange
DSEGEN	Dhaka Stock Exchange General Index

ECM	Error Correction Model
EGARCH	Exponential Generalised Autoregressive Conditional Heteroscedastic
EMH	Efficient Market Hypothesis
FSRP	Financial Sector Reform Project
FTSE	Financial Times Stock Exchange
GARCH	Generalised Autoregressive Conditional Heteroscedastic
GDP	Gross Domestic Product
ICAPM	Intertemporal Capital Asset Pricing Model
IPI	Industrial Production Index
ISE	Istanbul Stock Exchange
JJA	Johansen and Juselius Approach
KLCI	Kuala Lumpur Composite Index
KPSS	Kwiatkowski, Phillips, Schmidt, and Shin
LAN	Local Area Network
LA-VAR	Lag-augmented Vector Autoregression
LM	Lagrange Multiplier
NPV	Net Present Value
NSE	Nigerian Stock Exchange
NYSE	New York Stock Exchange
OLS	Ordinary Least Squares
PBR	Price to Book Value Ratio
P/E	Price Earning
PP	Phillips and Perron

RWM	Random Walk Model
S&P	Standard & Poor
SENSEX	Sensitivity Index
SES	Stock Exchange of Singapore
TSE	Tokyo Stock Exchange
UK	United Kingdom
US	United States
USD	United States Dollar
VAR	Vector Autoregression
VEC	Vector Error Correction
VECM	Vector Error Correction Model
WAN	Wide Area Network

Chapter 1

Scheme of the Research

1.1 Introduction

A stock market is often seen as an indicator or predictor of the economy in which it operates. Many believe that large current decreases in stock prices are reflections of a future recession, whereas large current increases in stock prices suggest future economic growth (Comincioli, 1996). The traditional "valuation model of stocks" and the "wealth effect" include the theoretical reasons for why stock prices might predict future state of economy.

The traditional valuation model of stock suggests that the determinants of a stock price are the expected cash flows from the stock and the required rate of return commensurate with the cash flows' riskiness. As investors' expectations about future cash flows and the required rate of return depend on investors' expectations about the future prospect of the economy, so stock prices should rise (or fall) before the actual rise (or fall) of general economic activity. Besides, Chen et al. (1986) have demonstrated that economic state variables, through their effect on future dividends and discount rate, exert systematic influence on stock returns.

The wealth effect suggests that with the rise in stock prices investors become wealthier and their propensity to consume more results in expansion of economy. On the other hand, if stock prices decline, investors become less wealthy and they spend less; this results in slower economic growth. Pearce (1983) has supported the claim of stock market's ability to predict the future state of economy arguing that as fluctuations in stock prices have a direct effect on aggregate spending, so the economy can be predicted from the stock market.

Stock market as an indicator or predictor of movements of the economy, however, does not go without controversies. Critics have pointed to several reasons for not trusting the stock market as an indicator of future state of economy. Many believe that economy is not just about a bunch of public companies; economy is about all the companies - public and private; it is, in fact, about every citizen who is in the nation. So, stock market constitutes only a tiny fraction of the whole economy, which is not enough to make a measurable impact on the overall economic performance of the country (Mishra and Pan, 2016). However, the argument does not hold the ground as a tiny mirror can reflect a huge banyan tree. In fact, a miniscule retina can reflect all planets and stars in the sky.

Pearce (1983) has mentioned that stock market has previously generated false signals about economy, and therefore, should not be relied on as an economic indicator. Also, skeptics have pointed to the strong economic growth in US followed by 1987 stock market crash in New York Stock Exchange as a reason to doubt the stock market's predictive ability. Moreover, investors' expectations about future prospect of the economy are subject to human error, because investors could not always anticipate it correctly. Thus, stock prices sometimes increase before the economy enters recession and decrease before the economy expands. Hence the stock market often misleads the direction of the economy (Comincioli, 1996).

Despite all these controversies, stock markets are commonly believed to react sensitively to economic news. Our experiences also support the truth that individual stock prices are influenced by a wide variety of unanticipated events and some of these events are more pervasive than others (Chen et al., 1986). Although a single stock can be affected by influences that are not systematic or pervasive to economy, but returns on stock market mainly be influenced by systematic risk because idiosyncratic risk on individual stocks are cancelled out through the process of diversification.

1.2 Objective of the Research

It is revealed from the foregoing discussion that stock prices react sensitively to economic news and there is a general belief among economists and market participants that the stock market return and economy are closely correlated. On the other hand, macroeconomic variables are indicators or main signposts signaling the trends in the economy (Siamwalla et al. 1999). So, macroeconomic variables are the economic state variables which affect the economy and thereby affect the returns on stock market.

Considering this, the broad objective of this research is to find empirical evidence defining relationship between stock market and overall economy. More specifically, our objective is to find relationship between Dhaka Stock Exchange (DSE) and some important economic state variables which are considered important from the perspective of the economy and the stock market of Bangladesh.

1.3 Research Questions

Based on the objective of the research, the study will focus on the following specific research questions:

1. Does any significant long-run equilibrium relationship exist between the stock market, represented by Dhaka Stock Exchange General Index (DSEGEN), and six macroeconomic variables - namely Industrial Production Index, Interest Rate, Inflation, Exchange Rate, Money Supply and Gold Price?

2. Is there any short-term equilibrium relationship between DSEGEN and the macroeconomic variables?
3. Is there any causal relationship between DSEGEN and the macroeconomic variables?
4. Are the relationships same between DSEGEN and the macroeconomic variables in different periods, viz.; bubble, meltdown and recovery periods?
5. Is there any relationship between DSEGEN volatility and the macroeconomic variables' volatilities?
6. What is the relationship between DSEGEN and the real economy of Bangladesh?

1.4 Scope, Limitations and Assumptions of the Research

In this study, the relationship between the aggregate stock market, represented by DSE General Index, and the macroeconomic variables have been investigated for the period from January 1991 to December 2015. Hence the outcomes of this study are not applicable, in terms of generalizability, to individual stocks listed on the Dhaka Stock Exchange (DSE) and to any other period. Moreover, the DSE General Index tracks the performance of category A, B, G and N companies. Therefore, the findings are also limited to only aggregate stock market returns comprising those categories of stocks. Additionally, the stock market returns have been calculated based on the market index considering the capital gains component of stock returns and excluded the dividend aspect of the returns, thus limiting the full impact of actual returns.

In our empirical analysis, we have used monthly data of industrial production index of medium to large-scale manufacturing industries as a proxy of Gross Domestic Product (GDP), because data on the former is available on monthly basis but the latter is not. Tainer (1993) is of the view that the industrial production index is procyclical; that is, it rises during economic expansion and falls during a recession. It is typically used as a proxy for the level of real economic activity, that is, a rise in industrial production would signal economic growth. In many studies (for example Adrangi et al., 1999; Ibrahim and Aziz, 2003), GDP is represented by industrial production index. However, among the fifteen sectors of GDP, Bangladesh economy is dominated by the services sector which accounted for 56.3% of GDP in FY2015, followed by broad industry sector (28.1%). The broad industry sector includes following four sectors: (1) construction; (2) mining and quarrying; (3) manufacturing; and (4) electricity, gas and water supply. Out of these four sectors, the contribution of the manufacturing sector is the highest (17.6%) in GDP.[1] In this perspective, the small contribution of the manufacturing sector to GDP may create question whether the industrial production index remains as an acceptable proxy for GDP in Bangladesh.

Apart from macroeconomic variables, this study has not considered the impact of many other factors such as the effectiveness of legal institutions, corruption due to insider trading, and political instability consequences, just to mention a few, on the stock market returns. The non-inclusion of such factors may also be considered as a limitation of the study. Furthermore, this study has focused on six macroeconomic variable which may not represent completely the macroeconomic condition of Bangladesh.

The underlying theories and prior empirical works have relied on the validity of various assumptions and to that extent, this study is not an exception. Like the previous studies, on relationship between stock market and macroeconomic variables, this study is also

[1] Source: Bangladesh Bureau of Statistics

based on following two fundamental assumptions: (1) financial markets are informationally efficient; and (2) market participants are rational.

1.5 Rationale of the Research

The current literature does not provide specific direction as to which macroeconomic variables affect stock market returns and to what extent (Chen et al., 1986). There are also unresolved theoretical and methodological issues. It is expected that a common set of macroeconomic risk factors will be identified from the empirical studies. But the existing literatures, coming from a wide range of different time periods and countries, fail to identify the common set of economic factors. So, there is a need for continuing research in this area.

In this context, this study has aimed to tackle this complex challenge of examining the relationship between stock market and macroeconomic indices in Bangladesh. By doing this, we have tried to identify the significant macroeconomic factors that affect Bangladesh stock market. Apart from identifying the significant macroeconomic factors, the research has also examined the relationship between stock market and macroeconomic indices of Bangladesh from different perspectives.

Firstly, a long-term equilibrium approach has been applied to address the question as to how some important macroeconomic variables are related with the stock market index in the long-run. The motivation behind this is that most of the institutional investors - like insurance companies or pension funds, have long-term investment horizons of several years or even decades. So, these investors are more interested in the long-term expected returns from stock market, rather than short-term fluctuations based on business cycles or investors' sentiment.

Secondly, even though there exists a significant long-run equilibrium relationship, there might be disequilibrium in the short-run. So, the study has also investigated the significance of short-run relationship along with the presence of error correction process which will adjust the short-term disequilibrium between the stock market and the macroeconomic variables to bring about a stable long-run equilibrium relationship.

Thirdly, the causal relationships between the selected macroeconomic variables and the stock market have been investigated to determine whether one series is useful for forecasting another. This is very crucial to the investors as well as to the policy makers. If the macroeconomic condition can be used as a reliable indicator for the stock market, then the macroeconomy can help investors in managing their investment portfolios. On the other hand, from the macroeconomic point of view, if stock market leads economy, then the policymakers could use stock market as a leading indicator to predict future economy.

Fourthly, this study has investigated the relationships between the stock market and the macroeconomic factors in different periods. These investigations have helped us describe the relationships in bubble, meltdown and recovery periods of the stock market. The relationships in these periods have been be assessed separately to compare the influences of the priced factors across the different periods. The study has also tried to identify the macroeconomic factors which have played the key role in bubble creation as well as in bubble crush.

Fifthly, considering two irrational fluctuations of stock prices in Bangladesh within one and a half decades, one in 1996 and other in 2010, and the size of their effects on households, banks and finally on overall economy, the knowledge on the nexus between the stock market volatility and the macroeconomic variables' volatilities has become very important to the investors and to the policy makers. So, the study has also focused on the relationship between the macroeconomic volatility and the stock market volatility using non-linear models.

Finally, stock market in Bangladesh and its economy has been going through numerous liberalization and deregulation processes since 1991, which has significantly increased the size of the economy as well as the stock market. In addition, Dhaka Stock Exchange (DSE) has been striving for continuous up-gradation of its trading platform since August 1998 to set the foundation for sustainable market development and to build up state-of-the-art market surveillance system to increase the transparency of market transactions to increase the investors' confidence. These initiatives are expected to enhance the interrelation between stock market and real economy of Bangladesh. In view of this, the study has aimed to examine the relationships between the stock market and the real economy during different market conditions. Moreover, the investigation has been extended further to examine whether the stock market's ability to predict the real economy has increased following the aforesaid initiatives or the stock is still not in a position to influence the real sector and hence further development is required.

1.6 Research Methodology

The study has aimed to examine the long- and short-run dynamic relationships along with the direction of causality between stock market and some important macroeconomic variables of Bangladesh. Towards this effort, different models have been formulated, using the secondary data of stock market and macroeconomic variables of different time span, according to the need of the study. Nelson and Plosser (1982) have argued that most macroeconomic series are nonstationary, meaning that these time series data evolve over time such that their mean and variance are not constant. They have showed that linear regression of such nonstationary time series data may lead macroeconomists to wrongly conclude that the variables are related when, in reality, they are not. This phenomenon is well known as spurious regression in the literature.

Later, it is thought that the typical method to analyze a nonstationary process is either to detrend or difference the data depending on the type of trend to make it stationary. Although these methods may provide stationary variables for the regression, but they can cause a serious loss of significant long-run information and omitted variables bias. In this context, Granger and Newbold (1974) have showed that de-trending does not work to eliminate the problem of spurious regression, and that the superior alternative is the use of cointegration approach.

There are different cointegration approaches available in the literature to investigate the long-run equilibrium relationship among variables based on the idea of Granger (1981). The most popular are the Engle and Granger (1987) and the Johansen and Juselius (1990) cointegration approaches. Later, the cointegration technique proposed by Pesaran et al. (2001), known as Auto Regressive Distributed Lag (ARDL), provides some econometric and estimation advantages over both Engle and Granger (1987) and Johansen and Juselius (1990) cointegration techniques.

In this study, both Johansen and Juselius (1990) and Auto Regressive Distributed Lag (ARDL) cointegration approaches have been used. These two approaches have been used to examine the long-run relationship among the variables and to check the robustness of the findings. However, tests for stationarity and deterministic trend of the time series are essential for the cointegration test. So, the empirical analysis of the study has begun with testing the stationarity of the variables by applying different unit root tests. Then to check the trend specification of each variable, we have used loglikelihood ratio test.

To examine the short-run relationships among the variables and the speed of adjustment towards the long-run equilibrium relationship the Error Correction Models (ECM) have been used. Granger causality test has been applied to determine the direction of causality between macroeconomic variables and the stock market returns. Finally, different diagnostic and stability tests of the residuals have been employed to check the viability of the model and the stability of the long-run coefficients respectively.

This study has also examined the asymmetric relationship and the link between stock market volatility and macroeconomic variables' volatilities in Bangladesh using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) family models. Later, the GARCH family models have been used to estimate the conditional variance of each variable being studied, and then these conditional variances have been used to examine the cointegration relationship and the causality between the stock market volatility and the macroeconomic volatility.

1.7 Organization of the Thesis

The thesis is organized in seven chapters. Chapter 1 introduces the subject matter of the thesis. The chapter has described the background for studying relationship between stock market and macroeconomic indices. It also has articulated the objectives of the research, research questions, scope, limitation and assumptions of the dissertation, rationale of the study and the research methodologies.

The relevant literatures are reviewed, and research gap is established in Chapter 2. The relevant studies on different countries as well as on Dhaka Stock Exchange have been reviewed to oversee the findings on the relationship between macroeconomic variables and stock markets in different economies. More specifically, the literatures on relationship in line with our research questions have been reviewed and arranged separately to identify the gaps on various aspects of the relationships.

The theoretical framework is described in chapters 3. The chapter has outlined the economics of the stock market and has presented the economic theories relevant to this study. The theories related to the valuation of stocks from the perspective of portfolio theory, efficient market hypothesis, and rational expectations hypothesis are investigated. In addition, the basis of portfolio theory, the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) are discussed in detail. The details of these theories along with empirical evidences and other relevant questions are covered in this chapter.

Chapter 4 is the first empirical investigation chapter of the thesis. In this chapter, we have investigated the long-run, short-run and causal relationships between the stock market and the macroeconomic variables using data over a period of twenty-five years (from January 1991 to December 2015). At the beginning, we have discussed the motivation of selecting the macroeconomic variables for the empirical analysis. After that, the methodologies to be used in the analysis have been described in detail. Finally, the findings of the empirical investigations are reported.

Chapter 5 has outlined the results of the statistical analyses on relationships between the stock market and the selected macroeconomic variables in the bubble, meltdown and recovery periods of the stock market. The relationships in these periods have been assessed separately to compare the influences of the priced factors across different conditions of the stock market. In this chapter, further investigations have been carried out to identify the macroeconomic factors which have played the key role in bubble creation as well as in bubble crush.

Chapter 6 has reported the findings of the investigations on the asymmetric relationship and the nexus between stock market volatility and macroeconomic volatility in Bangladesh. Moreover, the long- and short-term relationships between stock market and macroeconomic conditional volatilities are investigated in this chapter. The causal relationships between the stock market volatility and the macroeconomic variables' volatilities have also been examined.

In chapter 7, the relationship between the stock market and the real economy has been investigated. Explaining such a relationship involves assessing the direction of causality, hence the causal relationship between stock market and the real economy has also been investigated using Granger causality test. Furthermore, considering the crash of 1996 and subsequent capital market development initiatives, the study has been extended further to examine the relationship during different periods, viz., bubble, meltdown and recovery periods. The study has also examined whether capital market development initiatives have improved the efficiency of the stock market.

Finally, in the last Chapter (Chapter 8) a summary of the empirical evidence and findings obtained to answer the research questions has been presented. This chapter has also discussed the contributions of the research along with the policy implications of the study. The shortcomings which have emerged over the course of the research have been pointed out to outline the areas where further research could be done to address these issues.

Chapter 2

Literature Review

2.1 Introduction

Perceiving the importance of influences of economic forces on stock market returns, many studies have been conducted on relationship between stock market and the macroeconomic forces for both developed and developing countries. Initially, studies on the determinants of stock returns have concentrated on developed markets. Later, the academics have turned their attention to developing countries, especially emerging economies, with the rapid development of capital markets in these countries. However, it is also valuable to review the previous studies on developed markets before exploring the existing literature on emerging markets.

In addition, the number of crashes in the stock markets and the size of their effects on households, banks and finally on economy have increased the interest of practitioners, regulators and researchers towards the study of the volatility of the stock market. Since stock market at aggregate level depends on the state of economy, so it is likely that an uncertainty about future macroeconomic conditions would introduce a change in stock market volatility. In view of this, the relationship between macroeconomic volatility and stock market volatility has received a considerable attention in the recent days. However, most of the researchers have studied the volatility of stock market in the context of developed economies, even though the risk return behavior analysis of stock market in the developing countries is of immense importance. Because these stock markets are smaller in size and relatively illiquid, which result in higher risk compared to the developed markets. This higher risk compels the risk averse investors to demand higher risk premium that results in higher cost of capital on investments, which slows down the economic growth of the country (Mala and Reddy, 2007).

In this perspective, literature review has been conducted on relevant previous and existing studies on different countries as well as on Dhaka Stock Exchange to examine the findings on the relationship between macroeconomic variables and stock market in different economies from the two aforesaid perceptions and in line with our research questions. It is essential to review the relevant empirical literatures, because this will assist us to choose the appropriate models, methodologies and important macroeconomic indices from the viewpoint of economy and stock market of Bangladesh.

Based on the research questions, the reviews are arranged in five sections. The first section describes literatures on long-term relationship and short-term dynamics between stock market and macroeconomic indices. Second section portrays the empirical works which have examined the causal relationships between different macroeconomic variables and stock market to examine whether one variable is useful for forecasting another. Literatures on the relationships in different periods, viz., bubble, meltdown and recovery periods, are reported in the third section. Fourth section describes the studies on relationship between macroeconomic indices and stock market volatilities. Fifth section focuses on studies on relationship between stock market and real economy. Finally, based on the literature review, the research gap has been identified in the conclusion.

2.2 Long-term Relationship and Short-term Dynamics

Most of the empirical studies have examined the relationship between macroeconomic variables and stock market utilizing Arbitrage Pricing Theory (APT). However, different econometric models and methodologies have been used for this purpose. Most of the early studies are based on different regression techniques, while recent studies are using more sophisticated models - such as Vector Autoregression (VAR), cointegration techniques along with error correction model, and Autoregressive Integrated Moving Average (ARIMA). In this section, the early studies based on regression analysis will be discussed first and then the studies which have used more sophisticated methodologies will be described. Finally, the studies on Bangladesh stock market will be reviewed.

2.2.1 Based on Regression Analysis

Many of the early studies on relationship between economic forces and stock market were conducted pioneering the studies of Chan et al. (1985) and Chen et al. (1986) which have been conducted using US data. Most of the earlier studies have tried to examine the validity of these two studies in their countries.

The study of Chan et al. (1985), hereafter denoted as CCH, used Fama-MacBeth (1973) regression technique, which is a two-stage regression technique. The first set of regressions estimated the portfolios' exposures to pricing factors (betas) and the second set of regressions estimated the market prices for the beta values obtained from the first set of regressions. The result of this two-stage regression methodology was used to generate a time series of estimated premium for each risk factor. The time series of risk premium were then tested to see if these were significantly different from zero.

They tried to examine whether the returns on 20 size-ranked portfolios were related to the market portfolio and a few macroeconomic variables. They used data for the period 1953-1977. For each test year from 1958 to 1977, the previous five-year intervals were considered as an estimation period (i.e., 1953-1957 was the estimation period for 1958, 1954-1958 was the estimation period for 1959, etc.). The sample of the study consisted of New York Stock Exchange (NYSE) firms that existed at the beginning of the estimation period and had price data up to the end of the estimation period. Firm size was defined as the market capitalization of the firm's equity at the end of the estimation period. Each firm was ranked by firm size and assigned to one of twenty portfolios.

They found that the risk premium for the equally weighted market portfolio was positive in each sub-period but not statistically significant. Over the entire period, they found significant premium for the industrial production, the expected and unexpected inflation, and the low-grade bond spread. The study highlighted that the difference in raw return between the smallest and the largest stocks was 11.5% per annum; however, the yearly risk-adjusted return difference was only 1.5%. They mentioned that almost half of this difference in raw returns could be explained by the spread between low-grade and government bonds, which was regarded as a measure of risk premia due to the change in risk exposure of the largest and smallest stocks. So, they argued that the firm size effect disappeared when the macroeconomic factors were considered. Hence, they concluded that the macroeconomic variables essentially captured the size effect.

Similarly, Chen et al. (1986), hereafter denoted as CCR, explored the impacts of a set of economic state variables on stock market using security-pricing model following APT. They used the Fama-MacBeth (1973) technique like CCH, but unlike CCH, the cross-sectional regressions were run simultaneously with the time series regressions. That is, the time periods used to get estimates of betas by the time series regressions was the same time periods as those were used for the cross-sectional regressions. CRR used US data for the period 1958 to 1984. To reduce the noise of individual asset returns, 20 equally weighted portfolios based on firm size were formed.

They divided the whole study period into four sub-periods (1958-84, 1958-67, 1968-77 and 1978-84) and by employing seven macroeconomic variables, they found that the financial market did not price per capita consumption and oil prices. However, industrial production, changes in risk premium and twists in the yield curve were found significant in explaining stock returns. On the other hand, measures of unanticipated inflation and changes in expected inflation had some influence as well, but only when these variables were highly volatile.

They claimed that the study did not develop a theoretical foundation for signs of the state variables, but the results revealed that stock returns had positive relations with industrial production and changes in risk premium, while negative relations with twist in yield curve, changes in unexpected and expected inflation. Consistent with the study of CCH, they also reported that the value-weighted New York Stock Exchange Index, although explaining a significant portion of time series variability of stock returns, had an insignificant influence on stock pricing when macroeconomic factors were also considered. They argued that the variability of the stock market returns was included into the different macroeconomic variables used in the study. Further, they mentioned that the size effect, which was expected to be strongly related with the average return, did not create any bias to the results of the study.

Like CRR, Hamao (1988) employed Fama-MacBeth (1973) approach to present an empirical investigation of the Arbitrage Pricing Theory (APT) in the Japanese equity market using Japanese macroeconomic factors. Factors considered were industrial production, inflation, default risk premium, interest rate, foreign exchange, and oil prices. He argued that these variables were chosen in view of a simple financial theory of asset pricing. He tried to examine the international robustness of the CRR study and also to find out the risk premium for different priced and non-price factors in the context of Japanese economy.

The study used data for the period from January 1975 to December 1984. Out of a total of 1066 companies, some were excluded because of missing observations. In order to average out individual eccentricities in the data, stocks are grouped into 20 equally weighted portfolios with an approximately equal number of securities sorted by size. Like CRR, the cross-sectional regressions were run with the same time periods as time series regressions. He found that changes in expected inflation, unanticipated changes in default risk premium and unanticipated changes in the slope of term structure had a significant effect on the Japanese stock market, but the study documented weaker evidence of a risk premium against changes in monthly industrial production.

The study highlighted that signs of the risk premia were consistent throughout the analysis but opposite for expected and unexpected inflation compared to the results of CRR. The positive sign for inflation risk premia in this study indicated that stocks were more valuable with more inflation, other things being equal. On the other hand, Hamao included two additional macroeconomic factors - namely oil price and foreign exchange, but found both were not priced in the stock market. He opined that this was surprising considering the importance of international trade in the Japanese economy. Like CRR, he found that equally weighted market indices neither had statistically significant risk premium nor they captured extra systematic risk missed by other macroeconomic state variables. Finally, Hamao concluded that the risk premium on several factors showed the robustness of the approach of CRR in different but parallel economy like Japan.

Poon and Taylor (1991) used the data of the London Stock Exchange and considered the same macroeconomic variables as CRR for the period from 1965 to 1984 to see whether the CRR study was applicable to UK stock market. But the results showed that the variables did not affect stock prices in UK in the manner described in CRR. They argued that there could be other macroeconomic factors for UK market, or the methodology in CRR was inadequate for detecting such pricing relationship or possibly both explanations were applicable.

Their study had pointed two cons of CRR study to explain why CRR study could not be replicated in UK. Firstly, they pointed that the study of CRR had mentioned that size could provide the desired dispersion without biasing the results of the economic variables. But Poon and Taylor argued that this might be valid for US but not for other countries, because the "size effect" could be a determining factor for most of the countries. They added that the validity of this argument was further strengthened from the findings of Hamao, who stated that some of his findings were opposite to the findings of CRR and mentioned these results as surprising considering the economy of Japan.

Secondly, Poon and Taylor (1991) argued that the time periods used in the first set of regressions to estimate the betas and using these betas to predict returns for the same periods using second set of regressions might create bias towards producing significant results and this also be contradictory to the spirit of the ex-ante orientation of the Fama-MacBeth method.

Clare and Thomas (1994) presented empirical evidence of the pricing of macroeconomic factors in the UK stock market using two different portfolio-ordering techniques. The month end returns (adjusted for stock splits, dividends, etc.) on 840 UK stocks were chosen randomly for the period from January 1978 to December 1990. They used the variant of

Fama-MacBeth (1973) technique. First, the securities were grouped into 56 portfolios each comprised of 15 equally weighted stocks, and the excess returns were regressed on the macro surprises for the period from January1978 to December 1982, yielding 56 estimates for each beta. These betas were then used as independent variables in cross-section (for the period 1983 to 1990) regressions to provide estimates of risk premium associated with each macro variables.

The portfolios were ordered in two ordering methods in an attempt to assess the robustness of results to portfolio ordering. Firstly, they ranked the individual securities by their market betas, so the first portfolio consisted of those 15 stocks with the lowest betas, while the last portfolio consisted of those 15 stocks with the highest betas. Secondly, the stocks were ordered from small to large based on the market value of each firm as on 1st January 1978. Then 56 portfolios were formed based on size, so that portfolio 1 containing the smallest 15 firms and portfolio 56 containing the largest 15 firms.

For beta sorted portfolios, the study highlighted significant positive risk premium attached to the default risk, which was consistent with CRR finding, but in contrast with CRR, they found that shocks in inflation carry a positive risk premium. Also, they found negative risk premium for oil prices and they explained that this reflected the fact that the UK was a net exporter of oil. They included existing account balance in the list, which showed positive relation with risk premium. Finally, they documented a positive risk premium for the shocks in the amount of UK bank lending to the private sector, which reflected investors' dislike for expansions in bank credit. However, when market value ('size') sorted portfolios were used then default risk and the retail price index were priced. Most interestingly, they noted that the firm size ordering did not provide evidence for the "small firm effect" (as explained by Banz, 1981).

The foregoing studies has revealed that the studies of CRR and CCH have been considered as pioneer of many studies for exploring the relationship between the economic variables and the stock market. Unlike the three studies conducted by CRR, CCH and Hamao, the study of Clare and Thomas (1994) has used two portfolio ordering methods - based on size and betas. Their findings have revealed that beta sorted portfolio has provided more consistent results compared to the more conventional size sorted portfolio. This has indicated that the macro factors are sensitive to the ordering method chosen.

Nevertheless, Clare and Thomas (1994) have reported that larger firms' returns have outperformed smaller firms' returns, which is inconsistent with the study of Banz (1981). Reinganum (1982) has examined the differential return between small and large stocks between 1926 and 1989 to test their cyclical behavior. The study has revealed that the small capitalization portfolios outperformed the large capitalization portfolios, but this return behavior is volatile and tends to reverse itself. Similarly, Bhardwaj and Brooks (1993) have examined the size effect in bull and bear stock markets during 1926-1988 and have claimed that in bear market small firm stocks underperform large firm stocks, which is contrary to the evidence widely reported in prior studies. So, these studies suggest that firms' size could have varying impacts on returns depending on the stage of the market.

Buyuksalvarci (2010) analyzed the impact of macroeconomic variables on the Turkish Stock Market using the Arbitrage Pricing Theory (APT) framework. The study considered monthly data from January 2003 to March 2010 and used multiple regression models with stock market return represented by Istanbul Stock Exchange-100 Index as dependent variable and seven macroeconomic variables - namely consumer price index, money market interest rate, gold price, industrial production index, international crude oil price, foreign exchange rate and money supply, as independent variables.

The results of this study indicated that the Turkish stock market was negatively influenced by interest rate, industrial production index, oil price, and foreign exchange rate, while the impact of money supply was positive. Interestingly, he found consumer price index and gold price did not influence stock return. He argued that the market had evaluated inflation figures correctly before the announcement and to justify this argument, it was mentioned that the price stability was one of the macroeconomic policy objectives of the Turkish government. Considering gold as an alternative investment tool, a negative relation was expected. But the study found insignificant relationship, which was not explained.

However, the negative relations between stock returns and exchange rate was explained stating that a depreciation of the Turkish currency in terms of US dollars had not attracted foreign investments in stock market. Conversely, it had increased the cost of production. The study found relation between industrial production and ISE-100 index but with a wrong sign. The result of negative relation between oil price and stock market return was explained considering oil as a key factor in determining the production cost of the firms.

Singh et al. (2011) used GDP, employment rate, exchange rate, inflation and money supply as macroeconomic variables to determine the cause and effect relationship with stock return in Taiwan. The analysis was based on stock portfolios rather than single stock. In portfolio construction, four criteria were used: market capitalization, price to earnings ratio (P/E ratio), price to book value ratio (PBR) and yield. First, all the companies listed in Taiwan Stock Exchange were grouped into big, medium, and small companies based on market capitalization. Then from each of these groups, three sub-portfolios were formed based on P/E ratio, PBR, and yield.

They used data from 2003 to 2008 and considered the macroeconomic variables as the independent variables and the individual portfolio return as the dependent variable and applied regression to calculate the impact of macroeconomic variables on stock market. The results showed that employment rate, inflation and money supply had negative relationships with stock returns, while GDP and exchange rate had positive relationships with stock returns for all the six portfolios of big and medium companies.

They argued that the findings regarding inflation rate and GDP were consistent with the bulk of empirical evidences. They explained the positive relation between exchange rate and the portfolios index returns mentioning that one of the probable reasons for this might be continuous expansion of foreign trade, with a pronounced increase in Taiwan’s Trade Surplus. They highlighted the continuing loose monetary policy in Taiwan before 2006 along with the Central Bank’s continued interest rate hikes as a reason for the negative relationship between money supply and portfolio index returns. However, for small size companies the results were slightly different - for P/E ratio portfolio, only exchange rate had positive relationship with stock returns; for yield portfolio, employment rate and exchange rate had positive relationship; while for PBR portfolio, exchange rate and inflation had positive relationships with stock returns.

Diacogiannis (1986) used data of London Stock Exchange for the period from January 1972 to December 1983 to verify whether the security return generating model utilizing Arbitrage Pricing Theory (APT) remained the same across security groups and across various time periods. The study was made with two objectives: firstly, it aimed to verify whether the number of factors affecting the security returns was related to the size of the group been factored. Secondly, the study examined whether the number of factors that influenced the security returns remained unchanged across various time periods for security groups having the same size.

In the study, 200 securities were listed in ascending order of size and five master groups, each consisting of forty securities, had drawn from these 200 securities. Further, seven subgroups were formed from each of the master group of samples containing 5, 10, 15, 20, 25, 30 and 35 securities respectively. The findings indicated that the number of factors changed as group size was changed and the number of factors also changed across various time periods for the same as well as for the different groups of securities.

Diacogiannis (1986) argued that the security return-generating model of Arbitrage Pricing Theory (APT) was not a unique one. He suggested that since APT did not specify the number and nature of the underlying factors that influenced the security returns, so there existed an identification problem. He also pointed that for specified group size, the security return-generating model produced by factor analysis did not represent a unique generating model of APT and this generating model could not necessarily test the validity of APT.

The finding of Diacogiannis (1986) has indicated that the security-pricing model of APT is dependent on group size and on time of the study. These two major findings can be explained with the existing financial theories and the behavior of the stock market. Firstly, although individual stock returns can be affected by influences that are systematic as well as nonsystematic to the economy but returns on large portfolios are mainly influenced by systematic risk because idiosyncratic risk on individual stocks are cancelled out through the process of diversification. But the benefit of diversification depends on the number of securities in the portfolio or group. This may be the reason of getting different results for different portfolio compositions by Diacogiannis (1986). Secondly, the diverse results across the periods have revealed the fact that investors have the tendency to react differently to the same type of news during different conditions of the stock market. For example, during a crisis in stock market, a slight fall in expected industrial production could initiate panic among investors and they hastily try to close their position causing an increase in stock market volatility, which may not happen in a long bull market.

The findings of the early literatures are summarized in Table 2.1. The summary reveals that the findings are diverse - different studies have found different relationships, even a single study has found varied relationships in different periods and different portfolio formations. This divergence of findings discloses the fact that the response of stock market to changes in economy, represented by macroeconomic variables, cannot be determined in advance as it varies across countries as well as across time within the same country.

The empirical studies have also disclosed that firm size is an important factor and size effect is dependent on stages of the stock market; in good economic condition, small firms usually grow faster than large and mature firms; but in the bad time, small firms tend to perform poorly (some even enter into bankruptcy). Different studies have provided the empirical evidence of the cyclical behavior of size effect. These studies have also depicted that the formation of portfolio on different criterion creates divergence in results.

Moreover, Clare and Thomas (1994) pointed that neither CCH nor CRR were concerned with econometric model to derive innovations in the series, rather they considered the changes in the growth of the variables as surprises. Although CRR suggested that a VAR model might be more appropriate and believed that single equation could be more robust, but they argued that since monthly returns were nearly serially uncorrelated, these could be employed as innovations without alteration. But Clare and Thomas (1994) mentioned that it was evident from the autocorrelation properties of the ‘surprises’ of CRR that highly significant lagged information was omitted from the generation of the innovations and this was clearly not consistent with the interpretation of these variables as ‘surprises’.

Table 2.1: Summary of the Findings of Early Studies on Relationship between Stock Market and Macroeconomic Variables

Macroeconomic Variables	Positive	Negative	Insignificant
GDP	Singh et al. (2011) *		Singh et al. (2011) ** Singh et al. (2011) *** Singh et al. (2011) ****
Oil Prices		Clare and Thomas (1994) Buyuksalvarci (2010)	Hamao (1988)
Industrial Production Index	Chan et al. (1985) Chen et al. (1986)	Buyuksalvarci (2010)	Hamao (1988) Poon and Taylor (1991)
Default Risk Premium	Chan et al. (1985) Chen et al. (1986) Hamao (1988) Clare and Thomas (1994)		Poon and Taylor (1991)
Interest Rate		Chan et al. (1985) Chen et al. (1986) Hamao (1988) Buyuksalvarci (2010)	Poon and Taylor (1991)
Inflation	Hamao (1988), Clare and Thomas (1994) Singh et al. (2011) ****	Chan et al. (1985) Chen et al. (1986) Singh et al. (2011) *	Poon and Taylor (1991) Buyuksalvarci (2010) Singh et al. (2011) ** Singh et al. (2011) ***
Exchange Rate	Singh et al. (2011) * Singh et al. (2011) ** Singh et al. (2011) *** Singh et al. (2011) ****	Buyuksalvarci (2010)	Hamao (1988)
Employment Rate	Singh et al. (2011) ***	Singh et al. (2011) *	Singh et al. (2011) ** Singh et al. (2011) ****
Money Supply	Buyuksalvarci (2010)	Singh et al. (2011) *	Singh et al. (2011) ** Singh et al. (2011) *** Singh et al. (2011) ****
Gold Price			Buyuksalvarci (2010)

* For all 6 portfolios based on P/E ratio, Yield and PBR of big and medium capitalization firms   ** For portfolio based on P/E ratio of small firms
*** For portfolio based on Yield of small firms   **** For portfolio based on PBR of small firms

In this context, with the availability of sophisticated econometric tools, such as Vector Autoregression (VAR), the cointegration and the ARIMA, recent studies have used these tools to investigate the relationship between stock market and macroeconomic variables. The VAR model can examine the lead-lag relationships among the variables and can also be considered as a means of conducting causality tests. Furthermore, Johansen and Juselius (1990) have proposed a testing procedure that can capture the short-term dynamics and long-term relationship among variables. However, the Johansen and Juselius (1990) approach can only be applied if the variables are integrated of order 1, *I(1)*.

Later, Pesaran et al. (2001) have developed a new approach to cointegration testing which is applicable irrespective of whether the variables are *I(0)* or *I(1)*. The test is based on a single Autoregressive Distributed Lag (ARDL) equation, rather than a VAR in Johansen and Juselius approach, thus reducing the number of parameters to be estimated. Moreover, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee et al., 1993). The ECM integrates the short-run dynamics with the long-run equilibrium, without losing long-run information. Finally, the ARDL approach provides robust results for a smaller sample size. In the next section, we will focus on the literatures which have used these latest methodologies.

2.2.2 Based on Sophisticated Econometric Tools

Mukherjee and Naka (1995) employed Johansen's (1991) Vector Error Correction Model (VECM) to examine the relationship between Tokyo Stock Exchange (TSE) index and six Japanese macroeconomic variables - namely the exchange rate, money supply, inflation, industrial production, long-term government bond rate, and call money rate. The sample period for this study spanned from January 1971 to December 1990, consisting of 240 monthly observations for each variable.

The study found positive relationship between TSE index and three macroeconomic variables, these were exchange rates, money supply and industrial production. The relation between TSE index and inflation was negative. But interestingly, the findings of the study showed a mixed relationship between TSE index and interest rates. While the relation between the TSE index and long-term government bond rates was negative, the opposite seemed to hold between the TSE index and call money rates. They argued that possibly in Japan the long-term government bond rate had served as better representative for the nominal risk-free component of the discount rate in the stock valuation model than the short-term call money rates.

To check the robustness of the results to the selection of macroeconomic variables, they took six possible combinations of five microeconomic variables chosen from the original set of six. For each of these five combinations of microeconomic variables, the study explored the relations in six-dimension systems (the TSE index and five macroeconomic variables). The study found at least one cointegrating relation in each system. To examine the equilibrium relations over sub-periods the sample data was divided into two sub-periods having equal numbers of observations (from January 1971 to December 1980 and from January 1981 to December 1990). The result indicated three possible cointegrating relations for the first sub-period and two for the second sub-period. In this context, they argued that their findings are robust to the selection of microeconomic variables and the sub-periods.

Adrangi et al. (1999) conducted empirical tests within Fama's proxy hypothesis framework, which stated: (1) a negative relationship between inflation and real activity; and (2) a positive relationship between the real stock returns and real activity. They selected Korea and Mexico for their study and argued that these two countries were selected because these two countries were at dissimilar stages of implementing market economy; Korea was one of the first emerging market economies to introduce economic reforms in the mid-1980s, while Mexican economy was mired in chaos during 1980s. However, they added that in the early 1990s the Mexican economy was relatively healthy. They argued that these two economies might represent two emerging economies at dissimilar stages of development.

The period of this study covered from January 1978 to March 1996 for Korea and from August 1985 to December1995 for Mexico and the index of industrial production was selected as a proxy for the real economic activity in both the markets. To derive the expected and unexpected components of inflation rate, they employed two commonly used statistical approaches, Hodrick-Prescott filter (HP) and ARIMA. They mentioned that these two approaches had been adopted as the series for expected inflation rate were unavailable in developing economies.

Their findings revealed that the expected inflation was negatively related to stock market and significant for Korea but positively related and insignificant for Mexico. On the other hand, unexpected inflation in both markets were negatively related to real stock returns but it was significant for Korea only. So, they argued that these results did not unequivocally validate the proxy hypothesis. They stated that the negative relationship between inflation rates and real stock returns in both markets seemed to stem from the unexpected component of the inflation rate.

The negative relationship between the real stock returns and inflation rate for Korea persisted even after the negative relationship between inflation and real activity were purged. To explain these, they stated that the real stock returns might be adversely affected by inflation because (1) inflationary pressures had threaten future corporate profits; and (2) nominal discount rates rose under inflationary pressures, reducing current value of future profits, and thus, stock returns. The study also found that real returns are positively related to real economic activity for both Korea and Mexico.

They also applied Johansen and Juselius (1990) cointegration approach to examine the long-run equilibrium relationship among price level, industrial production, and stock prices in each of the two countries. The results showed some evidence of a long-run equilibrium relationship among stock prices, inflation, and industrial production in both economies consistent with the proxy effect hypothesis. So, they argued that the proxy effect hypothesis might be valid in the long-run and yet not in the short-run.

Ibrahim and Aziz (2003) considered the interactions between the Malaysian equity market and four macroeconomic variables – namely real output, price level, money supply and exchange rate. The study used monthly data for the period from January 1977 to August 1998. They employed Johansen and Juselius cointegration approach and vector autoregression techniques. To measure stock market returns, they used end-of-the-month values of the Kuala Lumpur Composite Index (KLCI). They represented real output by real industrial production index (IPI), the aggregate price level by the consumer price index (CPI), money supply by broad money M2, and bilateral Ringgit exchange rate vis-a-vis US dollar as a measure of the exchange rates.

They found that the stock prices had long-run positive relationships with industrial production index and CPI. They explained that the positive relation between CPI and stock return was consistent with the finding of Khil and Lee (2000), where Malaysia was found as only country out of ten Pacific-rim countries which exhibited a positive association between CPI and stock return.

They found a negative long-run association between stock prices and money supply M2. They argued that theoretically the relation between these two variables could be positive or negative. Because the expansionary effect of money supply on real economic activity might create a positive relation (Mukherjee and Naka, 1995). However, if the increase in money supply initiated inflation as well as created inflationary uncertainty, then it might exert a negative influence on the stock prices. They added that the increase in money supply might have generated inflationary uncertainty causing equity prices to fall (Cornell, 1983). They argued that their negative long-run coefficient seemed to indicate the dominance of these negative channels.

A surprising aspect of the results was that they found money supply was negatively related to stock prices, while consumer price index was positively related to stock prices. They explained this dissimilarity by mentioning that the expansionary effect of money supply had affected the stock prices through two channels: (1) by creating inflationary pressures; and (2) by creating expectation of contractionary monetary policy in near future. The first channel had created positive impact on stock prices due to the positive relation of inflation with stock prices, while the second channel had created negative impact on stock prices as the expected contraction had generated higher risk premium for investing stocks. Finally, they concluded that the dominance of the second channel had resulted the negative relationship between money supply and stock prices.

The negative association between stock prices and the exchange rate was explained by mentioning that Malaysian economy was highly dependent on international trade, i.e. on exports and imports of capital and intermediate goods, while currency depreciation had encouraged exports, conversely, it increased costs of production through increasing domestic prices of imported capital and intermediate goods. The latter effect of currency depreciation on expected cash flows of the firms seemed to be more dominant.

Maysami et al. (2004) highlighted a void in the literature related to examining the cointegration between macroeconomic variables and stock market's sectoral indices rather than the composite index. Their study built upon and extended the literature to examine the long-run equilibrium relationship between selected macroeconomic variables and the Singapore stock market index, as well as with three sectoral indices, which were the finance index, the property index, and the hotel index.

The study considered six macroeconomic variables - namely short- and long-term interest rates, industrial production, inflation, exchange rate and money supply. The results showed that the aggregate stock market was significantly positively related to industrial production and money supply, while negatively related to exchange rates and long-term interest rates. On the other hand, the finance sector was significantly positively affected by inflation and short-term interest rates, while negatively affected by exchange rates and long-term interest rates. The impact of changes in money supply to the finance sector was weaker as compared to the aggregate stock market. The results for property sector were similar to the aggregate stock market with an exception that short-term interest rates were significant; they pointed that this supported the findings of Wang and Liow (1999) who reported a strong co-movement of the returns of property stocks and the general market.

The results of hotel sector were curious because except for real economic activity, all other relations were opposite of those observed for the aggregate stock market. The results highlighted short- and long-term interest rates as well as the money supply did not have significant effects on the Singapore Hotel Index. Their finding of significant positive relation between the Hotel sector and the exchange rate was explained with the argument that the depreciation of the currency was deemed favorable for the Singapore tourism industry as the hotel rates had become relatively cheaper in terms of foreign currencies and hence had increased the demand. The finding of negative relation between inflation and hotel sector was explained with the justification that controlling inflation had ensured the competitiveness of the tourism sector of the country.

Humpe and Macmillan (2007) examined whether a number of macroeconomic variables influence stock prices in the US and Japan. A cointegration analysis was applied to model the long-term relationships between industrial production, the consumer price index, money supply, long-term interest rates and stock prices in the US and Japan. They used monthly data over the period from January 1965 to June 2005 to analyze the impact of the macroeconomic factors on both stock markets.

Using US data, they found a single cointegrating vector between stock prices, industrial production, inflation and the long-term interest rate. They pointed that the coefficients of long-run equation suggested that US stock prices were influenced, as expected, positively by industrial production and negatively by inflation and the long-term interest rate. However, they found that the money supply had an insignificant influence over the stock prices in US. They pointed that money supply was likely to influence share prices through at least three mechanisms: firstly, changed in the money supply might be related to unanticipated increases in inflation and future inflation uncertainty and hence negatively related to the share price, secondly, changes in the money supply might positively influence the share price through its expansionary impact on economic activity, thirdly, portfolio theory also suggested a positive relationship, since an increase in money supply might create a shift from interest bearing money to equities. Their findings of insignificant impact of money supply were explained suggesting that the various influences of the money supply on the stock price might 'cancel out' each other.

In Japan, their findings were less straightforward. They found two cointegrating vectors. The first cointegration vector, normalized on the stock prices, provided evidence that stock prices were positively related to industrial production but negatively related to money supply. The second cointegrating vector, normalized on industrial production, indicated that the industrial production were negatively influenced by the consumer price index. So, the finding suggested that the influence of inflation on stock prices was negative but indirectly, via industrial production. They pointed that this result was surprising and different from that of Mukherjee and Naka (1995), who found a negative coefficient on inflation for a cointegrating vector normalized on the stock prices.

They argued that one reason for this difference might be the longer sample period; while Mukherjee and Naka used data from the period 1971 to 1990, which corresponded to a period of relatively high inflation in Japan (after the impact of the 1973 oil price shock) and stable growth in industrial production. On the other hand, their study considered sample from January 1965 until June 2005 which included the period of strong disinflation (in the late 90s) and falling stock price (the downturn of Japanese stock market in the early 90s) with stagnant but volatile industrial production.

They also found that the discount rate was insignificant, and they explained this unexpected result arguing that this might also be, at least partly, due to the difficulties faced by the Japanese economy since 1990. Finally, they mentioned that their results on Japan were consistent with an increasing money supply, falling interest rate that were unable to pull Japanese economy out of its slump, or prevented stock prices from falling.

Mohammad et al. (2009) studied the impact of macroeconomic variables on stock prices in Pakistan. For this purpose, the quarterly data were obtained for the period 1986-2008. The macroeconomic variables considered were exchange rate, foreign exchange reserve, gross fixed capital formation, broad money M2, Call Money Rate (proxy of interest), Industrial Production Index (IPI) and whole sales price index (proxy of inflation). They used Autoregressive Integrated Moving Average (ARIMA) model for testing.

The result showed that the exchange rate, foreign exchange reserve and inflation had positive significant effects on the stock prices, while interest rate and money supply had significant negative effect on stock prices. However, the other variables like industrial production index and gross fixed capital formation did not affect stock prices. They explained that the positive relation between exchange rate and stock return revealing the fact that depreciation of domestic currency had increased the foreign investments in the stock market, which had increased the demand of stocks and thus the value. This increased in foreign investment had increased the foreign exchange reserve showing a positive relation between the foreign exchange return and stock prices.

Chia and Lim (2015) investigated the response of the Malaysian stock market on selected macroeconomic variables - namely industrial production, inflation, money supply, interest rate and exchange rate, using the Autoregressive Distributed Lag (ARDL) Bounds test. The results indicated that share prices were cointegrated with the selected macroeconomic variables. Moreover, the long-run coefficients suggested that Malaysian share prices were influenced positively by money supply and interest rate and negatively by inflation. On the other hand, the results from the error correction mechanism revealed that real share returns were Granger caused by real money growth and real interest rate growth. When exchange rate was included in the estimation, the results indicated that exchange rate fluctuations could also cause movement in stock prices. They concluded that domestic macroeconomic activities had influenced the Malaysian stock market.

Joshi and Giri (2015) examined the dynamic long- and short-run relationship between stock prices and a set of macroeconomic variables for Indian economy with monthly data from April 2004 to July 2014 using the ARDL Bounds testing approach. The Bounds test confirmed that there existed a long-run cointegrating relationship between different macroeconomic variables and stock prices in India. The long-run estimates of ARDL test showed that industrial production, inflation and exchange rate influenced stock prices positively and the influences were significant, while gold price had significant negative influence on stock price. Thus, they concluded that industrial production, exchange rate, inflation and gold prices seemed to be suitable targets for the government to focus on to stabilize the stock market and to encourage more capital flows into the capital market. The error correction model of ARDL approach revealed that the adjustment process from the short-run deviation was slow. More precisely, error correction term confirmed that the derivation from the long-run equilibrium path was corrected 22% per year.

The findings of the studies, which have used sophisticated models, are summarized in Table 2.2. The summary has revealed that the findings are diverse – i.e., different studies have found different relationships in different countries as well as across different sectors in the same country. Also, a single study has found varied relationships for different countries. This divergence of findings has disclosed the fact that the response of stock market to macroeconomic variables cannot be determined in advance as it varies across countries. So, there is a need for continuing research in this area.

Table 2.2: Summary of the Findings of Studies on Relationship between Stock Market and Macroeconomic Variables using Sophisticated Econometric Tools

Macroeconomic Variables	Positive	Negative	Insignificant
Industrial Production Index	Mukherjee and Naka (1995) Adrangi et al. (1999) [K] Adrangi et al. (1999) [M] Ibrahim and Aziz (2003) Maysami et al. (2004) [A] Maysami et al. (2004) [P] Maysami et al. (2004) [H] Humpe and Macmillan (2007) [U] Humpe and Macmillan (2007) [J] Joshi and Giri (2015)		Maysami et al. (2004) [F] Mohammad et al. (2009) Chai and Lim (2015)
Gross Fixed Capital Formation			Mohammad et al. (2009)
Short-term interest rate/ T-Bill Rate/ Call Money rate	Mukherjee and Naka (1995) Maysami et al. (2004) [F] Maysami et al. (2004) [P] Chai and Lim (2015)	Humpe and Macmillan (2007) [U]	Maysami et al. (2004) [A] Maysami et al. (2004) [H]
T-Bond Rate		Mukherjee and Naka (1995) Maysami et al. (2004) [A] Maysami et al. (2004) [F] Maysami et al. (2004) [P]	Maysami et al. (2004) [H]
Inflation	Ibrahim and Aziz (2003) Ibrahim and Aziz (2003) Maysami et al. (2004) [F] Joshi and Giri (2015)	Mukherjee and Naka (1995) Adrangi, et al. (1999) [K] Maysami et al. (2004) [H] Humpe and Macmillan (2007) [U] Mohammad et al. (2009) Chai and Lim (2015)	Adrangi, et al. (1999) [M] Maysami et al. (2004) [A] Maysami et al. (2004) [P]

[K] For Korea [M] For Mexico [U] For US [J] For Japan
[A] For Aggregate Market [F] For Finance Sector [P] For Property Sector [H] For Hotel Sector

Table 2.2: Summary of the Findings of Studies on Relationship between Stock Market and Macroeconomic Variables using Sophisticated Econometric Tools (Cont'd)

Macroeconomic Variables	Positive	Negative	Insignificant
Exchange Rate	Mukherjee and Naka (1995) Maysami et al. (2004) [H] Mohammad et al. (2009) Joshi and Giri (2015)	Ibrahim and Aziz (2003) Maysami et al. (2004) [A] Maysami et al. (2004) [F] Maysami et al. (2004) [P]	Chai and Lim (2015)
Foreign Exchange Reserve	Mohammad et al. (2009)		
Gold Price	Joshi and Giri (2015)		
Money Supply	Mukherjee and Naka (1995) Chai and Lim (2015) Maysami et al. (2004) [A] Maysami et al. (2004) [P]	Ibrahim and Aziz (2003) Humpe and Macmillan (2007) [J] Mohammad et al. (2009)	Maysami et al. (2004) [F] Maysami et al. (2004) [H] Humpe and Macmillan (2007) [U]

[K] For Korea [M] For Mexico [U] For US [J] For Japan
[A] For Aggregate Market [F] For Finance Sector [P] For Property Sector [H] For Hotel Sector

2.2.3 Based on Bangladesh

Quadir (2012) examined whether the return of Dhaka Stock Exchange (DSE), represented by stock market indices, could be explained by two macroeconomic variables -namely interest rates and industrial production. The study considered monthly averages of respective stock market indices, T-bill rate and industrial production from January 2000 to February 2007. The Autoregressive Integrated Moving Average (ARIMA) time series process was applied to determine the relationship between the dependent variable (stock market return) and independent variables (industrial production and interest rate). The study hypothesized a positive relationship between the industrial growth and stock return and a negative relation between stock return and T-bill rate. But they found that the stock market returns had statistically insignificant relationships with T-bill rate and industrial production. This inconsistency of the result with the existing literature was explained with stating that many of the macroeconomic variables, such as inflation rate, exchange rate, money supply, balance of trade and consumer price index, which were influential in determining the value of stocks, were not considered in the study.

Khan and Yousuf (2013) investigated the long-term relationship between macroeconomic variables and the Dhaka stock market prices using Johansen multivariate cointegration analysis and Vector Error Correction Model. They used data from January 1992 to June 2011 and macroeconomic forces were represented by interest rates, exchange rates, consumer price index, crude oil prices and money supply, while the Dhaka Stock Exchange All-Share Price Index was used to represent the Dhaka stock market prices.

The main finding of the study indicated a long-term relationship between the stock prices and macroeconomic variables. The long-run equilibrium equation disclosed that interest rate was positively related with the stock prices, which was unexpected as higher interest rates, theoretically, shift investors away from stocks and vice versa. They argued that this converse result was not uncommon in the literature; Mukherjee and Naka (1995), Maysami and Koh (2000), and Bulmash and Trivoli (1991) found a positive relation between short-term interest rates and stock prices, and a negative relation between long-term interest rates and stock prices. They opined that the increase in short-term interest rates might give the signal to fall in the future, which instigated the investors to buy more stocks now since fall in interest rate in near future would increase the stock prices.

The study showed that the exchange rate was negatively related with the stock price, which was unexpected. They hypothesized that the depreciation of Bangladesh currency (BDT) against US dollar should result in increasing foreign investment in the stock market, and would increase the stock prices. To explain this converse relationship, they pointed to the findings of some literatures, where the negative relationship between the exchange rate and stock prices was described with the argument that depreciation of currency resulted in increased imported raw materials and capital goods cost and thereby had increased the cost of production of the forms.

The impact of consumer price index was found negative, but insignificant. They argued that large inflation in Bangladesh might render this insignificant relationship. The relationship between crude oil prices and stock prices was found positive and significant. They opined that this was consistent with some recent studies, although inconsistent with theory. The positive relation of money supply with the stock prices was explained by the expansionary effect of the money supply. They found that the relationships of stock prices with interest rates, exchange rates and consumer price index were robust, while with money supply and oil price were sensitive to lag length. The short-term results of VECM revealed that the stock return and macroeconomic variables were insignificant at most lags.

Ahmed and Imam (2007) investigated long-term equilibrium relationship as well as short-run dynamic adjustment of such relationship between a group of macroeconomic variables and stock market of Bangladesh. They used monthly data for the period from July 1997 to June 2005. The stock market was represented by market index and the macroeconomic variables were represented by the industrial production index, broad money supply, interest rate, T-bill rate and GDP.

They found no cointegration between stock market prices with industrial production index, money supply and GDP. However, when one additional variable - interest rate was added with the previous model, a significant long-run relationship was observed. Furthermore, industrial production index, GDP and interest rate were positively related with stock index, however, relation was statistically insignificant for industrial production index. On the other hand, money supply (M2) was positively and significantly related with stock market index. Similarly, instead of interest rate when T-bill rate was considered, the model provided almost same results with only one exception that T-bill had negative relation with stock market index. The results of the Vector Error Correction model showed no convincing argument in favor of the short-run adjustments. The Granger causality test provided a unidirectional causality from interest rate change to stock market return.

Ali (2011) investigated the long-run equilibrium, short-run dynamic adjustment as well as causal relationship between the all share price index of Dhaka Stock Exchange (DSE) and the macroeconomic variables including consumer price index (CPI), Gross Domestic Product (GDP), foreign remittances, and import payment. He employed Johansen and Juselius (1990) cointegration approach to examine long-run equilibrium relationship and Vector Error Correction Model (VECM) to test short-run dynamic adjustment towards equilibrium among the variables.

Finally, Granger (1988) causality test was performed to identify the causal relationships among the variables. The data used for this investigation included monthly data series for the period from January 1987 to December 2010. He pointed that due to unexpected abnormal behavior of stock prices at Dhaka Stock Exchange (DSE) during the period from January 1996 to June 1997 (total 18 months), these monthly observations were excluded from the analysis.

The results of the study indicated that there existed one cointegrating equation among the variables at 5 percent significance level. The long-run equation showed that the stock market prices were influenced positively by consumer price index (CPI) and foreign remittances (REMIT). Conversely, gross domestic product measured at current market price (GDPMP) and import payment (IMPMT) affected the stock market prices negatively. The Vector Error Correction Model (VECM) showed a short-run dynamic adjustment rate of 5.98 percent per month indicating a slower adjustment towards long-term equilibrium, thus revealing weak form of efficiency in Dhaka Stock Exchange.

From the summary of the findings of different studies (see Table 2.3) on Bangladesh, we can conclude that the results are also diverse for Bangladesh. Furthermore, most of the studies have employed Johansen and Juselius (1990) cointegration approach to examine long-run equilibrium relationship and Vector Error Correction Model (VECM) to test short-run dynamic adjustment towards equilibrium among the variables. We have not found any study on relationship between macroeconomic variables and stock market on Bangladesh which has used the ARDL approach. This study has used ARDL cointegration approach along with Johansen Juselius test. Use of ARDL has assisted not only to check the robustness of the results but also has helped to examine the cointegration when the variables are not integrated in the same order.

Table 2.3: Summary of the Findings of Studies on Relationship between Stock Market and Macroeconomic Variables on Bangladesh

Macroeconomic Variables	Positive	Negative	Insignificant
Gross Domestic Product	Ahmed and Imam (2006)	Ali (2011)	
Industrial Production Index			Quadir (2012) Ahmed and Imam (2006)
Short-term interest rate/ T-Bill Rate/ Call Money rate	Khan and Yousuf (2013)	Ahmed and Imam (2006)	Quadir (2012)
T-Bond Rate	Ahmed and Imam (2006)		
Inflation	Ali (2011)		Khan and Yousuf (2013)
Exchange Rate		Khan and Yousuf (2013)	
Oil Prices	Khan and Yousuf (2013)		
Money Supply	Khan and Yousuf (2013)	Ahmed and Imam (2006)	
Import Payments		Ali (2011)	
Foreign Remittance	Ali (2011)		

2.3 Causal Relationships

There are evidences that stock prices are driven by macroeconomic variables, the so-called "fundamentals" of the economy. Furthermore, another issue in the interpretation of this relationship is very important, which is whether the relationship is a contemporaneous or lead-lag relationship. Many studies on the relationship between stock market return and macroeconomic variables has also examined whether macroeconomic variables can be used to predict future stock market movement or stock market can be used to predict future macroeconomic conditions.

Gunasekarage et al. (2004) examined the influence of macroeconomic variables on equity values in Sri Lanka. They used the Colombo All Share Price Index to represent the stock market and the macroeconomic variables were represented by money supply, treasury bill rate (as a measure of interest rates), consumer price index (as a measure of inflation), and exchange rate. With monthly data from January 1985 to December 2001 and using unit root test, cointegration, and Vector Error Correction Model (VECM), they examined both long- and short-run relationships between the stock market index and the macroeconomic variables.

The results of study indicated that at least one cointegrating relationship existed among these variables. Therefore, the causal relationship between the market index and macroeconomic variables was examined using the VECM specification. The results provided some support for the argument that the lagged values of changes in macroeconomic variables Granger caused variations in the share price index for Sri Lanka. They found statistically significant negative influence of inflation at lag 3, positive influence of growth on money supply at lag 1, and consistent negative influence of interest rate on the stock prices. Surprisingly, the result indicated that the exchange rate did not have any influence on stock prices. They argued that though the devaluation of the local currency throughout the sample period provided attractive investment opportunities in the stock market to foreign investors, but practically the limited participation of foreign investors in share trading activities of the Colombo Stock Exchange might be the reason for the absence of any relationship.

The study revealed that in case of reverse causality from the market index to economic variables, the market index did not exert any lagged influence on macroeconomic variables except interest rate. They opined that the negative bilateral relationship between the Treasury bill rate and the stock index might indicate that the local investors employed a market timing strategy and shifted their funds between the risk-free asset and risky securities using their predictions about the movements of the returns on these two assets. The results of the variance decomposition analysis indicated that a major proportion of the variability in the market index was explained by its own innovations, while only a minority was explained by macroeconomic variables. They pointed that this might be for the subset of the total macroeconomic variables used in this study.

Ali (2011) investigated the long-run equilibrium, short-run dynamic adjustment as well as causal relationships between the all share price index of Dhaka stock Exchange (DSE) and the macroeconomic variables including consumer price index (CPI), Gross Domestic Product (GDP), foreign remittances, and import payment. The Granger (1988) causality test was performed to identify the causal relationships among the variables. The data used for this investigation included monthly data series for the period from January 1987 to December 2010. The results of the Granger causality provided unidirectional causal relationships from CPI and foreign remittance to DSE Index, bi-directional causality between import payment and stock index, and no casual relation between GDP and stock index. He pointed that the no causal relation between GDP and stock index was consistent with the test performed by Ahmed and Imam (2007).

Joshi and Giri (2013) investigated the relationship between stock prices and macroeconomic variables in India. They employed multivariate cointegration test and the Granger causality test to examine the relation between the Bombay Stock Exchange (BSE) Sensitivity Index (SENSEX) and the macroeconomic variables. The macroeconomic variables selected were 91 days T-bill rate, Foreign Institutional Investors, Reserve Money, Money Supply (Narrow Money-M1, Broad Money-M3), Gold Prices, Crude Oil Prices, Index of Industrial production, Foreign Exchange Reserve, and Real Effective Exchange Rate.

The findings from Granger causality based on the Vector Autoregression (VAR) Framework indicated that Foreign Exchange Reserve and 91 day T-Bill Granger caused stock price but stock price did not Granger cause either of the two so the causations were unidirectional, and there were no causal relationships between Real Effective Exchange Rate, Foreign Institutional Investors, Index of Industrial Production, Crude Oil Prices, Gold Price, Money Supply (Narrow Money-M1, Broad Money-M3), and Reserve Money to BSE Sensitivity Index. So, they concluded that the stock market could not be used as a leading or lagging indicator for the selected macroeconomic variables.

Tangjitprom (2012a) examined the relationship between stock market return and macroeconomic variables in Thailand. He used four macroeconomic variables, which were unemployment rate, interest rate, inflation and exchange rate. He used normal regression model to find the relationship between the stock market return and the macroeconomic variables. The Vector Autoregression (VAR) model was used to examine the lag structure of the above regression model. Also, Granger causality tests were conducted to reexamine the lead-lag relationships among the variables. Finally, the variance decomposition was used to examine the impacts of innovations of each of the macroeconomic factors to the overall stock market and sectoral level.

He used monthly data of the variables for the period from January 2001 to December 2010. Due to unavailability of monthly GDP data in Thailand, the monthly unemployment rate was used to represent the general business condition and business cycle factor, while interest rate, inflation and exchange rate were represented by a five-year government bond yield, monthly consumer price index, and the nominal exchange rate between Baht and US Dollar respectively.

The results of the regression showed, as expected, two macroeconomic variables - interest rate and exchange rate, were significantly related with stock market return. While unemployment rate and inflation were not significant. He pointed that though both unemployment rate and inflation normally should carry valuable information about general business condition and cyclical factor but surprisingly these variables were not found significant to explain the stock market performance. He explained that it happened due to timing gap problem of the available data. He pointed that data about stock market, interest rate and exchange rate were available day-to-day, but that of unemployment rate and consumer price index were not available immediately.

So, he re-estimated the regression using two-month lagged of unemployment rate and inflation. The results revealed that unemployment rate slightly Granger-caused the stock market return, but the opposite was not true indicating that the change in unemployment rate could be used to predict the future stock market return, but the stock return could not help to predict the future unemployment rate. On the other hand, interest rate Granger caused the stock market return and stock market return also Granger caused the interest rate. However, both inflation rate and exchange rate did not Granger cause stock market return but stock market return Granger-caused both inflation and exchange rate. Therefore, the results highlighted that stock market return Granger caused most of the macroeconomic variables. So, they concluded that the performance of stock market was a good indicator to explain the future macroeconomic situation. He mentioned that this result was consistent with the report of Bank of Thailand, where stock market index was used as the leading economic indicator.

For sectorial index, he found that the sensitivity of each industry to macroeconomic variables was different from other industries. He pointed that because of the requirement of high capital investment, the importance of interest rate was very high for some industries like Automobile, Petrochemical, Household Products and Transportation. On the other hand, he found that some industries like Personal Care were more sensitive to unemployment rate, and some industries were less sensitive to any of the macroeconomic variables.

It is revealed from the literature review that the informational efficiency of major stock markets has been extensively examined through the study of causal relationships between stock market indices and macroeconomic aggregates. The findings of these studies are important since informational inefficiency in stock market implies on the one hand, that market participants can develop profitable trading rules and thereby can consistently earn more than average returns, and on the other hand, that the stock market is not likely to play an effective role in channeling financial resources to the most productive sectors of the economy.

In an efficient capital market security prices adjust rapidly to all available information and, therefore, the current prices of securities reflect all information about the security. Moreover, economic theory suggests that stock prices should reflect expectations about future corporate profits and corporate profits generally depend on future prospect of the economy. Therefore, it can be concluded that, in an informationally efficient market, past (current) information about the economic activities are not useful in predicting current (future) stock prices. However, the causality from lagged values of stock prices to economic activities does not violate informational efficiency, this finding is equivalent to the existence of causality from current values of stock prices to future levels of the economic variable. This would suggest that stock prices lead the economic activities and that the stock market makes rational forecasts of the economy.

If, however, lagged changes in one economic variable cause current variations in stock prices and past fluctuations in stock price also cause current variations in the economic variable, then a bi-directional causality is implied between these two series. This behavior indicates stock market inefficiency. In contrast, if changes in the economic variable neither influence nor are influenced by stock price fluctuations, then the two series are considered as independent of each other and the market is termed as informationally efficient.

In this study, literature on causal relationships are reviewed and summary of the results is reported in Table 2.4. From the summary, it is evident that the findings on causal relationship between stock market and macroeconomic variables are mixed. So, there is a need for continuing research in this area.

Table 2.4: Summary of the Findings on Causal Relationship between Stock Market and Macroeconomic Variables

Macroeconomic Variables	Unidirectional Causality Running from Stock Market	Reverse Unidirectional Causality	Bi-directional Causality	No Causal Relationship
Gross Domestic Product				Ali (2011)
Industrial Production Index				Joshi and Giri (2013)
Unemployment Rate	Tangjitprom (2012a)			
Short-term interest rate/ T-Bill Rate/ Call Money rate	Joshi and Giri (2013)		Gunasekarage et al. (2004) Tangjitprom (2012a)	
Inflation	Tangjitprom (2012a)	Gunasekarage et al. (2004) Ali (2011)		
Exchange Rate	Tangjitprom (2012a)			Gunasekarage et al. (2004) Joshi and Giri (2013)
Oil Price				Joshi and Giri (2013)
Gold Price				Joshi and Giri (2013)
Foreign Remittance		Ali (2011)		
Foreign Exchange Reserve	Joshi and Giri (2013)			
Import Payment			Ali (2011)	
Money Supply		Gunasekarage et al. (2004)		Joshi and Giri (2013)
Foreign Institutional Investors				Joshi and Giri (2013)

2.4 Relationships during Bubble, Meltdown and Recovery Periods

Critics argue that stock market does not always accurately reflect the underlying fundamentals of the economy, especially, when speculative bubbles and subsequent crashes emerge in the market (Binswanger, 1999). The author has argued that under such situations, prices of stock are no longer driven by macroeconomic fundamentals rather they tend towards irrational behavior. So, explaining the price pattern becomes a challenge during the crisis of the stock market. Yet extreme price movements - at odds with any reasonable economic explanation, are observed throughout history. Considering the adverse effect of these extreme price movements on economy, may studies have explored the reasons behind these irrational fluctuations.

Kazuo (1995) mentioned that since the 1950s, Japan's stock market has gone into bubbles every ten years or so (early 50s, early 60s, and early 70s). However, the bubble of 1980s was very strong and went on for several years (late 1982 to the end of 1989). He tried to investigate the causes of this strong bubble using quarterly data for the period from 1981 to 1994. The study examined the stock-price formation in Japan in the 1980s and the early 1990s. He applied the fundamental equation to decompose the changes in stock prices due to the changes in the earnings of the stocks, interest rates, and stock price appreciation expectations.

The study revealed that the key factor was the nominal interest rate which continued to decline until the late 1980s due to the extremely relaxed monetary policy pursued by the Bank of Japan. In addition, investors' stock price expectations added to the effect of low interest rates. In fact, the expectations factor played the leading role in the beginning and end of the bubble period, as well as in the post-bubble period, while more blame must be given to the interest factor during the bubble period.

He argued that in the 1980s, the Japanese economy faced a macroeconomic contradiction - a low rate of goods inflation and a high rate of asset inflation. He explained this apparent contradiction mentioning that the double-digit rate of money growth did not lend itself to goods inflation. Instead, it gave rise to asset inflation, both in stock price and in land price.

The study of Azeez and Yonezawa (2006) tried to examine the effect of macroeconomic factors on stock returns under pre-bubble, bubble and post-bubble conditions. They used McElroy and Buremeister (1985) framework to explore whether macroeconomic factors were priced source of risk using monthly data for the period 1973-1998. They argued that the study had considered data over a relatively longer period compared to other studies on the Japanese stock returns. Particularly, they pointed that the bubble economy of Japan in the late 1980s was well known and its impact continued even during the time of the study not only on the financial market but also on the whole economy. This motivated them to investigate the causes of asset-price fluctuations during that period.

To identify systematic influences on stock returns under the bubble period, they used 10 years data from January 1980 to December 1989. The rest of the periods were considered as pre-bubble period (1973–1979) and post-bubble period (1990–1998), and separately assessed to compare the priced factors of these periods with bubble period. The dependent variables were monthly returns expressed in excess of risk-free rate on 28 industry portfolios (as per the classification of the Tokyo Stock Exchange). The industry portfolio returns are fully adjusted for dividends. The macroeconomic factors considered were unanticipated shocks to money supply, inflation, industrial production, term structure of interest, and exchange rate.

They found negative risk premium for inflation and exchange rates, while positive risk premium for industrial production, money supply, and term structure of interest rate in all sample periods. However, money supply, inflation, exchange rate, and industrial production had significant influence on stock returns in all sample periods. On the other hand, the term structure of interest rates was significantly priced over the bubble period and insignificantly priced both in pre-bubble and post-bubble periods.

Although the number of priced factors and the signs of risk premiums were approximately stable across each period, but the magnitudes of risk premiums in absolute values increased during the bubble and post-bubble periods compared to pre-bubble period. Meanwhile, the variances of macroeconomic factors were not increased in the bubble period. They pointed that the higher risk premiums during the bubble and post-bubble periods could be due to the increase of bubble crash risk.

Finally, they pointed that over the bubble period during the 1980s, factors that were pervasive and carried a reward for systematic risk were those that were likely to be directly affected by monetary policy, specifically the money supply factors. Because in the loose monetary policy, money supply grew at a double-digit rate, but interest rates were kept at low level. They argued that these results were consistent with Kazuo (1995), who argued that the most important single factor for raising Japan’s stock prices was Japan’s low interest rate.

Asekome and Agbonkhese (2015) examined the macroeconomic variables that contributed the market’s bubble, burst, and its gradual recovery. The study covered a period of 24 years from 1990 to 2013 during which the Nigeria stock market witnessed a remarkable market bubble and eventual melt down when the market capitalization of 12.6 trillion Nigerian Naira during the month of March 2008, dropped to 6.96 trillion Nigerian Naira in the month of December and crashed to 4.48 trillion Nigerian Naira in the month of March 2009. However, as at the end of December 2013, the market recovered gradually with market capitalization increased to well over 13.6 trillion Nigerian Naira.

They used Nigerian Stock Exchange (NSE) value index as the dependent variable, while gross domestic product, money supply (M2), exchange rate, capacity utilization and inflation were used as independent macroeconomic variables. The results indicated that the coefficients of gross domestic product and exchange rate had the correct signs and in conformity with the theoretical expectations. However, money supply (M2) and capacity utilization had negative signs instead of a positive, while inflation had a positive sign instead of a negative sign. Nevertheless, the coefficients of GDP and money supply (M2) were statistically significant, while exchange rate, capacity utilization and inflation were not significant. The result further showed that regressors could explain about 97 percent of the systemic variations of all share index (ASI) during the period.

They argued that the negative sign exhibited by the money supply might be due to the fact that a reasonable portion of the total deposit mobilized by the deposit money banks (DMBs) did not translate to the domestic economy of Nigeria by way of credit creation. They added that the negative sign of capacity utilization was an indication of poor performance of the manufacturing sector which could be explained by low capacity utilization, poor effective demand for final products, exchange rate misalignment, and input procurement constraint; while the positive sign of inflation might not be unconnected with conspicuous consumption of Nigerians.

It is revealed from the literature review that a bubble is a well-known empirical phenomenon in stock markets, but there is no consensus about the mechanisms behind it.

When a pricing bubble appears, prices rise rapidly, making the listed stocks substantially overvalued. Generally, a bubble is followed by a crash. As the impact of a large crash on the stock market is considerable, hence bubbles and crashes are of profound importance to risk management of investment portfolios. Bangladesh stock market has experienced inefficient and irrational fluctuations twice since its inception, one in 1996 and the other one is in 2010. But no empirical study on Bangladesh has been found which has examined the reasons for the stock market bubble and its demise? Is it, as is commonly alleged, investors' speculative zeal? Or are there more mundane factors such as mismanaged monetary policy or some other macroeconomic factors behind this?

This research has aimed to examine the relationships between the selected macroeconomic factors and the stock market in Bangladesh during bubble and crash of 1996, as this is more prominent than that of 2010, and to find out which factors have played the key role in the bubble creation and subsequent crash. Also, the analysis has been extended to the recovery period. The relationships between the stock market and the macroeconomic variables in these periods have been separately assessed to compare the influences of the priced factors across the different periods. This new dimension has contributed to the void in the literature related to Bangladesh in this area.

2.5 Relation between Stock Market and Macroeconomic Volatilities

Theoretically, the fundamental value of a corporate stock equals the present value of expected dividends. On the other hand, the future dividends ultimately depend on future corporate profits, and corporate profits, in turn, depend on future economic activities. So, if available information is taken into account, there would be a close relationship between stock prices and expected future economic activities. Similarly, as the prices of stocks at the aggregate level depend on the state of economic activities, so it is likely that any change in the level of uncertainty of future macroeconomic conditions would cause a change in stock return volatility. In other words, stock markets may be volatile simply because real economic activities fluctuate (Zukarnain and Sofian, 2012).

In this context, the impacts of macroeconomic volatility on stock market volatility received a considerable attention among academics, economists and financial analysts. One of the earliest attempts to examine the impact of macroeconomic variables' volatilities on stock market return volatility has been made by Schwert (1989). His study has mentioned three important reasons as to why stock market volatility and the macroeconomic volatility are interrelated. Firstly, he has found a positive linkage between macroeconomic volatility and stock market volatility, with the direction of causality being stronger from the stock market volatility to the macroeconomic volatility. Secondly, he has argued that the evidence of stock market uncertainty being higher during recessions than expansions. These results have been explained through an operating leverage effect, i.e. profits tend to fall more rapidly than revenues during recessions if fixed costs are large. Thirdly, he has found that the level of macroeconomic volatility can explain less than half of the volatility of stock market returns.

Liljeblom and Stenius (1997) examined the relationship between conditional stock market volatility and macroeconomic volatility using monthly data of Finland for the period from 1920 to 1991. Conditional monthly volatility was measured as simple weighted moving averages which was obtained from the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) estimations. The results of the study indicated that the stock market conditional volatility was a predictor of macroeconomic volatility, as well as the converse. Tests of the joint and simultaneous explanatory power of the macroeconomic volatilities indicated that one-sixth to more than two-thirds of the changes in aggregate stock market conditional volatility might be related to macroeconomic volatility.

Morelli (2002) attempted to determine the relationship between conditional stock market volatility and conditional macroeconomic volatility using monthly UK data for the period from January 1967 to December 1995. Conditional volatilities were estimated using the well-known Autoregressive Conditional Heteroscedasticity (ARCH) and Generalised ARCH (GARCH) models. The macroeconomic variables used were industrial production, real retail sales, money supply, inflation, and exchange rate. The results of the study confirmed that conditional macroeconomic variables' volatilities did not explain the conditional stock market volatility.

Beltratti and Morana (2006) investigated the relationship between macroeconomic volatility and stock market volatility using S&P500 data for the period 1970-2001. They found evidence of both long memory and structural change in volatility and a twofold linkage between stock market and macroeconomic volatility. In terms of the break processes, their results showed that there were frequent cases where the break in the volatility of stock returns was associated within few months with breaks in the volatility of the Federal funds rate and M1 growth. After accounting for the structural breaks, there remained interesting relations among the break free series.

Using fractional cointegration analysis, the study found the existence of three long-run relationships linking stock market, money growth, inflation, the Federal funds rate, and output growth volatility, and two common long memory factors which were mainly associated with output and inflation volatility. The study showed that stock market volatility dynamics, both persistent and non-persistent, were associated in a causal way with macroeconomic volatility shocks, particularly to output growth volatility. The stock market idiosyncratic shock, which accounted for the bulk of the overall dynamics, also had influenced macroeconomic volatility. Yet the evidence suggested that the causality direction was stronger from macroeconomic to stock market volatility than the other way around.

Chowdhury et al. (2006) examined how the macroeconomic risk associated with industrial production, inflation, and exchange rate was reflected to the stock market return in the context of Bangladesh capital market. They used monthly data for the period from January 1990 to December 2004. Since many macroeconomic variables and stock returns were believed to follow GARCH (Generalized Autoregressive Conditional Heteroskedasticity) process, this technique was used to find predicted volatility series for the variables considered in the study.

Finally, VAR (Vector Autoregression) was employed to investigate the relation between the variables. The results showed significant unidirectional causality running from industrial production volatility to stock market volatility and from stock market volatility to inflation volatility. The latter being consistent considering the theory. They concluded that there was relation between stock market volatility and macroeconomic volatility, but it was not that strong as suggested by standard finance theory. They recommended for further study.

Chinzara (2010) examined how the time-varying macroeconomic risk associated with industrial production, inflation and exchange rates were related to time-varying volatility in the South African stock market. The study focused on both aggregate stock market indices and sectorial indices to investigate whether the response to macroeconomic volatility varied across sectors. Furthermore, the study also distinguished between the different stages of the economy, i.e. times of tranquility and times of crisis. He used augmented autoregressive GARCH (AR-GARCH) and Vector Autoregression models. The findings showed although the volatilities in inflation, gold price and oil price played a role, but volatility in short-term interest rates and exchange rates were most important, suggesting that South African domestic financial markets are increasingly becoming interdependent. The results also revealed that the financial crises had increased the volatility in the stock market and in most macroeconomic variables and, by doing so, strengthened the effects of changes in macroeconomic variables on the stock market.

Kadir et al. (2011) examined the predictability power of exchange rate and interest rate volatilities on stock market volatility and return using monthly Kuala Lumpur Composite Index (KLCI) returns, 3 months Malaysia Treasury bond and monthly exchange rate of Ringgit per US Dollar for the period from January 1997 to November 2009. The study adopted two models based on GARCH (1,1), model 1 (model 2) without (with) interest rate and exchange rate. Mean equations of model 1 and model 2 suggested that lagged KLCI returns had insignificant impact on contemporaneous KLCI returns, but the relationships between interest rate and exchange rate with KLCI returns were found negative, but significant for exchange rate and insignificant for interest rate. The results suggested that the conditional volatility of the stock market return was quite persistent in both models.

On the other hand, variance equations of the models showed that the volatility of KLCI was negatively related to interest rate volatility and positively related to exchange rate volatility. However, both relationships were not significant. They opined that exchange rates and interest rates could not be used to predict the volatility of the market.

Wang (2011) examined the relationship between stock market volatility and macroeconomic volatility for China using exponential generalized autoregressive conditional heteroskedasticity (EGARCH) and lag-augmented VAR (LA-VAR) models. They found evidence that there was a bilateral relationship between inflation and stock prices, while a unidirectional relationship existed between the interest rate and stock prices, with the direction from stock prices to the interest rate. However, the relationship between stock prices and real GDP was not significant. They argued that the results suggesting that the stock market was likely to be less efficient than those of the US and other developed countries and was somehow separated from the real economy of China.

The study of Adeniji (2015) pursued analysis on the relationship between stock market volatility and macroeconomic volatility in a developing country, Nigeria. He used GARCH (1,1) models with monthly data for a period from January 1990 to December 2014. To examine the relationship between stock market volatility and macroeconomic volatility, the study used cointegration, bi-variate and multivariate VAR, Granger causality tests as well as regression analysis. The cointegration test confirmed a long-run relationship among the volatilities of the variables.

The results of GARCH (1,1) model showed that three out of the five macroeconomic variables chosen had significant relationships with stock market prices volatility. At the same time GARCH results confirmed that stock market volatility was influenced by its own ARCH and GARCH factors, meaning that the stock market volatility was influenced by its own past volatilities as well as the new innovations. However, the results of Granger causality revealed that the volatility in GDP, inflation and money supply did not Granger-cause stock market volatility, but the volatility in interest rate and exchange rate did Granger-cause stock market return volatility.

On the other hand, ordinary least squares (OLS) regression analysis showed that interest rate and exchange rate volatilities were significantly related to stock market volatility. Also, OLS results disclosed that the coefficient of volatility of exchange rate was relatively large compared to other coefficients, which indicated that exchange rate volatility was a key factor in determining the volatility in stock market returns in Nigeria. However, pointing to the low explanatory power of the regression analysis, the researcher argued that the volatilities of the macroeconomic variables used in regression played very minor role in explaining the stock market volatility in Nigeria. He added that this finding was admissible in the case of developing countries with the supremacy of non-institutional investors and the existence of information asymmetry problem among investors.

From the foregoing literature review, it is revealed that stock market volatility has profound importance to policy makers, financial managers, firms, investors and other stakeholders to understand the causes and determinants of this volatility. Alongside, macroeconomic variables have been considered as the powerful tool to forecast the volatility of stock market all over the globe. In this backdrop, enormous studies have been conducted to investigate the relationship between stock market variability and macroeconomic variability. However, a very few studies on Bangladesh have focused on this topic and it is very important to find out the factors causing the irrational fluctuations in the stock market of Bangladesh.

2.6 Relation between Stock Market and Real Economy

A stock market is seen as a general measure of the state of the economy of the country where it operates. An increase in stock prices provides a stimulus to the confidence of households and firms and reduces the uncertainty they have about their future economic situation. So, the equity risk premium provides an insight into the degree of risk aversion in the economy which, in turn, can affect the real economy. This channel works through the perceived riskiness of equity and the risk compensation desired by investors.

Men and Li (2006) examined the relationship between the stock market index and the national economy of China using cointegration and Granger causality tests. This study used Gross Domestic Product (GDP) to represent the economy and two stock market indices - namely Shanghai Securities Exchange Composite Index and Shenzhen Securities Exchange Composite Index, as the representatives of Chinese stock markets. The study period was from1995 to 2005 and the number of the observations was 132 in total.

The results of empirical study showed that both Shanghai Securities Exchange Composite Index and Shenzhen Securities Exchange Composite Index were not cointegrated with Chinese GDP. Moreover, for both markets they did not find any causal relationship between stock markets' return and GDP growth rate. They argued that there could be many possible reasons to explain the seemingly abnormal relationship between Chinese stock index and the national economy.

Firstly, although the private sector played a key role in contributing to the GDP growth in China, but 90.5% of the capital of private sector financing were based on self-financing, 4% was supported by bank loan, and even less financing was acquired from stock market. Therefore, the stock did not show the actual situation of the GDP.

Secondly, most of Chinese financing was supported by commercial bank loans and the total capital raised from stock market accounted for only 0.57% of the volume of bank loan in 2004. So, the dominant commercial banking industry weakened the role played by the stock market. Hence, the unbalanced financial structure could explain at least partly why Chinese stock market was not playing an important role in the development of the national economy.

Antonios (2010) investigated the causal relationship between stock market development and economic growth using Granger causality test. The study also examined the long-run relationship between these variables applying the Johansen cointegration analysis. The sample used in this study consisted of annual observations for Germany for the period from 1965 to 2007. The variable of economic growth was measured by the rate of change of real GDP, while the general stock market index was used as a proxy for the stock market development.

The empirical analysis suggested that there existed a cointegration relationship among the variables. Then the short-run dynamics of the model was studied using Vector Error Correction Model (VECM). The results of the VECM indicted that the speed of adjustment forced the long-run behavior of the endogenous variables to converge to their equilibrium relationship. Finally, the Granger causality test showed that there was a unidirectional causality between stock market development and economic growth with direction from stock market development to economic growth.

Husain (2006) examined the causal relationships between stock prices and the variables in Pakistan. The variables representing the real sector of the economy were real GDP, real consumption expenditures, and real investment spending. Annual data for the period from 1959-60 to 2004-05 were used in the study. He considered the expected shift in the data due to the start of the economic liberalization program in the early 1990s, which resulted in significant improvements in the size and depth of the Pakistani stock market. To take care of that economic liberalization program the sample was further classified into two sub-samples. Sample I, from 1959-60 to 1990-91 which covered the period prior to the liberalization program, while Sample II, from 1991-92 to 2004-05 represented the post-liberalization period. Similarly, in regression analysis he included a dummy from 1991-92 onwards to take care of the possible shift in relations between variables due to economic liberalization program.

The results showed that in the pre-reform period, the correlations are almost zero. However, the post-reform period showed a significant increase in correlation coefficients, indicating the beginning of association of stock prices with real variables following liberalization measures. In particular, the correlation between stock prices and GDP was very high. On the other hand, the results of the Engle-Granger cointegration tests indicated that in all cases there existed significant long-run relationships between stock prices and real variables.

The findings of Error Correction Models indicated a unidirectional causality running from the real sector variables to the stock prices in the long-run. But the lagged variables as well as the F-values were not significant in all the cases suggesting that in the short-run these variables were independent of each other. Hence, he concluded that the stock market in Pakistan was not that developed to influence the real sector and therefore could not be considered as the leading indicator of the economy.

In addition, to take care of the shifts in variables representing the stock market as well as the real sector due to the liberalization measures, a dummy variable was added in the analysis that took the value of one from 1991-92 onwards. The results showed that the dummy variable was not significant implying that the relations of stock prices with the variables representing real sector were not affected by the liberalization measures.

Nevertheless, the results of error correction model were similar to those obtained without taking care of the shifts. So, he concluded that despite significant developments the stock market in Pakistan was still not in a position to influence the real sector.

Krchniva (2013) investigated the relationships between stock markets and the economic growth of seven countries – namely United States, Japan, Germany, Poland, Hungary, the Czech Republic and the euro area. She used seasonally adjusted quarterly time series data of those seven countries for the period from first quarter of 2000 to the second quarter of 2012. The stock markets were represented by stock market indices and the economic growths of the selected countries were represented by Gross Domestic Product (GDP) at constant prices.

The hypothesis of the study was whether the stock markets had an ability to predict the economic development. This was tested by correlation analysis and the Granger causality test. The results exhibited unique correlation between the stock market and the economy in five of the seven countries. In addition, Granger causality test showed in most cases the stock market led economic development by one quarter. However, for US the relationship between the stock market and economy reversed, while for Hungary the relationship was bi-directional.

The results revealed that for German, Japan, Czech, Polish and the euro area the stock markets led economic development by one quarter. She mentioned that these results were consistent with the study of Estrella and Mishkin (1996). On the other hand, in the case of US the opposite unilateral relation seemed to exist between the stock market and the economy, which corresponded to the conclusion of the study of Goktas and Hepsag (2011), where it was showed that the performance of stock markets was overtaken by economic development.

Finally, she concluded that the findings of the study were in contradiction with the conclusions of some studies but on the other hand, in accordance with many others. This could be due to the maturity or size of the economy and its stock market. However, at the end, she supported the view that stock indices could be used as an important leading indicator of economic development.

From the foregoing literature review, it is revealed that the relationship between the stock market and the real economy depends on the size and maturity of the economy and its stock market. The stock market in Bangladesh and its economy are passing through numerous liberalization and deregulation processes. As a result, size of the economy as well as the stock market have increased significantly during our study period. So, it would be interesting to examine whether this has increased the stock market's ability to reflect the real economy as per the theory.

Moreover, Bangladesh stock market has experienced two major bubbles within a decade and a half, one in 1996 and other in 2010. However, the catastrophe of 1996 is more prominent compared to that of 2010. This has motivated us to examine the relationships between the stock market and the real economy of Bangladesh around the catastrophe of 1996 - that is during the bubble and meltdown periods of 1996. In fact, these investigations have been conducted to describe the relationships between the stock market and the real economy during the crisis times of the stock market.

On the other hand, following the crash of 1996, several capital market development programs have been initiated through a strong partnership between the government of Bangladesh and the Asian Development Bank to broaden the market capacity and develop a fair, transparent, and efficient domestic capital market. The main objective of these programs has been set forth to restore investors' confidence, which has significantly damaged after the market crash of 1996, because of excessive speculations, allegedly aggravated by widespread irregular activities. Also, the stock market has been striving for continuous upgradation of its trading platform since August 1998 to fulfill the dream of transforming Dhaka Stock Exchange (DSE) into modern world class exchange. In these perspectives, this study has also examined whether these initiatives have increased the response of stock market to real economy of Bangladesh.

2.7 Conclusion

In last three decades, numerous studies have tried to investigate empirically the relationship between macroeconomic variables and stock market. The results of these studies reveal that the relationship cannot be determined in advance since it varies across countries and within a country it varies across times because of different legal and institutional structures that affect the link between stock prices and macroeconomic variables vary from country to country and within the country that vary across times.

Although most of the researchers have documented evidence that fundamental economic activities in developed countries are strongly linked to stock market returns, it is unclear whether such a relationship exists in emerging stock markets in less developed countries. Because compared to their developed market counterparts, these stock markets are smaller in size and relatively illiquid. The economies of these countries are influenced to a far greater extent by global economic factors rather than domestic economic measures. Furthermore, the growing influence of foreign investors in these markets may weaken any link between national economic variables and stock market returns.

The literature review has revealed that early studies have used multi-factor asset pricing models based on the assumption that stock market returns are affected by different macroeconomic factors. However, to forecast the stock returns variation and its relationship to macroeconomic factors need modern econometric techniques and models. The selection of an appropriate model for the investigation of relationship is still a contentious issue due to distinctive features and parameters of different models.

The literature review has indicted that most of the studies have used a single model to examine the relationship between macroeconomic variables and stock market. However, this study has employed multiple models to check the robustness of the results on the relationship. Furthermore, we have found that none of the studies on Bangladesh has used most recent ARDL cointegration approach to examine the relationship between stock market and macroeconomic variables. This study has attempted to fill this gap by exploring the relation between stock market and macroeconomic variables in Bangladesh applying the ARDL approach.

Many studies on the relationship between stock market and macroeconomic variables have also examined stock market predictability to examine whether stock market is a leading indicator of the future economic activities or other way around. The findings of the existing literature on this implication are also mixed. Moreover, most of the works, if not all, on Bangladesh has hitherto concentrated primarily on contemporaneous relationship leaving gap in causal relationship. This study has attempted to examine the casual relationships between stock market and macroeconomic variables to address the void in the literature.

On the other hand, a bubble is a well-known empirical phenomenon in stock markets, but there is no consensus about the mechanisms behind it. A bubble is followed by a crash. As the impact of a large crash on the stock market is considerable, hence bubbles and crashes are of profound importance to risk management of investment portfolios. Alongside, Bangladesh stock market has experienced inefficient and irrational fluctuations twice since its inception. However, we have found that no study on Bangladesh has concentrated on this implication, leaving a serious gap in the literature.

This study has examined the relationships between stock market and macroeconomic variables during bubble and meltdown periods of stock market. In addition, this study has aimed to identify the factors responsible for creating bubble and bubble crash. Moreover, the analysis has been extended to the recovery period to compare the influences of the priced factors across different periods. This will add a new dimension in the literature on Bangladesh.

The impact of a large market crash on households, banks and finally on overall economy has increased the interest of regulators, researchers and investors towards the relationship between stock market volatility and macroeconomic volatility. Additionally, the risk return behavior analysis of stock market is more important in developing countries because these markets are very volatile. The degrees of volatility in these stock markets compel the investors to demand higher risk premium, which creates higher cost of capital and slows down the economic development (Mala and Reddy, 2007). The stock market volatility in Bangladesh is mostly influenced by trade syndication or the decisions of other regulatory bodies like Bangladesh Bank (Siddikee and Begum, 2016). In this perspective, this study has examined the stock market volatility and macroeconomic volatility in Bangladesh.

Furthermore, stock market is seen as a general measure of the state of economy through which stock prices affect the real economy via a confidence channel. An increase in stock prices provides a stimulus to the confidence of households and firms and reduces the uncertainty about future economic situation. However, empirically the predictive content of stock prices for economic growth is less clear-cut and it depends on size of the economy as well as the stock market (Krchniva, 2013).

Bangladesh stock markets have grown significantly during the last decade due to the steps taken to strengthen the stock market following the crash of 1996. Still, the size of the market is relatively small compared to other Asian Markets. However, Bangladesh stock market is continuously passing through upgradation of its trading platform to set the foundation for sustainable market development and to build up state-of-the-art market surveillance system to increase the transparency of market transactions and contribute significantly to enhanced investor confidence.

In this backdrop, it important to know the relationship of stock market with the dynamics of real economic activities of Bangladesh. It is also important to investigate whether the reforms and the automation initiatives have improved the ability of the stock market to predict the real economy. But none of the study is found which has addressed these issues. This study has focused on these issues to fill up the void in the literature on Bangladesh.

The major drawbacks of our stock market are the lack of information transparency and investors have lack of knowledge (fundamental and technical). Moreover, DSE has very short histories of organized share trading system and the perception of investors may be different from those in developed markets. Therefore, the behavior of the market prices may not be tied to economic fundamentals; rather the stock prices may be driven by the speculative activities of irrational investors.

Hassan et al. (1999) have found that DSE returns show positive skewness, excess kurtosis and deviation from normality. They have also found that DSE volatility has changed over time, and is serially correlated implying stock market inefficiency. Gunasekarage and Power (2001) have provided convincing evidence that investors in DSE can earn excess returns by employing technical trading rules. This study has also revealed that the fixed length moving average rule generates excess return of 9.81 percent in Bangladesh.

There is no doubt that a vibrant capital market supports economy but two major catastrophes in the capital market of Bangladesh within a decade and a half do not indicate the existence of a vibrant market; rather these irrational fluctuations prove that the capital market is highly risky and unstable. Moreover, the Finance Minister of the country AMA Muhith termed the stock market as 'naughty' and said 'the economy would not suffer if he does not worry about the market'[2].

In the above context, the outcome of the research could be noteworthy. A successful innovation of relationship between the macroeconomic indices and the stock market will assist the entire interested group to decide efficiently the operational, management and sustainable growth issues. Investors can ensure maximum return from their investment in the stock market by taking information from this research. Regulator and policy makers may find the outcomes of the research helpful in formulating different policies and taking decisions for ensuring and creating smooth trading and investment atmosphere, controlling market strategies and assessing the degree to which the stock market may need to be reformed.

To sum up, it can be concluded that apart from contributing to the existing literatures on relationship between stock market index and macroeconomic indices, this research extends

[2] The Financial Express, 13 June 2012.

the existing relevant studies on Bangladesh in several ways. Firstly, most recent data has been used, which is necessary given that the Bangladesh stock market is still undergoing through technical changes, which is likely to increase the efficiency, thus increasing its response to macroeconomic factors.

Secondly, multiple econometric models have been used to cross validate the results. More specifically, in addition to Johansen and Juselius cointegration test, the Autoregressive Distributed Lag (ARDL) cointegration approach has been applied in this study. Thirdly, the study has examined whether the stock market can be used as a leading indicator of future macroeconomic condition or vice versa.

Fourthly, contrary to other studies (Ali, 2011; Quadir, 2012; Khan and Yousuf, 2013), this study has examined the relationships of macroeconomic variables with stock market during bubble, meltdown and recover periods, because the investors have the tendency to react differently to the same type of news during different periods. This study has also aimed to identify the factors responsible for creating the bubble and bubble crash of 1996. Fifthly, since the stock market volatility provides some important implications for policy makers, economic forecasters and investors, this study has examined the relationship between stock market volatility and macroeconomic volatility in Bangladesh.

Finally, the study has also investigated the relationship between the stock market and the real economy of Bangladesh to examine whether any significant link exists between the these two. The study has also attempted to examine this relationship during different conditions of the stock market. In addition, the study has been extended further to examine whether the reform measures and the technical changes implemented for the development of the stock market have increased its efficiency.

Chapter 3

Theoretical Framework

3.1 Introduction

According to the modern financial theory, the value of a financial asset is equal to the sum of its discounted expected cash flows. So, the determinants of stock prices are the expected cash flows from the stock and the required rate of return commensurate with the cash flows' riskiness. For an individual stock, these two aforesaid variables can be affected by influences that are not pervasive or systematic to economy. But returns on market are mainly influenced by systematic risk because idiosyncratic risk on individual stocks is cancelled out through the process of diversification. Furthermore, macroeconomic variables are the indicators or main signposts signaling the trends in economy (Siamwalla et al., 1999) and these variables are considered as economic state variables (Chen et al., 1986). Accordingly, the expected changes in macroeconomic variables have impact on the expected cash flows and/or the required rate of return of stocks and thereby can affect the current stock prices.

The financial theories to carry out research works on various aspects and determinants of stock prices, started in the 1950s, were refined during the following decades and resulting in a unified framework of financial theory during the 1980s. The rapid development of these theories, especially the formation of the theories in defining the nature and working of capital markets, has resulted in the establishment of flexible asset pricing models which are widely applied in capital markets in recent time. These financial theories on asset pricing revolve around two fundamental issues, which when taken together suggest the lack of prolonged arbitrage opportunities. These two fundamental issues are: (1) financial markets are informationally efficient; and (2) market participants are rational. That is why, the Efficient Market Hypothesis (EMH) and the Rational Expectation Hypothesis are considered as the cornerstones of modern financial economics, which assert that stock prices should reflect all available information about the fundamental value of the underlying security (Fama, 1970). The EMH, rational expectations hypothesis and asset pricing models are interrelated topics.

Since the objective of this research is to investigate the relationship between the stock market index and the macroeconomic indices, the understanding of the theoretical foundations of different asset pricing models, such as the Capital Assets Pricing Model (CAPM) and Arbitrage Pricing Model (APM), are crucial in analyzing the determinants of stock prices from the perspective of Efficient Market Hypothesis (EMH) and Rational Expectations Hypothesis. Our review of empirical literatures has also revealed that different studies have used different econometric models within the framework of different asset pricing models to investigate the relationship between stock market and macroeconomic indices.

In view of this, the concept of EMH, rational expectations hypothesis and the evolution of different asset pricing models have been discussed in the next four sections of this chapter. In section 3.2, we have introduced the concept of the efficient market hypothesis. Section 3.3 describes the theory of expectations and stock prices. A review of stock valuation and portfolio selection under uncertainty are discussed in section 3.4. In section 3.5, we have portrayed a detailed overview of relevant asset pricing models. More specifically, the capital asset pricing, intertemporal capital asset pricing and arbitrage pricing models have been described. Finally, summary of the chapter is drawn in section 3.6.

3.2 Efficient Market Hypothesis

A market is said to be efficient with respect to an information set if the price fully reflects that information set (Fama, 1970) i.e. if the price would be unaffected by revealing the information set to all market participants (Malkiel, 1992). It is generally believed that security markets are extremely efficient in reflecting information about individual stocks and about the stock market as a whole. The EMH asserts that when information arises that spreads very quickly and is incorporated into the prices of securities without delay.

Thus, the main engine behind price change is the arrival of new information. In an efficient market prices adjust quickly to new information and, on average, without being biased. So, the current prices of securities reflect all available information at any given point in time and there is no reason to believe that prices are too high or too low. Security prices adjust before an investor has time to trade on and profit from a new piece of information. Presently, with the advent of modern telecommunications facilities, enthusiastic business media and a large number of buyers and sellers, securities markets are much more efficient than before.

Moreover, many investment analysts spend a significant amount of effort and time to detect "mispriced" securities and as more and more analysts compete against each other in their effort to take advantage of over- and under-valued securities, the likelihood of being able to find and exploit such mispriced securities becomes smaller and smaller. In equilibrium, only a small number of analysts can be able to profit from the detection of mispriced securities and mostly by chance. Thus, no one can consistently beat the market.

In the short-run, investors may earn unusual returns even if the market is efficient. For example, an investor could buy a stock today, and tomorrow a major discovery could be announced that would cause its stock price to increase significantly. But it does not mean that the market is inefficient; rather it means that the investor is very skillful or, more likely, very lucky. The question is whether the investor and enough other investors can do this a sufficient number of times in the long-run to earn abnormal profits? Even in the long-run, some people may be lucky given the total number of investors. Thus, neither technical analysis, which is the study of past stock prices to predict future prices, nor the fundamental analysis, which is the analysis of financial information such as company earnings, asset values etc., can help investors to select “undervalued” stocks.

Therefore, none of the market analyses would enable an investor to achieve returns greater than those which could be obtained by holding a randomly selected portfolio of individual stocks with comparable risk. However, market efficiency invariably depends on following two factors: (1) how efficiently investors interpret information (before taking investment decision); and (2) how fast the information is reflected on the asset prices. Since the interpretation of information and the speed at which investors react vary across markets and across assets within the same market, meaning that efficiency is a relative term.

Many investment analysts try to identify securities that are undervalued and are expected to increase in value in the future, and particularly those which will increase more than others. They believe that they can select securities that can outperform the market. They use a variety of forecasting and valuation techniques to aid them to make their investment decisions. But the EMH states that none of these techniques are effective (i.e., the advantage gained does not exceed the transaction and research costs incurred).

Possibly, like EMH, no other theory in economics or finance generates more passionate discussion between its challengers and proponents. For example, noted Harvard financial economist Jensen (1978) has written - "there is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Market Hypothesis", while investment maven Peter Lynch has claimed in an interview with the Fortune Magazine - "Efficient markets? That's a bunch of junk, crazy stuff" (Fortune, April 1995).

In this context, Malkiel (2003) has made the convincing remarks that markets can be efficient even if many market participants are quite irrational, markets can be efficient even if stock prices exhibit greater volatility than can apparently be explained by fundamentals and many economists who believe in efficiency do so because they view markets as amazingly successful devices for reflecting new information rapidly and, for the most part, accurately. Also, he has added that the records of professional fund managers do not suggest that sufficient predictability exists in the stock market or that there are recognizable and exploitable irrationalities sufficient to produce excess returns. Furthermore, Graham (1965) has suggested that while the stock market in the short-run may be a voting mechanism, in the long run it is a weighing mechanism and true value wins out in the end.

3.2.1 Different Forms of Market Efficiency

Considering the different information sets, Fama (1970) has identified the following classification of market efficiency depending on three relevant information subsets:

- **Weak Form Efficiency:** The weak form of the efficient market hypothesis asserts that all information contained in historical prices is fully reflected in current prices of securities. This indicates that nobody can detect mispriced securities and "beat" the market by analyzing past prices.
- **Semi-strong Form Efficiency:** The semi-strong form of market efficiency hypothesis suggests that the current price fully incorporates all publicly available

information. Public information includes not only past prices, but also data reported in a company’s financial statements, announcements of earnings and dividend, announced merger plans, financial situation of company’s competitors, expectations regarding macroeconomic factors etc.

- **Strong Form Efficiency:** The strong form of market efficiency states that the current price fully incorporates all existing information, both public and private. The main difference between the semi-strong and strong efficiency is that in the latter case nobody should be able to systematically generate profits even if trading on information that is not publicly known at that time.

Later, Fama (1991) has modified these three forms of market efficiency. He has put forward three test procedures to determine different forms of market efficiency. These are: (1) Return predictability: whether the past information can be used to forecast present stock returns; (2) Events studies: whether asset price responses to new information as hypothesized; and (3) Test for private information: whether asset prices are related to the private information. The idea of EMH is based on the idea of perfect stock market. Therefore, it is necessary to consider it in relation to perfect capital market.

3.2.2 Efficient Market vs Perfect Market

Perfectly competitive markets (or perfect market for short) are termed as efficient market. A perfect market is one in which there is no arbitrage opportunity because assets are priced with total efficiency. Copeland and Weston (1988) has contrasted the efficient capital market with the theoretical perfect market. They have stipulated following conditions for the market to be perfect market:

- **Markets are perfectly competitive:** There are many buyers and sellers, each firm in the market produces and sells a nondifferentiated or homogeneous product, no barriers to entry and exit, producers supply goods and services at minimum average cost, participants in the market are price takers;

- **Markets are frictionless:** There are no transaction costs, no taxes, all assets are perfectly divisible and perfectly marketable, there are no constraining regulations;
- **Markets are informationally efficient:** Information is costless, and all individuals receive it simultaneously; and
- **Investors are utility maximizer:** All individuals are rational expected utility maximizers.

When these conditions are satisfied both product and security markets are productively, operationally and allocatively efficient.

However, according to Grossman and Stiglitz (1980), the stock market is not a perfectly competitive market. There are some sources of imperfection such as perfectly inelastic supply curve, transaction cost, taxes and informational inefficiency. So, a weaker and economically more sensible version of the market efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed the marginal costs (Jensen, 1978). In addition to EMH, theory of expectations is another key concept to understand the stock market.

3.3 Expectations and Stock Prices

Participants in stock markets formulate their expectations of future returns and it is generally believed that security prices are determined by expectations, which concern firm and economic variables (Elton et al., 1981). Expectations of the economic events and especially the macroeconomic variables have significant effect on the stock market returns. However, there is no common method of measuring expectations. The asset valuation models, such as CAPM and APT, are formulated in terms of expectations. So, it is necessary to transform parameters from expectations or ex-ante form (as expectations cannot be measured) to a form that uses observed data (Elton and Gruber, 1991). The betas (βs) in the CAPM and APT are the future betas of the security. Similarly, both the returns on the market and the zero-beta portfolio (which is the minimum variance portfolio and uncorrelated with market portfolio) are also expected future returns (Elton and Gruber 1991). All these facts highlight the importance of expectations and their impact on investments.

In this context, expectations have become central and pervasive to economic analysis (Gertchev, 2007; Figlewski and Wachtel, 1981) because of the role they play in current investment decisions. Modeling of expectations has also gained importance over the time, especially in contemporary macroeconomics. But the expectations are unobservable – they exist or are formed in the mind and are abstract. Expectations formation models are arbitrary assumptions and their use is categorized as a ‘positivism’ approach (Mlambo, 2012). There are various expectations models. Among these, the two most common ones are adaptive expectations and rational expectations, with the latter being the standard in mainstream economics.

3.3.1 Adaptive Expectations

The adaptive expectations hypothesis states that future expectations of an economic event are based on actual outcomes in the past. These expectations are formed based on the past experiences only. This is equivalent to the technical analysis or the weak form of the EMH. It states that the past experiences determine the future events. People change their decisions according to previous information. They make mistakes time to time, but they learn from past mistakes (Copeland and Weston 1988).

According to Evans and Garey (2003), the adaptive expectations hypothesis introduced by Cagan (1956) and Friedman (1957), was a plausible and empirically meaningful approach to modeling expectations of future variables in the world of uncertainty. They have argued that the apparent empirical success of their studies has led to widespread use of the adaptive expectations hypothesis before it has been swept away by the rational expectations revolution, initiated by Muth (1961) and advanced by Sargent and Wallace (1975). Finally, they have concluded that rational expectations hypothesis has shown greater advantage of providing optimal expectation and under the standard of optimality, adaptive expectations hypothesis suffers by comparison and should be rejected.

3.3.2 Rational Expectations

Rational expectations have two basic forms: weak-form rational expectations and strong-form rational expectations. Weak-form rational expectations imply that whatever information people have (no restriction placed on information), they make optimal use of the information in forming their expectations. Conversely, strong-form rational expectations suggest the use of all relevant available information (strong restriction placed on information) in forming expectations.

Moreover, if there is a change in the way a variable is determined, people immediately change their expectations regarding future values of that variable even before seeing any actual changes in that variable. Although forecasts are not always accurate, but forecast errors are not predictable in advance and errors average out to zero. The two reasons why expectations can fail to be rational in the strong-form sense are: (1) investors are aware of all available information but fail to use all the information to formulate the expectations; and (2) investors are unaware of some available information which are relevant to formulate the expectations. The best forecast of a future variable can be made if a forecaster uses all available and relevant information, the latest statistical data and the best available economic models.

The theory of rational expectations and EMH imply that expectations in financial markets are made based on optimal forecasts by using all relevant available information (i.e., investors have strong-form rational expectations). Security prices in financial markets are determined at market clearing level, where supply is equal to demand. Security prices reflect true fundamental (intrinsic) value, meaning that there is no price bubble. Believers in EMH and rational expectations insist that the unexpected changes in economic variables can only affect the returns on the stock market.

In an efficient market, market participants are sophisticated, informed and act only on available information. Since everyone has the access to same information, all securities are appropriately priced at any given time. Therefore, both a novice and expert investor, holding a diversified portfolio, obtain comparable returns regardless of their varying levels of expertise. However, one major strike against this is that some investors routinely beat the market, especially Warren Buffett. The implication is either that some people have better information than others or that some people are better at interpreting information than others. This gives rise to the concept of fundamental analysis which assumes that investors can achieve excess returns by purchasing stocks below their intrinsic value.

3.4 Fundamental Analysis vs Portfolio Theory

The stock investment process looks considerably different depending on the investor's belief about market efficiency. Based on the belief in the degree of market efficiency, two major investment theories emerged that still divide the financial community. One is the fundamental analysis based on the idea of non-efficient markets and other hand is the modern portfolio theory (MPT) with a strong faith in market efficiency. These two different approaches to investment (fundamental analysis and MPT) are based on two fundamentally different understanding of the relationship between intrinsic value and price. Price balances supply and demand for stocks on the stock exchange and can be exactly determined. Intrinsic value is more difficult to establish and measure. Value must be determined through a valuation process. This process requires forecasting the future, hence is unavoidably subjective and various approaches are generally used.

In efficient markets, price should be equal to its intrinsic value, but fundamental analysis assumes that value and price can deviate. It is too simplistic to assume that markets are always efficient, and prices adjust to intrinsic value instantly. Lee (2001) has argued that price convergence towards intrinsic value is characterized by a process, which is accomplished through the interplay between noise traders and information arbitrageurs. Prices move from the intrinsic value as investors trade based on imperfect informational signals. Eventually, through trial and error when the information procession is completed, then prices fully reflect the impact of that information. However, by that time, many new informational signals have arrived, starting a new adjustment process. Consequently, the market is in a continuous state of adjusting prices to intrinsic values.

On the other hand, the underlying philosophy of the modern portfolio theory (MPT) is based on the idea of efficient markets hypothesis, which states that a large number of informed participants ultimately drive the stock prices to its intrinsic value and create an efficient market. In such an environment, mispriced stocks would be detected and the under- or overvaluation would disappear immediately, so no profit could be gained from using any fundamental analysis. In other words, the MPT states that all stocks are fairly priced, and nobody can persistently outperform the market. Consequently, followers of

MPT try to reduce risk by diversification and costs by minimizing transaction fees and taxes. The optimal investment strategy is the creation of an efficient portfolio based on covariances of all the stocks in the global marketplace. The natural extensions of the portfolio theory are the equilibrium asset pricing models

3.5 Assets Pricing Models

Valuation is the process of determining the intrinsic value of common stocks. A fundamental principle of finance holds that the economic value of a security is properly measured by the sum of its future cash flows, where the cash flows are adjusted considering the riskiness associated with expected cash flows and the time value of money. A popular model used to value common stock is the dividend discount model (DDM). The DDM argues that competition among rational investors, who want to diversify to optimize the statistical properties of their portfolios, lead to an equilibrium in which prices equal the discounted value of the rationally expected cash flows. So, the price, P of a stock having expected dividend stream E(c) and discount rate k can be express by:

$$P = \frac{E(c)}{k}$$

Taking natural logarithm of both sides, we get:

$$\ln P = \ln E(c) - \ln k \qquad 3.1$$

Differentiating Equation (3.1), we get:

$$\frac{dP}{P} = \frac{dE(c)}{E(c)} - \frac{dk}{k} \qquad 3.2$$

On the other hand, the total return (TR) from a stock can be given by:

$$TR = Yield + Price\ Change$$

$$\therefore TR = \frac{c}{P} + \frac{dP}{P} \qquad 3.3$$

From equation (3.2) and (3.3) we get:

$$TR = \frac{c}{P} + \frac{dE(c)}{E(c)} - \frac{dk}{k} \qquad 3.4$$

So, theoretically, the factors that change the stock returns are unexpected changes in cash flows, *dE(c)* and/or discount factors, *dk*.

The unsystematic and systematic risk are the factors that create unexpected changes in cash flows and/or discount rate. However, the unsystematic risk, which is generated by microeconomic factors and is specific to an individual stock or an industry, can be eliminated through the process of diversification. But the systematic risk, which is mainly created by macroeconomic factors, cannot be eliminated by diversification. Hence risk and return on a diversified portfolio depend on the pervasive or systematic risk factors which is generated by economic factors and this is the area of concentration of this research.

Portfolio theory integrates the efficient market hypothesis and rational expectations hypothesis. The natural extensions of the portfolio theory are the equilibrium asset pricing models, such as CAPM and APM, which integrate macroeconomic risk factors into the stock valuation process. Portfolio theory is a description of how the rational investors should build efficient portfolios and the asset pricing models indicate how equities should be priced in the efficient capital market.

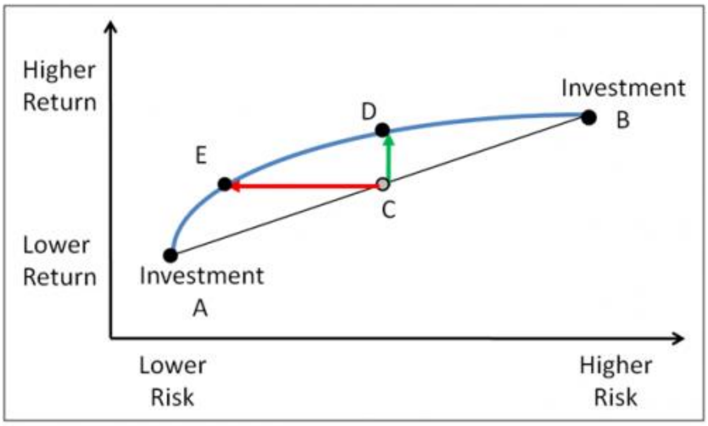
3.5.1 Capital Asset Pricing Model

The basis of the Capital Asset Pricing Model (CAPM) is the portfolio theory with a riskless asset and unlimited short sales. CAPM does not consider the decision of a single investor, but aggregates them to determine a market equilibrium. In portfolio theory, the price of an asset is exogenously given and could not be influenced by any investor. Given this price, an investor forms his beliefs on the probability distribution. The beliefs can vary across investors. However, in CAPM, the asset prices (or equivalently expected asset returns) are no longer exogenously given, but are determined by the equilibrium state of the market.

The CAPM is also known as the single factor (or single index) asset pricing model, which integrates only one macroeconomic variable, the return on market, to the return on individual stock through the value of the beta (β). Portfolio theory requires too many calculations to estimate the benefits of diversification. Diversification minimizes the unsystematic risk; however, it cannot minimize the systematic risk generated by macroeconomic variables. The CAPM is an attempt to minimize systematic risk by using asset allocation.

The benefit of asset allocation can be explained by the Markowitz efficient frontier, depicted in Figure 3.1. From the graph, it can be noticed that if an investor has invested solely in investment A, then his risk and return are determined at point A. While that are determined at point B, if he has invested solely in investment B. Now, if that investor invests 50% in investment A and 50% in investment B, then intuitively it seems that his risk and return would be somewhere around point C. But the modern portfolio theory states otherwise. In fact, if an individual decides to invest in both A and B, then his risk and return are determined at somewhere on the blue line (i.e., on the Markowitz efficient frontier). Note that investing heavily in A and a smaller amount in B (riskier than A) leads to a risk and return at point E. It is clear from the graph that at point E, we have a substantially higher return than A with only a small amount of added risk. As more of the risky asset is selected the rate of increasing risk diminishes with respect to rate of increasing return. The convexity of the efficient frontier is also known as the 'free lunch' of investing. Using asset allocation, one can potentially increase return without proportionate increase in risk. However, the benefit from asset allocation is dependent on the number of assets in the portfolio, the risk and return of each asset in the portfolio and the correlation between the assets.

Figure 3.1 Benefit of Asset Allocation



Following Markowitz efficient frontier, Capital Asset Pricing Model (CAPM) was developed by Sharpe (1964), and further contributed to by Lintner (1965a; 1965b) and Mossin (1966). The CAPM has the following form:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it} \qquad 3.5$$

where,

R_{it} is the actual return on stock *i* in time *t*;

R_{mt} is the actual return on a market index in time *t*;

R_{ft} is the risk-free rate of return in time *t*;

ε_{it} is a random error;

α_i is the measure of abnormal risk adjusted performance of the stock in time *t;*

β_i is the slopes from regression of R_i and R_m.

The key feature of this model is that only the systematic risk is "rewarded" and non-systematic risk is not. The CAPM's prediction of not rewarding the nonsystematic risk is the same as saying alpha is not statistically different from zero. The predominant view behind this is that markets are highly efficient, so it is quite unlikely for any individual to earn alpha consistently over time. Randomness or luck is the common explanation assigned to any organization or individual who demonstrate consistent ability to earn alpha over time. Thus, the CAPM can be stated formally in expected form as:

$$E[R_{it}] = R_{ft} + \beta_i\big(E[R_{mt}] - R_{ft}\big) \qquad 3.6$$

where E[·] implies an expected value.

From the advent of the CAPM in 1964 to the mid-1970s, there was relatively little controversy regarding the CAPM. However, Basu (1977) has showed that after controlling for systematic risk, low P/E stocks outperforms high P/E stocks. This finding run contrary to the predictions of the CAPM. It then seems possible that alpha can be earned consistently via skill, and not luck. Similarly, Banz (1981) and Reinganum (1981), working independently at the University of Chicago, have discovered that small capitalization stocks have outperformed large capitalization stocks after controlling for their exposure to market risk factors. These results are also anomalies - at least from the viewpoint of the CAPM.

Similarly, investigating portfolio returns in the Australian stock market, Kassimatis (2008) has used four factors to examine the significance of the size, book-to-market and momentum risk factors in explaining portfolio returns, and has compared these to the CAPM. The study has used the data between July 1992 to June 2005 and has constructed different portfolios to analyze the year to year returns. The results have shown that the additional factors have significant explanatory power rather than just market factor. Accordingly, the author has argued that the CAPM does not perform adequately in explaining realized returns. These results have justified the usage of alternative multifactor asset pricing models such as the Intertemporal Capital Asset Pricing Model (ICAPM) and the Arbitrage Pricing Model (APM).

3.5.2 Intertemporal Capital Asset Pricing Model

Intertemporal Capital Asset Pricing Model (ICAPM), developed by Merton (1973), is an extension of the CAPM. The ICAPM has a different assumption about investors' objectives. In the CAPM, investors care only about the wealth their portfolio produces at the end of the current period. On the other hand, ICAPM is a consumption-based asset pricing model, and it goes a step further than CAPM in considering how investors participate in the market. Most investors do not participate in the financial market for one year, but instead for multiple years. Over longer time periods, investors consider how their wealth in the future may vary with future variables, including their income, the prices of consumption goods and the nature of portfolio opportunities in future.

Therefore, Merton's (1973) ICAPM shows that investors act to maximize expected utility of lifetime consumption and can trade continuously in time. The assumption of continual trading in assets over time is not assumed in the traditional models. The author has shown that, unlike the one-period model, current demands are affected by the possibility of uncertain changes in future investment opportunities. Fama (1996) has mentioned that Merton has got the exact result without assuming the portfolio is perfectly diversified.

Like CAPM investors, ICAPM investors dislike wealth uncertainty; but ICAPM investors are also concerned with more specific aspects of hedging their future consumption-investment opportunities, such as the relative prices of consumption goods and the risk-return tradeoffs that they face in capital markets. Although ICAPM investors demand high expected return and low risk like the CAPM investors, but they also care about the movement of the returns of the portfolio with other dynamic variables. Therefore, the optimal portfolio will be a factor in many variables and have largest range of possible expected returns.

The ICAPM risk return relation is a natural generalization of the CAPM. It adds risk premiums for factors that must indicate special states of the world where portfolio returns might be very poor, and investors concerned about their payoffs. Hence investors are willing to sacrifice some of the expected return if an asset does well during “hard times”. The factors often include macroeconomic variables that may tell us something more about states of the world which influence utility. For instance, consumption is related to interest rates, GDP growth, inflation and other macroeconomic variables. These macroeconomic variables can therefore measure the state of the economy. So, the ICAPM has the following form:

$$R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \sum_{s=1}^{n} \beta_{is}\left(R_{st} - R_{ft}\right) + \varepsilon_{it} \qquad 3.7$$

where.

R_{it} is the actual return on stock *i* in time *t*;

R_{mt} is the actual return on a market index in time *t*;

R_{ft} is the risk-free rate of return in time *t*;

R_{st} is the actual return for macroeconomic risk factors at time *t;*

ε_{it} is a random error;

α_i is the actual return on stock *i* in time *t* when the market return is zero;

β_i and β_{is} are the slopes from multiple regression of R_i and R_m, and R_i *and* R_s respectively.

Fama (1998) has presented a study which has aimed to determine the number of priced state variables in the ICAPM. He has tried to answer the questions that go to the heart of the economics of the ICAPM. Specifically, given ICAPM asset pricing and given that there is a total of S state variables potentially of hedging concern to investors, we need to know the following: (1) how can we determine which of these state variables are, in fact, of hedging concern, and (2) in what sense do these state variables produce special risk premiums in expected returns.

Fama (1998) has added that it is possible to find the set of priced variables when the state variables are identified (named). When the number of state variables is known, but their names are not, confident conclusion about risk premiums are probably impossible. Moreover, the existing literature has failed to identify the specific state variables that produce risk in the context of ICAPM. So, there is no practical solution to manage the systematic risk and to identify significant economic state variables in the context of ICAPM. This has given rise to the usage of alternative multifactor assets pricing models such as the Arbitrage Pricing Model (APM).

3.5.3 Arbitrage Pricing Model

The arbitrage pricing theory (APT) is a multifactor mathematical model used to describe the relation between the risk and expected return of securities in financial markets. It computes the expected return on a security based on the security's sensitivity to movements in multiple risk factors. Furthermore, consistent with the portfolio theory and diversification, modern financial theory has focused on systematic factors as the likely sources of risk. So, the Arbitrage Pricing Model (APM) is designed to capture the sensitivity of the asset's returns to changes in certain macroeconomic variables, which are the economic state variables and are the sources of systematic risk. However, how many factors influence return on a stock and also how sensitive the stock is to a particular factor are virtually impossible to detect. But getting "close enough" is often good enough; in fact, studies use four to five factors to explain a security's return.

The arbitrage pricing theory is based on three assumptions. Firstly, that a factor model can be used to describe the relation between the risk and return of a security. Secondly, idiosyncratic risk can be diversified away. Thirdly, efficient financial markets do not allow for persisting arbitrage opportunities. Based on these assumptions, Ross (1976) has developed the Arbitrage Pricing Theory (APT) and Roll and Ross (1995) have provided a more intuitive explanation of the APT and have discussed its merits for portfolio management. The APT is an alternative approach to the CAPM which has become the major analytic tool for explaining the phenomena observed in capital markets. The APT model has the following form:

$$R_i = E[R_i] + \beta_{i1}F_1 + \beta_{i2}F_2 + \cdots + \beta_{in}F_n + \varepsilon_i \quad 3.8$$

where,

R_i is the actual (realized) return on security *i;*

$E(R_i)$ is the expected return on security *i*;

β_{ij} is the sensitivity of actual return on *i*th asset to the *j*th risk factor (F_j);

and ε_i is the random error term.

So, the return on any security or portfolio is dependent on expected return on security plus a series of macroeconomic factors. It is important to note that the expected value of factor, F, is zero. Therefore, these factors in Equation (3.8) are measuring the deviation of each factor from its expected value.

The model begins with the assumption that actual return on any security is equal to its expected return plus a series of impacts on expected return (i.e. the impacts of different macroeconomic variables on return). It breaks up the single factor CAPM into several components. The CAPM predicts that security returns are linearly related to a single common factor, the return on market portfolio. On the other hand, the APT is based on a similar intuition but is much more general. The CAPM is viewed as a special case of the APT when the market return is the single relevant factor. There are many multifactor assets pricing models developed in the literature. But all the multifactor asset pricing models developed in the literature can be treated as special theoretical cases of the APT (Sinclair, 1984).

The APT predicts a relationship between the returns of a portfolio or a single asset through a linear combination of variables. The APT approach moves away from the risk versus return logic of the CAPM, and exploits the notion of "pricing by arbitrage" to its fullest possible extent. Ross (1976) has noted that arbitrage theoretic reasoning is not unique to this theory only, but is, in fact, the underlying logic and methodology of virtually all of finance theory.

However, the APT does not provide a guideline as to how many pricing factors should be chosen and, more importantly, what those factors are. In application, researchers have relied either on a statistical method, such as factor analysis, or on fundamental variables (Merville et al., 2001). Thus, there are two different versions of APT: (1) the factor loading model and (2) the macro variable model. These two empirical models are used to implement and test the APT. The factor loading model uses artificial variables while macro variable model uses macroeconomic variables based on the economic transmission mechanism (Groenewold and Fraser, 1997).

Groenewold and Fraser (1997) have compared the factor loading model and the macro variable model of the APT and the CAPM. Both versions of the APT have found to clearly outperform the CAPM, but neither version of the APT is clearly superior to the other in terms of both within and out-of-sample explanatory power. However, Chen (1983) has argued that the APT is more in the spirit of macro variable approach, although he has not named the macroeconomic variables affecting stock return.

Similarly, Chen et al. (1997) have examined returns of real estate investment trusts based on the factor loading model as well as the macro variable model. This study has compared the ability of these two models to explain real estate returns. The results have shown that while the two models perform equally well during the period 1974-1979, the macro variable model outperforms the factor loading model over the periods 1980-1985 and 1986-1991.

Roll and Ross (1980) have tested the APT using the factor analysis technique with artificial variables. It has become a classic article on testing the APT. They have found that there are at least three and probably four significant factors. However, they have failed to determine which factors are significantly priced. Shanken (1985) has responded to Roll and Ross's work and has added that there are two problems with the decomposition of the variance-covariance matrix of returns. Firstly, the number of factors needed to complete the model is indeterminate and secondly, the factors themselves may not be unique. He has concluded that the identification of priced factors is difficult. He has suggested that the solution provided through factor analysis is not unique.

The arguments of Shanken (1985) concerning the number of factors are echoed in the study of Dhrymes et al. (1984). They have criticized the factor analytic technique of Roll and Ross (1980) and have argued that in the factor analytic technique, as the number of stocks increases then the number of artificial factors increases. Similarly, Beenstock and Chan (1986), using the factor analytic technique in UK stock market, have found results like Dhrymes et al. (1984). They have found 20 risk factors in UK stock market and also the number of factors is proportionate to the sample size. According to Merville et al. (2001) construction of a statistical method (like factor analysis) explains most of the cross-sectional variations of equity returns. However, it adds little understanding as to why equity returns differ. Economic factors, on the other hand, are important in sorting out the determinants of equity returns.

According to Chen et al. (1986) economic state variables have systematic effects on stock returns. They have added that from the perspective of the efficient market hypothesis and rational expectations, asset prices should depend on their exposures to the state variables that describe the economy. For this reason, following the pioneering work of Chen et al. (1986), there are several works in the literature (Beenstock and Chan, 1988; Groenewold and Fraser, 1997; Shanken and Weinstein, 2006; Tursoy et al., 2008) on relationship between stock market return and macroeconomic forces.

Alongside, Azeez & Yonezawa (2006) have mentioned that the primary advantages of using macroeconomic factors are: (1) the macroeconomic factors in principle can provide economic interpretations, while with a factor analysis approach it is unknown why these factors are being priced; and (2) rather than only explaining the asset-prices, observed macroeconomic variables also provide additional information related to the link between asset-price behavior and macroeconomic events.

In this backdrop, the framework of the macro variable model of the APT has been used in this research to examine the relationship between stock market index and macroeconomic variables in Bangladesh. For this purpose, advanced econometric models have been chosen. Moreover, multiple econometric models have been applied to check the robustness of the results.

3.6 Conclusion

Assets pricing procedure starts with the valuation of a single stock mostly based on predictions of the future cash flows or the profitability of the firm along with the riskiness associated with these future cash flows. Portfolio theory refers to the return from a group of stocks which states that the unsystematic risk is generated by microeconomic factors and is specific to an individual firm or industry. This risk can be eliminated through the process of diversification. But the systematic risk is mainly created by macroeconomic factors and cannot be eliminated through diversification, therefore, is rewarded in the stock market. So, the equilibrium asset pricing models, such as CAPM and APM, refer to the valuation of stocks based on the macroeconomic variables.

Efficient market hypothesis and rational expectation hypothesis suggest that people use all the available information and use the best valuation model. There are many studies trying to identify the number of significant variables in the context of different multifactor valuation models. However, the most widely used model is the macro variable version of APT. Because it has several advantages and the most important one is that the selected variables are economically interpretable factors. Empirical studies have also shown that the macro variable version of APT outperforms the factor loading version of the APT as well as the CAPM.

In this context, the most sophisticated econometric models and methodologies within the framework of macro variable version of Arbitrage Pricing Model have been applied to investigate the relationship between stock market index and macroeconomic indices in Bangladesh. Moreover, multiple econometric models have been used to examine the robustness of the findings.

Chapter 4

Long-term Equilibrium and Causal Relationships

4.1 Introduction

Institutional investors like insurance companies or pension funds have long-term investment horizons of several years or even decades. Thus, a large part of their asset allocation is based on strategic consideration and portfolio optimization. These investors are more interested in long-term expected returns, rather than short-term fluctuations based on business cycles or investors' sentiment. In view of this, a study of long-term equilibrium relationship is of immense importance to address the question as to how a shift in some macroeconomic variables may change long-term stock market returns for the investors. Although there exists a significant long-run equilibrium relationship, there may be disequilibrium in the short-run. This short-run disequilibrium may be adjusted through an error correction mechanism to bring about a stable long-run equilibrium relationship. Hence the study of error correction process is also crucial.

Furthermore, the causal relation between stock market and macroeconomic variables are important to decide on the efficiency of a stock market. Because the direction of causal relationship determines the market efficiency. If changes in the economic variables neither influence nor are influenced by stock price fluctuations, then the two series are independent of one another and the market is informationally efficient. Also, the unidirectional causality running from lagged values of stock prices to economic activities does not violate informational efficiency, rather this suggests that stock prices lead the economic activities and that the stock market makes rational forecasts of the economy.

In contrast, if lagged changes in some economic variables cause variations in stock prices, this implies a unidirectional causality running from economic variables to stock market. This behavior indicates that the market is inefficient as the past economic information is yet to be reflected into the stock prices. Similarly, a market is termed as inefficient if there exists a bi-directional causality between the stock market and economic variables, meaning that the lagged changes in some economic variables cause variations in stock prices and past fluctuations in stock prices cause variations in the economic variables.

Moreover, diagnostic tests of the residuals of the error correction model need to be conducted to examine the viability of the model. Although it is not the primary goal of the investigations, these diagnostic tests are crucial to check the viability and significance of the results. For a good model, the residuals of the regression equation should be homoscedastic, not be serially correlated and should be normally distributed. In addition, different stability tests are also important to investigate the stability of the parameters over the period.

The aforesaid issues are reported in five sections of this chapter. In section 4.2, we have discussed the motivation of selecting macroeconomic variables for our empirical analysis based on our review of theoretical and empirical literatures, own intuition and background knowledge. The methodologies to be used in the analyses have been discussed in section 4.3. More specifically, the econometric models for testing long- and short-run relationships along with the error correction mechanism have been discussed. Also, the procedure for causality test has been described in this section. In section 4.4, the results of the empirical investigations have been reported and explained in light with other relevant studies. Moreover, the findings of the viability tests to check the significance of the results have been portrayed. The results of the stability tests to examine the stability of the parameters have been reported in this section. Finally, in section 4.5, the findings are summarized in the conclusion.

4.2 Selection of Research Variables

The macroeconomic variables, which might have impact on future dividends and/or the discount rate from the perspective of Bangladesh economy, have been selected for the study. Chen et al. (1986) have suggested that the selection of variables requires judgment. Therefore, during the selection of variables, we have considered the existing theory and the empirical evidences. The description of the research variables along with the justification for selection and its hypothesized relationships with the stock market are discussed in the following section.

4.2.1 Description of Research Variables

Based on the previous works of the earlier scholars; such as Maysami et al. (2004), Mukherjee and Naka (1995) and Khan and Yousuf (2013), this study has examined the relationship between the stock market index and the selected macroeconomic variables. From a macroeconomic context, stock holders have an interest to know and understand the relationship between stock market and Gross Domestic Product (GDP), the impact of inflation as well as the implications of money supply, exchange rate and interest rate on equity returns. In addition to these factors, gold is considered as an alternative to stock investment in many countries and as such gold price has effect on stock market (Mukhuti, and Amalendu, 2013). Thus, all these macroeconomic factors have been considered in this research. The research variables are described below in more details.

Stock Market Index: A stock market index is a collection of the major firm's stock (Strong, 2005). Rafique et al. (2013) have claimed that stock market performance is measured through movement in its index. The fluctuation in the index is affected by macroeconomic, social, political, international as well as firm specific factors. Market index helps the interested investors to understand the movement of the stock market. In this study, we have used month end DSE General Index to represent the stock market of Bangladesh. The month end index data of 25 years have been collected, then these data have been adjusted considering base value of 100 at the beginning of our sample period i.e. end of January 1991.

Industrial Production Index (IPI): For our empirical analysis, monthly data of industrial production index of medium to large scale manufacturing industries with base year 1988-1989 has been considered as a proxy of GDP, because data on the former variable is available on monthly basis but the latter is not. Moreover, the productive capacity of an economy indeed depends directly on the accumulation of real assets, which in turn contributes to the production capacity of firms. Thus, economies of scale may generate higher profitability due to increased turnover. Tainer (1993) is of the view that the industrial production index is procyclical and can be used as a proxy for the level of real economic activity. Many studies (for example Adrangi et al., 1999; Ibrahim and Aziz, 2003) have represented GDP by industrial production index.

Many authors (Fama, 1981; Chen et al., 1986) have found that aggregate output, such as GDP or industrial production, can partly explain fluctuations in aggregate corporate cash flows of firms and thus stock market returns. Like these studies, the studies of Chan et al. (1985), Mukherjee and Naka (1995), Adrangi et al. (1999) and Humpe and Macmillan (2007) have documented a positive relationship between the industrial production index and the stock market index. Considering the findings of these studies, we have hypothesized a positive relationship between stock market and industrial production index.

Interest Rate: Interest rate directly changes discount rate in the valuation model of stock and thus influences stock prices. Theoretically, interest rate has a negative relationship with stock prices. When rates on deposits in the bank increase, people redirect their money from capital market to banks and this leads to a decrease in the demand of shares. The opposite is true if deposit rates decrease. When rates on deposits increase, lending rates also increase. This creates a negative impact on investment and hence stock prices and vice versa. The studies of Chan et al. (1985) and Chen et al. (1986) have documented negative relationship between interest rate and stock returns.

In this study, the weighted average deposit rate, offered by commercial banks on three to six months fixed or term deposits, has been considered as interest rate (like the study of Uddin and Alam, 2007). Consistent with the financial theory and findings of the literatures, a negative relationship between interest rate and stock market is hypothesized.

Inflation: Generally, inflation is measured in terms of Consumer Price Index (CPI), which tracks the price of a basket of core goods and services over time. Earliest inferences on positive relation between inflation and stock returns are based on hypothesis presented by Irving Fisher (1930). Conversely, Fama (1981) has proposed the proxy hypothesis, which illustrates a negative relationship between inflation and stock prices.

Talla (2013) has argued that inflation can affect stock market either positively or negatively. He has added that when demand exceeds supply, firms tend to increase their products prices, this increase in price leads to higher earnings of the firms. So, this channel creates a positive impact on stock returns. On the other hand, increase in inflation results in increase in discount rate used to determine the value of stock. So, this channel creates a negative impact on stock market return. Thus, the overall relation between the inflation and stock market depends on which factor outweighs the other. Many studies (Fama and Schwert, 1977; Chen et al., 1986; Nelson 1976; Jaffe and Mandelker, 1976) have pointed to a negative relation between inflation and stock prices. However, Maysami et al. (2004) have documented a positive relationship between inflation and Singapore stock market.

This study has hypothesized a negative relationship between stock market and inflation with the justification that an increase in inflation is likely to lead economic tightening policies, which in turn increase the nominal risk-free rate and raise the discount rate in the valuation model. Also, we have considered the argument of DeFina (1991) that nominal contracts disallow the immediate adjustment of the firm's revenues with costs and hence reduce the profit.

Exchange Rate: Gunasekarage et al. (2004), and Adam and Tweneboah (2008) have used national currency per United States Dollar (USD) as a proxy for exchange rate. Joseph (2002) has mentioned that changes in exchange rate affect the competitiveness of firms through their impact on input and output prices. When the exchange rate appreciates, the exporters lose their competitiveness in international market and the sales and profits of the exporters shrink, thus the stock prices decline. Conversely, importers gain their competitiveness as domestic currency appreciation results in decrease in the prices of foreign raw materials, leading to increase in the firm's profits, which in turn increase the stock prices. So, the impact of exchange rate on the economy depends on the level of international trade and the trade balance to a large extent. Therefore, the impact is determined by the relative dominance of import and export sectors of the economy.

In line with this, Ibrahim and Aziz (2003) have explained the negative relation between exchange rate and Malaysian stock returns stating that the currency depreciation encourages exports; conversely, it increases costs of production through increasing domestic prices of imported capital and intermediate goods, but the latter effect of currency depreciation on real output seems to be more dominant.

Khan and Yousuf (2013) have hypothesized a positive relationship between exchange rate and stock market stating that increase in exchange rate (Taka depreciation against US dollar) should increase foreign investment in Bangladesh stock market, which in turn increases demand of stocks and, therefore, increases the stock prices. But they have found opposite relationship between exchange rate and stock market. They have argued that depreciation of currency has not increased the foreign investment, conversely, it has increased the imported materials cost and leading to a negative relationship. On the other hand, Buyuksalvarci (2010) has found positive relation between stock returns and exchange rate and has explained this by stating that a depreciation of the Turkish currency in terms of US dollar has attracted more foreign investment in stock market, which has increased the demand of stock and has increased the stock prices.

In this study, exchange rate is measured in terms of Bangladeshi taka (BDT) per US dollar and we have hypothesized a positive relation between exchange rate and stock market index with an anticipation that depreciation of BDT against US dollar has attracted more foreign investment in the stock market and has increased the stock prices.

Money Supply: There are several standard measures of the money supply, but Bangladesh Bank includes only M1 and M2. According to Bangladesh Bank, M1 is the sum of currency outside the banks, deposits of financial institutions with Bangladesh Bank (except Deposit Money Banks (DBMs)), demand deposits with DMBs (excluding inter-bank deposits and government deposits), whereas M2 is the sum of M1 and time deposits with DMBs (excluding inter-bank deposits and government deposits). Hamburger and Kochin (1972), Kraft and Kraft (1977) and Sirucek (2011) have used M2 as a proxy of money supply and stated that there is a strong relation between money supply (M2) and stock prices.

Mukherjee and Naka (1995) have argued that theoretically, the relation between these two variables can be positive or negative. The expansionary effect of money supply on real economic activity may create a positive relation. However, if the increase in money supply creates inflation and contributes to inflationary uncertainty, then it may exert a negative influence on the stock prices. Friedman and Schwartz (1963) have explained the relationship between money supply and stock return by simply hypothesizing that an increase in M2 indicates excess liquidity available for buying securities, resulting in higher security prices. However, Ibrahim and Aziz (2003) have explained their finding of negative long-run association between stock prices and M2 mentioning that the continued increase in money supply may exert a negative effect on the stock prices due to increasing inflationary pressures and subsequent policy orientation to contain the pressure.

Considering the expansionary effect of money supply on real economic activity, we have hypothesized a positive relationship between the money supply (M2) and stock market.

Gold Price: Gold is a precious and highly liquid instrument that possesses the attributes of both commodity and currency. It has been used throughout the history as money as well as a most popular metal for investment purposes. Due to its currency characteristic, it is said that, it performs as medium of wealth, means of exchange and a unit of value (Tully and Lucey, 2007). Furthermore, gold is also used for industrial purposes, reserve asset, and jewelry. Sumner et al. (2010) have attempted to find the interdependence among gold, stocks and bonds by examining whether gold returns and its volatility can be used to predict the US stock and bond price movement or vice versa. By analyzing volatility spillover, the researchers have concluded that there is no significant relationship between gold and stock returns volatility.

On the other hand, gold price generally remains constant or increases overtime, thus it can be used as an ideal hedge against inflation. People invest in gold because despite high inflation, gold value does not depreciate. Gold price moves up on inflationary expectations, but stocks go down for the same reason. Considering these, we have hypothesized a negative relationship between gold price and stock market.

Month end data of the seven research variables are collected for the period from January 1991 to December 2015. Then, except interest rate, data of the other variables are normalized to a starting value of 100 at January 1991. The interest rates are expressed in terms of one plus the interest rates in percentage. Later, all these variables are expressed in natural logarithmic forms. Table 4.1 shows the selected macroeconomic indices along with their symbols in natural logarithmic format. Also, the hypothesized relationships between the macroeconomic variables and the natural logarithmic of DSE General Index, expressed as LDSEGEN, are shown in the Table 4.1.

Table 4.1. Selected Macroeconomic Indices and the Hypothesized Relations with Stock Market Index

Variable	Symbol in Logarithmic Term	Hypothesized Relation
Industrial Production Index	LIPI	Positive
Interest Rate	LINT	Negative
Consumer Price Index	LCPI	Negative
Exchange Rate	LEXR	Positive
Money Supply	LM2	Positive
Gold Price	LGDPRICE	Negative

4.2.2 Sample Period

Until the mid-1980s, the banking sector in Bangladesh was characterized by a financially repressed regime. The sector witnessed low interest rate, distortion in resource allocation, low rate of savings leading to financial distress. Banks were being used to service the needs of the public sector and a few business houses (Hassan, 1994). The internal control system of commercial banks was weak, the published accounts never reflected the actual financial health, the quality of the assets of the banks was never evaluated on strict accounting principles, profitability and liquidity aspects of portfolio management were unfamiliar concepts among management personnel, and the elements of capital adequacy for banking operations were never given due importance (Raquib, 1999). The cumulative effect of mismanagement in the banking system led to a huge accumulation on non-performing loans for the financial sector, which had risen to more that 40 percent of the total advances of the banking sector at one point (Financial Sector Reform Project, 1996). During that period, the only stock exchange of the country, the Dhaka Stock Exchange, was almost inoperative with only a few enlisted companies.

To counter these problems, the first round of financial sector reform was initiated in 1982 with the denationalization of some commercial banks, followed by the establishment of the National Commission on Money, Banking and Credit in 1984. However, unsuccessful results of the first round of reforms led to second round of reforms in the early 1990s. The second round of reforms led to the adoption of wide-ranging banking reform measures under the World Bank's Financial Sector Reform Project (FSRP). The focus of the reform, among others, was on gradual deregulations of the interest rate structure, providing market-oriented incentives for priority sector lending, and improvement in the debt recovery environment. Moreover, licenses were given for many private commercial banks.

Bangladesh Bank started open market operation actively and introduced its own securities, such as 90-day bill in 1990. Later, 30-day Bangladesh Bank Bill was also introduced in 1995 along with 90-day, 180-day and one-year maturity Treasury Bills with active participation of commercial banks. In place of arbitrarily fixed interest rate, Bangladesh Bank introduced a flexible market oriented interest rate from January 1990. The official and secondary market exchange rates were unified at the end of 1991.

The Securities and Exchange Commission (SEC) was established on 8 June 1993, through the enactment of the Securities and Exchange Commission Act, 1993, as a capital market regulator with a mandate to ensure proper issuance of securities, protection of the interest of investors in securities, development and regulation of the capital and securities markets in Bangladesh. On August 10, 1998 DSE introduced screen-based state-of-art automated online real-time trading through Local Area Network (LAN) and Wide Area Network (WAN). The latest up-gradation was web based trading software - MSA Plus, which was introduced on June 10, 2012. Now, investors can submit buy/sale orders on Dhaka stock exchange from anywhere of the world through Internet. Several reforms have been adopted to promote growth of capital market during this time.

Moreover, after nine years of military regime, Bangladesh started its fresh attempt towards a western liberal type of democracy in 1991. Considering the aforesaid factors, we have chosen January 1991 as the starting point of our research period. Furthermore, to include the most recent data, we have collected data up to December 2015.

4.2.3 Source of Data

The data of the DSE General Index has been collected from the Dhaka Stock Exchange Library. The data of selected six macroeconomic variables are obtained from Monthly

Statistical Bulletin published by Bangladesh Bureau of Statistics, Economic Trends published by Statistical Department of Bangladesh Bank and various editions of Economic Survey of Bangladesh. Monthly data over 25 years (from January 1991 to December 2015) have been collected. We have collected monthly data for longer period to capture long-term movements and to avoid the effects of settlement and clearing delays which are known to significantly affect returns over shorter sampling intervals (Faff et al., 2005; Liow et al., 2006).

4.3 Methodology

This section has outlined the empirical method used in this chapter. Nelson and Plosser (1982) have argued that most macroeconomic series have unit root indicating that the series are nonstationary, and this is an important issue for the analysis of macroeconomic variables. Yule (1926) has suggested that regression based on trending time series data can be spurious. This problem of spurious regression has further pursued by Granger and Newbold (1974) and they have developed the concept of cointegration.

The recent developments on cointegration have changed the way time series analysis is conducted (Maddala and Kim, 1999). In this context, cointegration approach has been applied in this chapter to examine the relationship between stock market index and the macroeconomic indices of Bangladesh. However, for cointegration test, it is required to know the order of integration of each variable and unit root tests are used for this purpose. Therefore, the cointegration test starts with unit roots test. At the same time, the trend specification of the variable is also important for cointegration test.

In this context, this section has described the concept of stationary vs nonstationary variables, trend vs differenced stationarity and spurious regression. Later, the most popular unit root tests have been discussed. Finally, the econometric tools to be used in this chapter have been outlined. More specifically, Johansen and Juselius cointegration test, error correction model, Granger causality test and Autoregressive Distributed Lags (ARDL) approach have been explained in detail.

4.3.1 Stationary vs Nonstationary Stochastic Processes

A time series is said to be stationary if its mean and variance are constant over time, i.e. time invariant along with its covariance. Such a time series tend to return to its mean and fluctuate around this mean and has constant amplitude. So, a stationary process does not drift too far away from its mean value. By contrast, a nonstationary time series has a time-varying mean or a time-varying variance or both. Nonstationary processes are example of Random Walk Model (RWM) with or without a drift and sometimes the processes have deterministic trends.

The autoregressive process is used in modeling empirical time series data, especially in economics. The autoregressive model treats a stochastic variable as depending on its own previous values and on a current independently and identically distributed (*iid*) stochastic term. A stochastic variable can be expressed as a *AR(1)* model, which is a random walk model without drift, as below:

$$Y_t = Y_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \tag{4.1}$$

If t = 1 then Equation (4.1) becomes:

$$Y_1 = Y_0 + \varepsilon_1 \tag{4.2}$$

If t = 2 then:

$$Y_2 = Y_1 + \varepsilon_1$$

Putting the value of Y_1 from Equation (4.2), we get:

$$Y_2 = Y_0 + \varepsilon_1 + \varepsilon_2$$

Similarly, Y_t can be written as:

$$Y_t = Y_0 + \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \ldots \ldots \ldots + \varepsilon_t$$

$$\therefore\ Y_t = Y_0 + \sum_{i=0}^{t-1} \varepsilon_{t-i} \qquad 4.3$$

Now, the mean of Y_t is $E(Y_t) = Y_0$, since errors have zero expectation. Again Y_0 is a constant, so it contributes nothing to the variance of Y_t, however, errors have variance σ^2 and are uncorrelated with each other, so the variance of Y_t will be:

$$Var(Y_t) = 0 + Var \sum_{i=0}^{t-1} \varepsilon_{t-i} = \sigma^2 \sum_{i=0}^{t-1} 1 = \sigma^2 \times t = t\sigma^2 \qquad 4.4$$

The third condition of a series to be stationary is that the covariance must be time invariant. So, for $t = t + h$ (where h > 1), we can get from Equation (4.3):

$$Y_{t+h} = Y_t + \sum_{i=0}^{h-1} \varepsilon_{t+h-i}$$

So, the covariance between Y_t and Y_{t+h} can be give as:

$$Cov(Y_t, Y_{t+h}) = Cov\left(Y_t, Y_t + \sum_{i=0}^{h-1} \varepsilon_{t+h-i}\right)$$

But the covariance between Y_t and ε_{t+h-i} is zero, as the error terms are independent. So, the covariance can be written as:

$$Cov(Y_t, Y_{t+h}) = Cov(Y_t, Y_t) = Var(Y_t) = t\sigma^2 \text{ (from Equation (4.4))}$$

Hence, RWM without a drift is a nonstationary process, because although the mean is constant over time, but the variance and covariance are time invariant. In this model, shocks persist as the current value is equal to the initial value plus a series of random shocks.

Now, consider a random walk with a drift α as follows:

$$Y_t = \alpha + Y_{t-1} + \varepsilon_t \quad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.5$$

So, $Y_1 = \alpha + Y_0 + \varepsilon_1$ 4.6

Similarly, $Y_2 = \alpha + Y_1 + \varepsilon_2$

Putting the value of Y_1 from Equation (4.6), we get:

$$or, Y_2 = \alpha + (\alpha + Y_0 + \varepsilon_1) + \varepsilon_2$$

$$\therefore Y_2 = 2\alpha + Y_0 + \varepsilon_1 + \varepsilon_2$$

$$Similarly,\ Y_t = \alpha t + Y_0 + \sum_{i=0}^{t-1} \varepsilon_{t-i}$$

Now, $E\ (Y_t) = \alpha t + \ Y_0$ since errors have zero expectation. Also, variance of Y_t is:

$$Var(Y_t) = 0 + \sigma^2 \sum_{i=0}^{t-1} 1 = t\sigma^2$$

and the $Cov(Y_t, Y_{t+h}) = t\sigma^2$

Hence, RWM with a drift is also a nonstationary process, because mean, variance and covariance of the variable increase over time.

Now, let us consider an *AR(1)* process as follows:

$Y_t = \rho Y_{t-1} + \varepsilon_t$ where $\varepsilon_t \sim iid(0, \sigma^2)$ and $-1 \leq \rho \leq +1$ 4.7

If $\rho = 1$ the model becomes a random walk model without drift. So, $\rho = 1$ is a case of nonstationary time series. For $\rho \neq 1$, Equation (4.7) can be expressed as:

$Y_t = \rho(\rho Y_{t-2} + \varepsilon_{t-1}) + \varepsilon_t$ [From Equation (4.7), we get $Y_{t-1} = \rho Y_{t-2} + \varepsilon_{t-1}$]

$$\therefore Y_t = \rho^2 Y_{t-2} + \rho\varepsilon_{t-1} + \varepsilon_t$$

$$Then\ Y_t = \rho^2(\rho Y_{t-3} + \varepsilon_{t-2}) + \rho\varepsilon_{t-1} + \varepsilon_t$$

$$\therefore Y_t = \rho^3 Y_{t-3} + \rho^2\varepsilon_{t-2} + \rho\varepsilon_{t-1} + \varepsilon_t$$

$$Similarly, Y_t = \rho^t Y_0 + \rho^{t-1}\varepsilon_1 + \cdots + \rho\varepsilon_{t-1} + \varepsilon_t$$

$$\therefore Y_t = \rho^t Y_0 + \sum_{i=0}^{t-1} \rho^i \varepsilon_{t-i}$$

Now, $E(Y_t) = \rho^t E(Y_0)$, since the errors have zero expectation. So, an *AR(1)* process will have constant mean, if $E(Y_0) = 0$. And the variance of Y_t of *AR(1)* process is:

$$Var\ (Y_t) = Var\ (\rho Y_{t-1} + \varepsilon_t)$$

$$\therefore Var\ (Y_t) = Var\ (\rho Y_{t-1}) + Var\ (\varepsilon_t)$$

$$\therefore Var\ (Y_t) = \rho^2 Var\ (Y_{t-1}) + Var\ (\varepsilon_t)$$

If we apply the condition that $Var(Y_t) = Var(Y_{t-1})$, then:

$$\therefore Var(Y_t) = \rho^2 Var(Y_t) + \sigma^2$$

$$\therefore Var(Y_t) - \rho^2 Var(Y_t) = \sigma^2$$

$$\therefore Var(Y_t) = \frac{\sigma^2}{1-\rho^2} \qquad 4.8$$

Now, if $|\rho| > 1$; $Var(Y_t)$ becomes negative, but variance cannot be negative.

Now, if $\rho = 1$; $Var(Y_t)$ becomes infinity, but the condition of a series to be stationary is that it must have a finite variance. So, the condition for the process to be stationary is $|\rho| < 1$.

Now, Equation (4.7) can be written as:

$$Y_{t+2} = \rho Y_{t+1} + \varepsilon_{t+2}$$

$$\therefore Y_{t+2} = \rho(\rho Y_t + \varepsilon_{t+1}) + \varepsilon_{t+2}$$

$$\therefore Y_{t+2} = \rho^2 Y_t + \rho\varepsilon_{t+1} + \varepsilon_{t+2}$$

$$\therefore Y_{t+2} = \rho^2 Y_t + \textstyle\sum_{i=0}^{1} \varepsilon_{t+2-i}$$

So, Y_{t+h} can be written as:

$$Y_{t+h} = \rho^h Y_t + \sum_{i=0}^{h-1} \varepsilon_{t+h-i}$$

So, the covariance between Y_t and Y_{t+h} can be give as:

$$Cov(Y_t, Y_{t+h}) = Cov\left(Y_t, \rho^h Y_t + \sum_{i=0}^{h-1} \varepsilon_{t+h-i}\right)$$

But the covariance between Y_t and ε_{t+h-i} is zero, as the error terms are independent. So, the covariance can be written as:

$Cov(Y_t, Y_{t+h}) = Cov(Y_t, \rho^h Y_t)$

$\therefore Cov(Y_t, Y_{t+h}) = \rho^h Cov(Y_t, Y_t)$

$\therefore Cov(Y_t, Y_{t+h}) = \rho^h Var(Y_t)$ 4.9

$\therefore Cov(Y_t, Y_{t+h}) = \rho^h \frac{\sigma^2}{1-\rho^2}$ (Putting the value from Equation (4.8))

Now, if $|\rho| > 1$; $Cov(Y_t, Y_{t+h})$ becomes negative, but variance cannot be negative.

Now, if $\rho = 1$; $Cov(Y_t, Y_{t+h})$ becomes infinity, but the condition of a series to be stationary is that it must have a finite variance.

So, the condition for the process to be stationary is $|\rho| < 1$.

Now the conditions for an *AR(1)* process to be stationary are:

i. The initial value Y_t must equal to zero i.e. $Y_0 = 0$.

ii. ρ must be less than 1.

Now, let us check the conditions under which *AR(1)* process to be weakly dependence. The correlation between Y_t and Y_{t+h} can be given as:

$Corr(Y_t, Y_{t+h}) = \frac{Cov(Y_t, Y_{t+h})}{\sqrt{Var(Y_t)}\sqrt{Var Y_{t+h}}}$ 4.10

From Equation (4.9) and (4.10), we get:

$\therefore Corr(Y_t, Y_{t+h}) = \frac{\rho^h Var(Y_t)}{Var(Y_t)}$

$\therefore Corr(Y_t, Y_{t+h}) = \rho^h$

when $h \rightarrow \infty$ then $Corr(Y_t, Y_{t+h}) \rightarrow 0$ if $|\rho| < 1$, but when $|\rho| > 1$ then the series becomes explosive.

So, again an *AR(1)* process to be stationary the condition is $|\rho| < 1$.

4.3.2 Trend Stationary and Differenced Stationary Processes

If the trend in a time series is a function of time, such as t and t^2, we call it a deterministic trend (predictable). If it is not predictable, then the trend is a stochastic trend. Let us consider the following *AR(1)* model:

$$Y_t = \alpha + \beta_1 t + \beta_2 Y_{t-1} + \varepsilon_t \quad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.11$$

Reparametrizing Equation (4.11) the following models can be found:

Pure Random Walk: Equation (4.11) is a pure random walk, if $\alpha = 0$, $\beta_1 = 0$, and $\beta_2 = 1$, then the model is:

$$Y_t = Y_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.12$$

As describe earlier, this is a nonstationary time series. If we take the 1st difference of the series (i.e. $\Delta Y_t = Y_t - Y_{t-1}$), we get $\Delta Y_t = \varepsilon_t$. Note that the mean of differenced series is $E(\Delta Y_t) = E(\varepsilon_t) = 0$, and $Var(\Delta Y_t) = Var(\varepsilon_t) = \sigma^2$. As both the mean and variance of the series are time invariant, hence a random walk without a drift is differenced stationary (DS) process.

The pure random walk has a stochastic trend and may be a good starting point for describing the way many financial market prices and returns seem to behave. However, realization of random walk is not usually being characterized by the tendency to grow over time, which is seen in many macroeconomic time series. That is, the stochastic trend in the random walk is not sufficient to explain the kind of trend behavior we observe in the typical macroeconomic time series.

Random Walk with Drift: The model will become a random walk with drift when $\alpha \neq 0$, $\beta_1 = 0$, and $\beta_2 = 1$. Then, the model is:

$$Y_t = \alpha + Y_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.13$$

This series is also nonstationary. If we take first difference, then $\Delta Y_t = \alpha + \varepsilon_t$. This differenced time series has mean $E(\Delta Y_t) = E(\alpha + \varepsilon_t) = \alpha$ (constant) and the variance is $Var(\Delta Y_t) = Var(\alpha + \varepsilon_t) = \sigma^2$, as the errors are serially uncorrelated. So, both the mean and variance of differenced series are time invariant. Hence a random walk with a drift is also differenced-stationary (DS). Also, Y_t is trending upward or downward depending on the sign of the drift (α), so, this is called a stochastic trend.

The random walk with drift has a stochastic trend, which includes a trend component that can account for a time series tendency to increase on average over time. Like the pure random walk, it is characterized by a long-run forecast error variance that is increasing without bound as the forecast horizon gets sufficiently long. However, the random walk with drift is still not quite enough, because it assumes that the error terms in the first difference of Y_t are serially uncorrelated.

Deterministic Trend: In case of deterministic trend $\alpha \neq 0$, $\beta_1 \neq 0$, and $\beta_2 = 0$ then

$$Y_t = \alpha + \beta_1 t + \varepsilon_t \qquad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.14$$

Note that the mean of the series is $E(Y_t) = E(\alpha + \beta_1 t + \varepsilon_t) = \alpha + \beta_1 t$, which is time varying, but its variance is $Var(Y_t) = Var(\alpha + \beta_1 t + \varepsilon_t) = \sigma^2$ which is time invariant. Still, due to the time variant mean, the series with a deterministic trend is nonstationary.

We can estimate α and β_1 by regressing the series on t. Once we know these values, we can estimate the mean value and forecast it perfectly. Hence, we can subtract the mean from the series and create detrended series, which is $Y_t = Y_t - E(Y_t) = \varepsilon_t$. Now the mean of the detrended series is $E(Y_t) = E(\varepsilon_t) = 0$, and its variance is $Var(Y_t) = Var(\alpha + \beta_1 t + \varepsilon_t) = \sigma^2$. So, both the mean and the variance of the series are time invariant and hence the detrended series is stationary. So, if the deterministic series is detrended, it becomes stationary.

Random walk with drift and deterministic trend: We can get a random walk with drift and deterministic trend by putting $\alpha \neq 0$, $\beta_1 \neq 0$, and $\beta_2 = 1$

$$Y_t = \alpha + \beta_1 t + Y_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim iid(0, \sigma^2) \qquad 4.15$$

Now, the first difference series is $\Delta Y_t = \alpha + \beta_1 t + \varepsilon_t$ is still time varying and hence the mean of the differenced series is nonstationary. Detrending is still necessary on the differenced series to make it stationary.

4.3.3 The Phenomenon of Spurious Regression

Suppose, we have two random walk series: $Y_t = Y_{t-1} + \varepsilon_t$ and $X_t = X_{t-1} + \mu_t$, where error terms are white noise. If we use these series in a regression, for instance, $Y_t = \alpha + X_t + \upsilon_t$, where υ_t is white noise error, then we can obtain a spurious regression, meaning that we may get a highly significant slope coefficient but a relatively small R^2 value. On the other hand, in the case of trending variables, we may get a high value for the R^2 as well as highly significant slope coefficient. Based on this result, we may be tempted to conclude that the variable X has a significant impact on Y, whereas a priori there should be none. In fact, this regression is meaningless.

Also, it must be noted that the differenced series, ΔY_t and ΔX_t are stationary and seems can be used in a regression. The differenced series are $\Delta Y_t = \varepsilon_t$ and $\Delta X_t = \mu_t$ and regressing one on the other should generate a R^2 which is practically close to zero (as a random shock regressed over another should show no correlation). This is yet another way to verify that the original series are random walks. Although quite dramatic, but the study of Box and Newbold (1971) has indicated just how easily one can be led to produce a spurious model if sufficient care is not taken over an appropriate formulation for the autocorrelation structure of the errors from the regression equation. So, this is a strong reminder that one should be cautious in running regression with such nonstationary series.

4.3.4 Unit Root Tests

As mentioned earlier, Ordinary Least Squares (OLS) estimates for nonstationary series results in a spurious regression. Therefore, cointegration analysis is used to investigate the long-run relationship among the nonstationary variables. Despite the versatility of cointegration techniques, first we have used Johansen and Juselius cointegration test. Furthermore, to examine the robustness of the findings, we have also used the ARDL Bounds testing procedure proposed by Pesaran et al. (2001) to test for the existence of a linear long-run relationship between stock market and macroeconomic variables.

However, the precondition of Johansen and Juselius cointegration test is that the series must be integrated in the same order. On the other hand, ARDL approach crashes if any of the time series is integrated of order 2, *I(2)*. So, for both the approaches, it is important to know the order of integration of the series under consideration. Unit root tests are used for this purpose. There are various unit root tests. Given the relatively low power of unit root tests, we have used multiple tests including the well-known Augmented Dickey Fuller (ADF) and non-parametric Phillips-Perron (PP) tests along with Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to investigate the order of integration of each series. To understand the evolution of ADF test the following sub-section starts with Dickey-Fuller test, then the ADF and PP tests and finally the KPSS test have been discussed.

4.3.4.1 Dickey-Fuller Unit Root Tests

Let us consider an *AR(1)* process:

$$Y_t = \rho Y_{t-1} + \varepsilon_t \qquad where\ \varepsilon_t \sim iid\ (0, \sigma^2) \tag{4.16}$$

If $\rho = 1$, meaning that the series has a unit root (or the series is nonstationary) and the null hypothesis cannot be rejected. Conversely, the alternative hypothesis is $\rho < 1$ (as we have already ruled out $\rho > 1$), meaning that the null hypothesis can be rejected, and the conclusion is that there is no unit root and the series is stationary. So, the null and alternative hypotheses are as follows:

$H_0 : \rho = 1$ Unit root [Variable is nonstationary]

$H_A : \rho < 1$ No unit root [Variable is stationary]

The asymptotic distribution of the *t*-statistic under $\rho = 1$ is not standard *t*-distribution, thus using the conventional critical values can lead to considerable over rejection of the null hypothesis of a unit root (Maddala and Kim, 1999). In this context, Fuller (1976) provided the critical values of these statistics to deal with the non-standard distribution issue.

If H_0 is rejected, then any of the following three scenarios can exist:

i) Y_t is stationary with zero mean:

$$Y_t = \rho Y_{t-1} + \varepsilon_t$$

ii) Y_t is stationary with a non-zero mean, say μ, in:

$$Y_t - \mu = \rho(Y_{t-1} - \mu) + \varepsilon_t$$

$$or\ \ Y_t = \rho Y_{t-1} + \mu(1-\rho) + \varepsilon_t$$

$$\therefore Y_t = \alpha + \rho Y_{t-1} + \varepsilon_t$$

where $\alpha = \mu(1-\rho)$

iii) Y_t is stationary around a deterministic trend in:

$$Y_t - a - bt = \rho\big(Y_{t-1} - a - b(t-1)\big) + \varepsilon_t$$

$$or\ Y_t = \rho Y_{t-1} - \rho a - \rho b(t-1) + \varepsilon_t + a + bt$$

$$or\ Y_t = \rho Y_{t-1} + \{a(1-\rho) + \rho b\} + bt(1-\rho) + \varepsilon_t$$

$\therefore Y_t = \alpha + \beta t + \rho Y_{t-1} + \varepsilon_t$ where $\alpha = a(1-\rho) + b\rho\ and\ \beta = b(1-\rho)$

In principle, we can run the regression to see whether $\rho = 1$ to check for a nonstationary process. However, regressing the series on its lagged value severely bias the *t*-statistics for the ρ coefficient in presence of a unit root. Therefore, the Equation (4.16) is manipulated and has been expressed it somewhat differently by subtracting the lagged value from both sides in the following form:

$$Y_t - Y_{t-1} = (\rho - 1)Y_{t-1} + \varepsilon_t$$

$$\therefore \Delta Y_t = \gamma Y_{t-1} + \varepsilon_t \qquad \text{where } \gamma = (\rho - 1) \qquad 4.17$$

So, the null hypothesis H_0: $\rho = 1$ is now equivalent to the null hypothesis H_0: $\gamma = 0$ (i.e. there is a unit root, and the series is nonstationary) and the alternate hypothesis, H_A: $\rho < 1$ is equivalent to H_A: $\gamma < 0$ (i.e. there is no unit root and the series is stationary). If H_0 is rejected, then any of the following three scenarios can exist:

The Equation (4.17) does not include trend and drift as:

$$\therefore \Delta Y_t = \gamma Y_{t-1} + \varepsilon_t$$

The Equation (4.17) can include a drift as follows:

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \varepsilon_t \qquad 4.18$$

The Equation (4.17) can also include a drift and a trend variable:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \varepsilon_t \qquad 4.19$$

So, the Dickey-Fuller test is performed for each of the three above models.

The Dickey-Fuller testing procedures assume that the error term ε_t follows a white noise process and $Y_0 = 0$. These are stringent assumptions for the real world. When the errors are correlated, there is a need to either change the estimation method (adopt another regression model) or modify the statistics to obtain consistent estimators and statistics. Dickey and Fuller (1979) have used the first approach of changing the estimating regressions using the parametric approach, known as Augmented Dickey Fuller test. On the other hand, Phillips and Perron (1988) have followed the second approach of modifying the statistics using a nonparametric approach.

4.3.4.2 Augmented Dickey-Fuller Unit Root Tests

In Augmented Dickey-Fuller (ADF) test the null hypothesis is tested by estimating an autoregression of ΔY_t on its own lags and ΔY_{t-1} using Ordinary Least Squares (OLS). The null hypothesis i.e. the presence of unit root is tested following the same DF distribution. Like DF test ADF test has following three main versions:

1. Test for a unit root without drift and deterministic trend

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varphi_t$$

2. Test for a unit root with drift

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varphi_t$$

3. Test for a unit root with drift and deterministic time trend

$$\Delta Y_t = a_0 + a_1 t + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varphi_t$$

where φ_t is a white noise, a_0 is the drift term (constant), t is the linear trend term and a_1 γ, and δ_i are coefficients. This model 3 is a least restrictive model, because it allows a constant and a deterministic trend. Here, p is the lagged values of ΔY_t, to control for the higher-order correlations, assuming the series follows an *AR(p)* process.

The hypotheses for ADF test are as follows:

$H_0: \gamma = 0$ the series has a unit root ("differenced stationary")

$H_A: \gamma < 0$ the series has no unit root (meaning that the series is either stationary, or trend stationary).

The null hypothesis is that a series does contain a unit root (nonstationary process) against the alternative of stationary. To test for the presence of a unit root, we need to calculate the t-statistic $\tau = \frac{\gamma}{se(\gamma)}$ and then compare it to the corresponding critical value given by Dickey and Fuller at different significant level. If the null hypothesis is rejected, it is concluded that a series Y_t, which includes drift and trend, drift, or none does not contain a unit root.

To perform Augmented Dickey-Fuller (ADF) test; firstly, we need to specify whether to include a constant and a linear trend, a constant, or none in the test regression. Maddala and Kim (1999) have argued that it is hard to believe the *AR(1)* model without deterministic trend can describe well most of the macroeconomic variables. This suggests that it may be appropriate to incorporate the linear trend term in the model. When we include the linear trend term into the model, we can classify the time series into two important classes, which imply the different methods of eliminating the trend. These classes are trend stationary process (TSP) and difference-stationary process (DSP).

Besides the importance of the presence of the deterministic trend in macroeconomic series, the specification of the trend plays an essential role in the unit root testing procedure and it is closely related to the power and size of the unit root tests. Campbell and Perron (1991) have argued that the proper handling of the deterministic trends is a vital prerequisite for dealing with unit roots. Perron (1988) has proposed a sequential testing strategy and has argued that a proper testing strategy should start from the most general trend specification and test down to more restricted specifications.

On the other hand, inclusion of irrelevant regressors in the regression can reduce the power of the test to reject the null hypothesis of a unit root**.** To overcome this problem, the form of test regression should be chosen based on the graphical inspection of a series (Verbeek, 2004). If the plot of the data does not start from the origin, then the estimation equation should include a constant. If the plot of the data indicates apparent upward or downward trend, then the trend term should be contained in the regression.

Furthermore, it is also very important to select the appropriate number of lagged difference term *p*. Too few lags may lead to the over rejecting the null hypothesis when it is true, while too many lags may reduce the power of the test to reject the null. One suggested solution is to determine the optimal lag length using different information criterion - such as LR (Log-Likelihood Ratio Criterion), AIC (Akaike Information Criterion), SIC (Schwarz Information Criterion). FPE (Final Prediction Error), HQ (Hannan-Quinn Information Criterion). All the models are considered as equally good. In this chapter, the lag length which is supported by the maximum number of above information criteria is selected.

The main criticism of the Augmented Dickey-Fuller (ADF) test is that the power of the test is very low when the process is nearly nonstationary which means the process is stationary but with a root close to the nonstationary boundary (Brooks 2002).

4.3.4.3 Phillips and Perron Unit Root Tests

Phillips and Perron (1988) have developed a more comprehensive theory of unit root tests. Phillips and Perron (PP) tests are similar to ADF tests, but they incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals. The PP tests use the standard DF test with modified *t* - ratio of the γ coefficient, so that serial correlation does not affect the asymptotic distribution of the test statistic. The hypotheses for PP test are:

$H_0: \gamma = 0$ the series has a unit root ("difference stationary")

$H_A: \gamma < 0$ the series has no unit root (meaning that the series is either stationary, or trend stationary).

The PP tests usually give the almost same conclusions as the ADF tests, and the calculation of the test statistics is complex. Like ADF test, the main criticism of PP tests is that the power of the test is low if the process is stationary but with a root close to the nonstationary boundary. For example, the tests are poor at deciding if $\gamma = 1$ or $\gamma = 0.95$, especially with small sample sizes (Brooks 2002).

4.3.4.4 Kwiatkowski, Phillips, Schmidt, and Shin Unit Root Tests

To circumvent the limitations of ADF and PP tests, Kwiatkowski, Phillips, Schmidt, and Shin (1992) proposed an alternative test where the variable is assumed to be stationary under the null. The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test is a Lagrange Multiplier (LM) test and the test statistic can be computed by firstly regressing the dependent variable Y_t on a constant and a time trend, and then on a constant only. Later, OLS residuals, ε_t are saved and compute the partial sums $S_t = \sum_{s=1}^{t} \varepsilon_s$ for all t. Further the test statistic is given by (Verbeek 2004):

$$KPSS\ LM = \sum_{t=1}^{T} \frac{S_t^2}{\hat{\sigma}_\varepsilon^2}$$

where $\hat{\sigma}_\varepsilon^2$ is the variance of the estimated error from the regression of the equations with drift $(Y_t = \alpha + \varepsilon_t)$ or drift and trend $(Y_t = \alpha + \beta t + \varepsilon_t)$. The null and alternative hypotheses of KPSS test are as follows:

H_0: the series is trend-stationary

H_A: the series has unit root.

In this chapter, the different versions of unit root tests are set up following the Pantula (1991) principle. As per the principle, the unit root tests are started on level data with the model containing both trend and intercept (constant), because this model is the least restrictive. If the null hypothesis is rejected due to a significant test statistic, there is no need to continue testing and the alternate hypothesis is accepted. If the null cannot be rejected, then the test is carried on level data with an intercept. If the null hypothesis is rejected due to a significant test statistic, then there is no need to continue testing and the alternate hypothesis is accepted. If the null is not rejected it is possible to continue with the model having no trend and constant. But this is seldom a good strategy if the variable is obviously nonstationary, so this most restrictive model has not been checked.

4.3.5 Concept of Cointegration Approach

The concept of cointegration was first introduced by Granger in 1981. However, Granger (1981) has only outlined the characteristics of integrated series without proposing any procedure for testing cointegration. Later, Engle and Granger (1987) have suggested a procedure for testing the hypotheses of cointegration. They have proposed a simple two-step procedure for testing cointegration using the Ordinary Least Squares (OLS) method. In the first step, a regression is estimated for two variables (at level) and residuals are extracted from the regression analysis. In the second step, the extracted residuals are tested for a unit root. If the residuals are found stationary at level, meaning that the residuals are integrated of order zero, *I(0)*, the null hypothesis of no cointegration between the two series is rejected.

However, Engle and Granger's two step procedure has been criticized for several reasons. Firstly, several academics have noted that as it involves a two-step process, any error introduced in the estimation of the error terms in the first step may enter the subsequent error correction model (Brooks, 2008). Secondly, changing the variables from the right-hand side to the left-hand side of the regression equation might give different results. For example, in investigating the relationship between income and expenditure, if income is placed on the left-hand side as the dependent variable and expenditure on the right-hand side, then it is possible to conclude that income and expenditure are cointegrated, but the reverse is not necessarily true.

These problems with the Engle and Granger two-step procedure were overcome by Johansen (1988) and Johansen and Juselius (1990). They estimated the cointegrating vector using the maximum likelihood estimation technique. They provided a method of estimating a multivariate vector error correction method (VECM) based on a vector autoregressive VAR(k) model with Gaussian errors and its implications on equilibrium. This process has the advantage of capturing both long- and short-term dynamic relationships of a system. Johansen and Juselius (1990) approach has been used to examine whether any long-run relationships exists between the variables.

4.3.6 Johansen and Juselius Cointegration Approach

Johansen and Juselius (1990) test is an extension of the single equation error correction model to a multivariate one. VAR(k) model of a $(n \times 1)$ vector, $\boldsymbol{Y_t}\,(y_{1t}, y_{2t}, y_{3t} \cdots\cdots y_{nt})$ at level can be given as:

$$\boldsymbol{Y_t} = \boldsymbol{D_t} + \boldsymbol{A_1 Y_{t-1}} + \boldsymbol{A_2 Y_{t-2}} + \boldsymbol{A_3 Y_{t-3}} + \dots\dots + \boldsymbol{A_k Y_{t-k}} + \boldsymbol{\varepsilon_t} \qquad 4.20$$

where $\boldsymbol{D_t}$ contains the deterministic terms (constant, trend, seasonal dummies etc.), $\boldsymbol{A_i}$ is a $(n \times n)$ coefficient matrix, $t = 1, 2, 3, \dots\dots, T$ and $\boldsymbol{\varepsilon_t}$ is a $(n \times 1)$ vector of white noise error terms.

Now, $\boldsymbol{Y_t}$ is cointegrated if there exist some linear combinations of the variables in $\boldsymbol{Y_t}$ that are stationary at level i.e. $I(0)$. However, if $\boldsymbol{Y_t}$ is nonstationary at level i.e. the variables are integrated of order 1, $I(1)$ and are possibly cointegrated, then the VAR representation is not the most suitable representation for analysis, because the cointegrating relationships are not explicitly apparent. The cointegrating relationships become apparent if the VAR at level is transformed into the Vector Error Correction Model (VECM). So, reparametrizing the Equation (4.20), that is subtracting $\boldsymbol{Y_{t-1}}$ from both sides, leads to:

$$\boldsymbol{Y_t - Y_{t-1} = D_t + A_1Y_{t-1} + A_2Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t - Y_{t-1}}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t - Y_{t-1} + A_1Y_{t-1} + A_2Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)Y_{t-1} + A_2Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)Y_{t-1} - (-I + A_1)Y_{t-2} + (-I + A_1)Y_{t-2} + A_2Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)(Y_{t-1} - Y_{t-2}) + (-I + A_1)Y_{t-2} + A_2Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)\Delta Y_{t-1} + (-I + A_1 + A_2)Y_{t-2} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)\Delta Y_{t-1} + (-I + A_1 + A_2)Y_{t-2} - (-I + A_1 + A_2)Y_{t-3} + (-I + A_1 + A_2)Y_{t-3} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + (-I + A_1)\Delta Y_{t-1} + (-I + A_1 + A_2)(Y_{t-2} - Y_{t-3}) + (-I + A_1 + A_2)Y_{t-3} + A_3Y_{t-3} + \cdots + A_kY_{t-k} + \varepsilon_t}$$

In this way if we proceed up to *k* lag, the equation can be written as:

$$\Delta\boldsymbol{Y_t = D_t + (-I + A_1)\Delta Y_{t-1} + (-I + A_1 + A_2)\Delta Y_{t-2} + (-I + A_1 + A_2 + A_3)\Delta Y_{t-3} + \cdots + (-I + A_1 + A_2 + \cdots + A_{k-1})\Delta Y_{t-k+1} + (-I + A_1 + A_2 + \cdots + A_k)Y_{t-k} + \varepsilon_t}$$

$$\therefore \Delta\boldsymbol{Y_t = D_t + \Pi Y_{t-k} + \Gamma_1\Delta Y_{t-1} + \Gamma_2\Delta Y_{t-2} + \Gamma_3\Delta Y_{t-3} + \cdots + \Gamma_{t-k+1}\Delta Y_{t-k+1} + \varepsilon_t} \quad 4.21$$

where, $\boldsymbol{\Pi}$ and $\boldsymbol{\Gamma}$ are *(n × n)* coefficient matrices representing the long-term and short-term dynamics respectively, which are defined as:

$$\mathbf{\Pi} = -\mathbf{I} + \sum_{i=1}^{k} \mathbf{A_i}$$

And

$$\mathbf{\Gamma_i} = -\mathbf{I} + \sum_{\mathrm{i}=1}^{\mathrm{k}-1} \mathbf{A_i}$$

The number of cointegrating vectors is identical to the number of stationary relationships in the $\boldsymbol{\Pi}$ matrix. If there is no cointegration, all rows in $\boldsymbol{\Pi}$ must be filled with zeros. On the other hand, if they are cointegrated, all the rows of $\boldsymbol{\Pi}$ must be cointegrated but not necessarily distinct. This is because the number of distinct cointegrating vectors depends on the row rank of $\boldsymbol{\Pi}$ (Harris, 1995). So, the rank of $\boldsymbol{\Pi}$ matrix, denotes by r, determines the number independent rows in $\boldsymbol{\Pi}$, and therefore also the number of cointegrating vectors. Since $\boldsymbol{\Pi}$ has rank r it can be written as the product of:

$$\underset{(n \times r)}{\boldsymbol{\Pi}} = \underset{(n \times r)}{\boldsymbol{\alpha}} \times \underset{(r \times n)}{\boldsymbol{\beta}'}$$

where $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are $(n \times r)$ matrices with rank $(\boldsymbol{\alpha})$ = rank $(\boldsymbol{\beta}) = r$. The rows of $\boldsymbol{\beta}'$, called the cointegrating matrix, form a basis for the r cointegrating vectors and the elements of $\boldsymbol{\alpha}$**,** called feedback or adjustment matrix**,** distribute the impact of the cointegrating vectors to the evolution of $\Delta\boldsymbol{Y_t}$. Then the VECM model (4.21) becomes:

$$\Delta\boldsymbol{Y_t} = \boldsymbol{D_t} + \boldsymbol{\alpha\beta' Y_{t-k}} + \boldsymbol{\Gamma_1}\Delta\boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2}\Delta\boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3}\Delta\boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}}\Delta\boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t} \qquad 4.22$$

where $\boldsymbol{\beta' Y_{t\text{-}k}} \sim I\,(0)$ since $\boldsymbol{\beta}'$ is a matrix of cointegration vectors. The vector series $\boldsymbol{\beta' Y_t}$ is referred to as the cointegrating series, and $\boldsymbol{\alpha}$ denotes the impact of the cointegration series on $\Delta\boldsymbol{Y_t}$.

It is important to recognize that the $\boldsymbol{\Pi} = \boldsymbol{\alpha}\ \boldsymbol{\beta}'$ is not unique since for any $(r \times r)$ nonsingular matrix $\boldsymbol{H}$, then we can write:

$$\boldsymbol{A}\ \boldsymbol{\beta}' = \boldsymbol{\alpha H H^{-1} \beta}' = (\boldsymbol{\alpha H})\ (\boldsymbol{\beta' H^{-1\prime}}) = \boldsymbol{\alpha}^* \boldsymbol{\beta}^{*\prime}$$

Hence, the factorization $\boldsymbol{\Pi = \alpha\ \beta'}$ only identifies the space spanned by the cointegrating relations. To obtain unique values of $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}'$ requires further restrictions on the model.

To explore this let us consider the bivariate VAR(1) model for $\boldsymbol{Y_t} = (y_{1t}, y_{2t})'$

$$\boldsymbol{Y_t} = \boldsymbol{\Pi_1 Y_{t-1}} + \boldsymbol{\varepsilon_t} \qquad 4.23$$

The VECM is:

$$\Delta\boldsymbol{Y_t} = \boldsymbol{\Pi Y_{t-1}} + \boldsymbol{\varepsilon_t}\ ; \text{ where } \boldsymbol{\Pi} = \boldsymbol{\Pi_1} - \boldsymbol{I_2}$$

$$\therefore \Delta \boldsymbol{Y_t} = \boldsymbol{\alpha\beta' Y_{t-1}} + \boldsymbol{\varepsilon_t} \tag{4.24}$$

Assuming $\boldsymbol{Y_t}$ is cointegrated and there exists a *(2 × 1)* vector $\boldsymbol{\beta} = (\beta_1, \beta_2)'$ such that:

$\boldsymbol{\beta' Y_t} = \beta_1 y_{1t} + \beta_2 y_{2t}$ is *I(0)*

Using the normalization $\beta_1 = 1$ and $\beta_2 = -\beta$ the cointegrating relation becomes:

$\boldsymbol{\beta' Y_t} = y_{1t} - \beta y_{2t}$

This normalization suggests the stochastic long-run equilibrium relation:

$y_{1t} = \beta y_{2t} + \mu_t$

where μ_t is *I(0)* and represents the stochastic deviations from the long-run equilibrium, then the equation can be written as:

$y_{1t} = \beta y_{2t}$

Since $\boldsymbol{Y_t}$ is cointegrated with one cointegrating vector, so rank ($\boldsymbol{\Pi}$) = 1 and can be written as:

$$\boldsymbol{\Pi} = \boldsymbol{\alpha\beta'} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \end{pmatrix} (1 \quad -\beta) = \begin{pmatrix} \alpha_1 & -\alpha_1\beta \\ \alpha_2 & -\alpha_2\beta \end{pmatrix} \tag{4.25}$$

Now putting the value of $\boldsymbol{\Pi}$ from Equation (4.25) to Equation (4.24) we get

$$\Delta \boldsymbol{Y_t} = \begin{pmatrix} \alpha_1 & -\alpha_1\beta \\ \alpha_2 & -\alpha_2\beta \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$$

$$\therefore \begin{pmatrix} \Delta y_{1t} \\ \Delta y_{2t} \end{pmatrix} = \begin{pmatrix} \alpha_1 y_{1t-1} - \alpha_1\beta y_{2t-1} \\ \alpha_2 y_{1t-1} - \alpha_2\beta y_{2t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \tag{4.26}$$

The VECM equation from Equation 4.26, can be given as follows:

$$\Delta y_{1t} = \alpha_1 y_{1t-1} - \alpha_1\beta y_{2t-1} + \varepsilon_{1t} = \alpha_1(y_{1t-1} + \beta y_{2t-1}) + \varepsilon_{1t}$$

$$\Delta y_{2t} = \alpha_2 y_{1t-1} - \alpha_2\beta y_{2t-1} + \varepsilon_{2t} = \alpha_2(y_{1t-1} + \beta y_{2t-1}) + \varepsilon_{2t}$$

The first equation relates the change in y_{1t} to the lagged disequilibrium error $\boldsymbol{\beta' Y_t}$ and the second equation relates the change in y_{2t} to the lagged disequilibrium error as well. We can see that the reactions of y_1 and y_2 to the disequilibrium errors are captured by the adjustment coefficients α_1 and α_2. The stability conditions for the bivariate VECM are related to the stability conditions for the disequilibrium error $\boldsymbol{\beta' Y_t}$. By multiplying Equation (4.24) by $\boldsymbol{\beta'}$, we get:

$$\boldsymbol{\beta'}\Delta\boldsymbol{Y_t} = \boldsymbol{\beta'\alpha\beta' Y_{t-1}} + \boldsymbol{\beta'\varepsilon_t}$$

$$\therefore \boldsymbol{\beta'}(\boldsymbol{Y_t} - \boldsymbol{Y_{t-1}}) = \boldsymbol{\beta'\alpha\beta' Y_{t-1}} + \boldsymbol{\beta'\varepsilon_t}$$

$$\therefore \boldsymbol{\beta' Y_t} - \boldsymbol{\beta' Y_{t-1}} = \boldsymbol{\beta'\alpha\beta' Y_{t-1}} + \boldsymbol{\beta'\varepsilon_t}$$

$$\therefore \boldsymbol{\beta' Y_t} = \boldsymbol{\beta'\alpha\beta' Y_{t-1}} + \boldsymbol{\beta' Y_{t-1}} + \boldsymbol{\beta'\varepsilon_t}$$

$$\therefore \boldsymbol{\beta' Y_t} = (\boldsymbol{I} + \boldsymbol{\alpha\beta'})\boldsymbol{\beta' Y_{t-1}} + \boldsymbol{\beta'\varepsilon_t} \qquad 4.27$$

Equation (4.27) can be written as:

$$y_t = \varphi y_{t-1} + \upsilon_t$$

where y_t = $\boldsymbol{\beta' Y_t}$, φ = $(\boldsymbol{I} + \boldsymbol{\alpha\beta'})$ = $1 + (\alpha_1 - \beta\alpha_2)$ and υ_t = $\boldsymbol{\beta'\varepsilon_t}$ = $\varepsilon_{1t} - \beta\varepsilon_{2t}$.

The *AR(1)* model for y_t is stable as long as $|\varphi| = |1 + (\alpha_1 - \beta\alpha_2)| < 1$. For example, suppose $\beta = 1$. Then the stability condition is:

$$|1 + (\alpha_1 - \alpha_2)| < 1$$

$$\therefore \{1 + (\alpha_1 - \alpha_2)\}^2 < 1$$

$$\therefore 1 + 2(\alpha_1 - \alpha_2) + (\alpha_1 - \alpha_2)^2 < 1$$

$$\therefore (\alpha_1 - \alpha_2)(\alpha_1 - \alpha_2 + 2) < 0 \qquad 4.28$$

So, the conditions to be satisfied for the Equation (4.28) will be:

$(\alpha_1 - \alpha_2) < 0 \; and \; (\alpha_1 - \alpha_2 + 2) > 0$ i.e. $\alpha_1 < \alpha_2$ and $(\alpha_1 - \alpha_2) > -2$

If $\alpha_2 = 0$ then $\alpha_1 < 0 \; and \; \alpha_1 > -2$ i.e. $-2 < \alpha_1 < 0$ is the condition for stability.

Also, considering *AR(1)* model in the long-run error correction term the VECM equation can be written as:

$$\Delta\boldsymbol{Y_t} = \boldsymbol{D_t} + \boldsymbol{\Pi Y_{t-1}} + \boldsymbol{\Gamma_1}\Delta\boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2}\Delta\boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3}\Delta\boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}}\Delta\boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t} \qquad 4.29$$

4.3.6.1 Steps in Johansen and Juselius Cointegration Approach

The Johansen and Juselius (1990) Cointegration Approach (JJA) has the following steps:

Step1: Testing for Stationarity of the Variables and its Order of Integration: The first step in cointegration analysis is to check for the stationarity of the variables and determine the order of integration. For Johansen and Juselius (1990) Cointegration Approach (JJA), all variables must be integrated in the same order. The order of integration of a series refers to the number of times the series must be differenced to make it stationary. A series is integrated in order of *d*, *I(d)*, if it needs to be differenced *d* times to make it stationary. If a series becomes stationary after differencing once, then it is integrated of order 1, *I(1)*.

Step 2: Optimum Lag Length Selection Process: It is necessary to determine the dynamic specification of *VAR(k)* model before the cointegration test is carried out. Hence, the selection of appropriate lag length *k* using proper information criteria is required. The determination of the appropriate lag length *k* starts by estimating a VAR model including all the variables in level (non-differenced data). The most common information criterions used for optimum lag selection are LR (Log-Likelihood Ratio Criterion), AIC (Akaike Information Criterion), SIC (Schwarz Information Criterion). FPE (Final Prediction Error), HQ (Hannan-Quinn Information Criterion). All the models are considered as equally good. In this study, we have estimated the VAR model with variables at level, then the stability of the model is also checked. Finally, the lag length is selected based on the lag length supported by the maximum number of above criterions.

Step 3: Specification of Deterministic Terms: Our research variables may have non-zero means and deterministic trends or the stochastic trends. Similarly, the cointegrating equations may have intercepts and deterministic trends. The asymptotic distribution of the Likelihood Ratio (LR) test statistic for cointegration does not have the usual χ^2 distribution and depends on the assumptions made with respect to deterministic trends. Maddala and Kim (1999) have argued that it is hard to believe that the pure *AR(1)* model without the deterministic trend describes well most of the macroeconomic variables. They have added further that almost all variables usually show some tendency to increase over time, this suggests that it may be appropriate to incorporate the linear trend term into the model.

However, based on the linear trend term into the model, we can classify the time series into two important classes which imply the methods of eliminating the trend. These classes are trend-stationary process (TSP) and differenced-stationary process (DSP). Following Johansen (1995), the deterministic terms are restricted to the form:

$$\boldsymbol{D_t = d_0 + d_1 t}$$

If the deterministic terms are unrestricted then the time series in $\boldsymbol{Y_t}$ may exhibit quadratic trends and there may be a linear trend term in the cointegrating relationships. Restricted versions of the trend parameters $\boldsymbol{d_0}$ and $\boldsymbol{d_1}$ limit the trending nature of the series in $\boldsymbol{Y_t}$. The trend behavior of $\boldsymbol{Y_t}$ can be classified into five cases:

Case I: $\boldsymbol{D_t} = 0$. In this case, there is no intercept and no deterministic trend. The restricted VECM Equation (4.29) becomes:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha\beta' Y_{t-1}} + \boldsymbol{\Gamma_1} \Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2} \Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3} \Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}} \Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

Here, all the variables in $\boldsymbol{Y_t}$ are *I(1)* without drift and the cointegrating relations $\boldsymbol{\beta' Y_t}$ have mean zero. However, this is quite unlikely to occur in practice, especially, as the intercept is generally needed to account for adjustment in the unit of measurements of the variables.

Case II: $\boldsymbol{d_0} = \boldsymbol{\alpha\rho_0}$ and $\boldsymbol{d_1 = 0}$. This is a case of restricted intercept and no deterministic trend. The restricted VECM of Equation (4.29) can be written as:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha\rho_0} + \boldsymbol{\alpha\beta' Y_{t-1}} + \boldsymbol{\Gamma_1} \Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2} \Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3} \Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}} \Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

$$\therefore \Delta \boldsymbol{Y_t} = \boldsymbol{\alpha}(\boldsymbol{\rho_0} + \boldsymbol{\beta' Y_{t-1}}) + \boldsymbol{\Gamma_1} \Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2} \Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3} \Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}} \Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

All the series in $\boldsymbol{Y_t}$ are *I(1)* without drift and the cointegrating series $\boldsymbol{\beta' Y_t}$ have non-zero mean $\boldsymbol{\rho_0}$. In this case, the intercept is restricted to the long-run model (in the cointegrating series). There are no linear trends in the data, and is appropriate for non-trending *I(1)* data like interest rates and exchange rates.

Case III: $\boldsymbol{d_1 = 0}$ and $\boldsymbol{d_0}$ is unrestricted. This is a case of unrestricted intercept and no deterministic trend. The restricted VECM of Equation (4.29) is:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{d_0} + \boldsymbol{\alpha\beta' Y_{t-1}} + \boldsymbol{\Gamma_1}\Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2}\Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3}\Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}}\Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

The series in $\boldsymbol{Y_t}$ are *I(1)* with drift vector $\boldsymbol{d_0}$ and the cointegrating series $\boldsymbol{\beta' Y_t}$ may have a non-zero mean. In this model, there are no linear trends in the level data, but allows both short-term and long-run specifications to drift around an intercept. However, the intercept in the cointegrating series is assumed to cancel out by the intercept in the VAR, leaving just one intercept in the short-run model. This is appropriate for trending *I(1)* data like asset prices, macroeconomic aggregates (real GDP, consumption, employment etc.).

Case IV: $\boldsymbol{D_t = d_0 + \alpha\rho_1} t$. This is a case of unrestricted intercepts and restricted deterministic trend. The restricted VECM is:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{d_0} + \boldsymbol{\alpha}(\boldsymbol{\rho_1} t + \boldsymbol{\beta' Y_{t-1}}) + \boldsymbol{\Gamma_1}\Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2}\Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3}\Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}}\Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

The series in $\boldsymbol{Y_t}$ are *I(1)* with drift vector $\boldsymbol{d_0}$ and the cointegrating series $\boldsymbol{\beta' Y_t}$ have a linear trend term $\boldsymbol{\rho_1} t$. In this model, a trend is included in the cointegrating series as a trend stationary variable to take care of exogenous growth (i.e. technical progress). The model also allows for intercept. The restricted trend case IV is also appropriate for trending *I(1)* as in Case III. However, there is a deterministic trend in the cointegrating series in Case IV as opposed to the stationary series in case III.

Case V: $\boldsymbol{D_t = d_0 + d_1} t$. This is a case of unrestricted constant and trend. The unrestricted VECM is:

$$\therefore \Delta \boldsymbol{Y_t} = \boldsymbol{d_0} + \boldsymbol{d_1} t + \boldsymbol{\alpha\beta' Y_{t-1}} + \boldsymbol{\Gamma_1}\Delta \boldsymbol{Y_{t-1}} + \boldsymbol{\Gamma_2}\Delta \boldsymbol{Y_{t-2}} + \boldsymbol{\Gamma_3}\Delta \boldsymbol{Y_{t-3}} + \cdots + \boldsymbol{\Gamma_{t-k+1}}\Delta \boldsymbol{Y_{t-k+1}} + \boldsymbol{\varepsilon_t}$$

The series in $\boldsymbol{Y_t}$ are *I(1)* with a linear trend (quadratic trend in levels) and the cointegrating series $\boldsymbol{\beta' Y_t}$ have a linear trend. This model is appropriate for *I(1)* data with a quadratic trend. An example might be nominal price data during times of extreme inflation.

The inclusion of appropriate deterministic components in the cointegration test is often difficult to determine. We have used log-likelihood ratio test to examine the presence of deterministic trend in the series. The main purpose of the test is not to identify the most appropriate model of the deterministic components, but to eliminate the most unlikely models of the deterministic components from consideration. The log-likelihood ratio test is carried out using ADF unit root tests with joint hypothesis of a unit root and no deterministic trend. The most unrestricted ADF unit root test model can be given by:

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + a_1(trend) + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t$$

where Y_t is an individual time series under consideration, the trend in the above equation is a linear deterministic time trend, and ε_t is a serially uncorrelated error terms with zero mean and constant variance. So, the null and alternative hypotheses for log-likelihood ratio test are follows:

H_0: $\gamma = a_1 = 0$ The series has unit root and no deterministic trend

H_A: $\gamma = 0,\ given\ a_1 > 0$ The series has unit root and deterministic trend.

Let the likelihood function is denoted as $L(\theta)$. If θ_0 be the value of the parameter, within the limit of the null hypothesis, which maximizes the likelihood function and θ_1 be the value of the parameter which maximizes the likelihood function out of possible value from the alternative hypothesis. Then the test statistic is defined as:

$$\tau = 2Ln[L(\theta_1) - L(\theta_0)]$$

$\therefore \tau = 2[Ln(L(\theta_1) - Ln(L(\theta_0)]$

This distribution follows Chi-square distribution and the critical value for one degree of freedom (as there is one restriction) is 3.841 at 5% significance level.

Then, after excluding the most unlikely models, we have applied the Pantula principle, following Johansen (1992), to identify the most appropriate one from the remaining models. The process of Pantula principle is to move from the most restrictive model to the least restrictive model and then to compare the trace and the maximal eigenvalue test statistics to their critical values at each stage. The test is completed when the null hypothesis is not rejected at the first time.

Step 4: Determining the Number of Cointegrating Vector: Johansen and Juselius (1990) have developed two likelihood ratio (LR) test statistics; the trace and maximum eigenvalues test, for determining the number of cointegrating relationships. Since the rank of the long-run impact matrix $\boldsymbol{\Pi}$ gives the number of cointegrating relationships in $\boldsymbol{Y}_t$, the likelihood statistics of Johansen and Juselius test determine the rank of $\boldsymbol{\Pi}$. The rank of $\boldsymbol{\Pi}$ is equal to the number of non-zero eigenvalues of $\boldsymbol{\Pi}$. The trace statistics are given by:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i)$$

where $\hat{\lambda}_i$ denotes the estimated values of the characteristic roots obtained from the estimated $\boldsymbol{\Pi}$, and T is the number of observations. Johansen proposes a sequential testing procedure that consistently determines the number of cointegrating vectors. First the test is conducted for H_0: $r = 0$ against H_A: $r > 0$. If this null is not rejected, then it is concluded that there are no cointegrating vectors among the n variables in $\boldsymbol{Y}_t$. If H_0: $r = 0$ is rejected, then it is concluded that there is at least one cointegrating vector and proceed to test H_0: $r = 1$ against H_A: $r > 1$. If this null is not rejected, then it is concluded that there is only one cointegrating vector. If the null is rejected, then it is concluded that there is at least two cointegrating vectors. The sequential procedure is continued until the null is not rejected. Johansen's second LR statistic i.e. maximum eigenvalue statistic is given by:

$$\lambda_{max}(r, r+1) = -Tln(1 - \hat{\lambda}_{r+1})$$

The computed likelihood values and eigenvalues are compared to the critical values to determine the exact number of cointegrating equations. The critical values depend upon which deterministic terms are included, and whether they are restricted or unrestricted. After the cointegration relation has been established, the resulted long-run cointegration equation(s) is (are) viewed and analyzed based on the objective of the study.

The Johansen and Juselius (1990) approach of testing cointegrating rank is very sensitive to the lag length and the deterministic trend terms included in the VAR system. Therefore, it is important to determine the appropriate lag length and deterministic terms to be used in the cointegration test in order to prevent errors in hypothesis testing (Enders, 2004).

Step 5: Vector Error Correction Model (VECM): After establishing the number of cointegrating vectors, the next step is to estimate the Error Correct Model (VECM). The VECM representation is essentially a VAR presented in Equation (4.29) with the short-term parameters $\boldsymbol{\Gamma}$ and the additional long-run term $\boldsymbol{\Pi Y_{t-1}}$. This restriction on the differenced VAR ties the individual series of the vector $\boldsymbol{Y_t}$ together and ensures that the system returns to its long-run equilibrium (Banerjee et al., 1993).

As stated earlier, the matrix $\boldsymbol{\Pi}$ and its rank r = rank ($\boldsymbol{\Pi}$) are of crucial importance for the cointegration relationship of the system. If $\boldsymbol{\Pi}$ has rank of zero, then the term drops out. In this case, Equation (4.29) reduces to a stable VAR in differences with no cointegration relationship (Enders, 2004). If $\boldsymbol{\Pi}$ has full rank, then this scenario is called trivial cointegration as cointegration is formally present, but the individual series do not share a common stochastic trend. If $\boldsymbol{\Pi}$ is rank deficient, it can be written as $\boldsymbol{\Pi} = \boldsymbol{\alpha\beta'}$ where $\boldsymbol{\beta'}$, called the cointegrating matrix, form a basis for the *r* cointegrating vectors and the elements of $\boldsymbol{\alpha}$**,** called the loading feedback or adjustment matrix, can be interpreted as the speed of adjustment to errors in the long-run relationship.

If the system is out of equilibrium, that is if $\boldsymbol{\beta' Y}_t \neq 0$, the loading matrix controls the change in $\Delta \boldsymbol{Y}_t$ in the next period to drive the time series back to the relationship given by the cointegrating matrix. Bigger values in $\boldsymbol{\alpha}$ correspond to faster adjustment to the long-run equilibrium. The matrices $\boldsymbol{\alpha}$ and $\boldsymbol{\beta'}$ are not unique and can be decomposed arbitrarily. A feasible way is therefore to normalize the first component of the cointegration vector to one (Luetkepohl, 2005).

The parameter sequence, $\boldsymbol{\Gamma}$ measures short-term reactions of a series to changes in its own past values, as well as those in other variables in the system just like in the standard non-cointegrated VAR. As the differences are stationary, the effect of these short-term fluctuations eventually dies out and does not have an influence on the long-run relationship.

The Maximum Likelihood method developed by Johansen (1988) is a full information approach that estimates the VECM in a single step. This procedure has the advantage that it does not carry over estimation errors of the first step into a second one, as like Engle and Granger (1987) two-stage method, and therefore yields more efficient estimators (Maysami and Koh, 2000).

4.3.7 Granger Causality Test

It is essential to consider the causal relationships among the variables under consideration using the causality test. Causality examines the ability of one variable to predict the others. It is a statistical measure that provides the extent to which lagged values of a set of variables are important in predicting another set of variables, when lagged values of the latter set are also included in the model. The causality test utilizes the concept of Vector Autoregression (VAR) model, which allows for the test of the direction of causality. There are various causality tests that can detect the cause and effect relationships among the variables. However, the most popular causality tests are Granger (1969) causality test, Sims (1972) causality test and Geweke et al. (1983) causality test. Among these, we have used Granger causality test to examine the causal relationships.

A simple definition of Granger causality, in case of two time-series variables, *X* and *Y* is: "*X* is said to Granger-cause *Y* if *Y* can be better predicted using the histories of both *X* and *Y* than it can be by using the history of *Y* alone". We can test for Granger causality by estimating the following VAR model:

$$\boldsymbol{Y}_t = \boldsymbol{a}_0 + \boldsymbol{a}_1\boldsymbol{Y}_{t-1} + \cdots + \boldsymbol{a}_k\boldsymbol{Y}_{t-k} + \boldsymbol{b}_1\boldsymbol{X}_{t-1} + \cdots + \boldsymbol{b}_k\boldsymbol{X}_{t-k} + \boldsymbol{\mu_t} \quad 4.30$$

$$\mathbf{X}_t = \mathbf{c}_0 + \mathbf{c}_1\boldsymbol{X}_{t-1} + \cdots + \mathbf{c}_k\mathbf{X}_{t-p} + \mathbf{d}_1\mathbf{Y}_{t-1} + \cdots + \mathbf{d}_k\mathbf{Y}_{t-p} + \boldsymbol{\upsilon_t} \quad 4.31$$

where it is assumed that the disturbances, $\boldsymbol{\mu_t}$ and $\boldsymbol{\upsilon_t}$, are white noise terms and are uncorrelated. Then, testing of null hypothesis, H_0: $b_1 = b_2 = \cdots = b_k = 0$, against the alternative hypothesis, H_A: 'H_0 is not true', is a test that determines whether *X* Granger-cause *Y* or not. Similarly, testing H_0: $d_1 = d_2 = \cdots = d_p = 0$, against H_A: 'H_0 is not true', is a test that determines whether *Y* Granger-cause *X* or not. In each case, a rejection of the null hypothesis implies that there is a causal relationship.

If the time series are stationary, then a VAR model at level is constructed. If the variables are differenced stationary, or integrated of order one, *I(1)*, the VAR is specified in first differences. If the series are cointegrated then vector error correction (VECM) models are used. Sims et al. (1990) have showed that if the variables are cointegrated and integrated of order 1, Wald tests of Granger non-causality at level VAR could be used based on the error correction model.

Toda and Phillips (1993) has further improved this and point out that the Wald tests are valid asymptotically if there is sufficient cointegration among the variables. Granger representation theorem suggests that if the variables are cointegrated then there must be a causal relationship among them running at least in one direction, therefore VECM Granger-causality test for zero restrictions on the coefficients can be employed.

Therefore, it is important to understand from the beginning the actual meaning of the VECM Granger-causality. The test does not say that changes in one variable cause changes in another. What Granger-causality test gives is the correlation between the current value of one variable and past values of the other variable. That is, if we say that X_t Granger-cause Y_t, we mean that past value(s) of X_{it} (where i = 1, 2, 3, ..., n) are correlated with the current value of Y_t. Granger-causality between two variables can go in one direction, both ways, or there is no Granger-causality at all (Brooks, 2008).

4.3.8 Autoregressive Distributed Lag Cointegration Approach

Pesaran et al. (2001) have developed a new approach to cointegration testing which is applicable irrespective of whether the regressors are *I(0)*, *I(1)* or mutually cointegrated. This technique has several advantages. Firstly, the test is based on a single ARDL equation, rather than on a VAR as in Johansen, thus reducing the number of parameters to be estimated. Secondly, unlike the Johansen approach the restrictions on the number of lags can be applied to each variable separately. Thirdly, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee et al., 1993). The ECM integrates the short-run dynamics with the long-run equilibrium, without losing long-run information. Finally, the ARDL approach provides robust results for a smaller sample size of cointegration analysis.

The ARDL model considers a one-period lagged error correction term, which does not have restricted error corrections. Hence, the ARDL approach involves estimating the following Unrestricted Error Correction Model (UECM):

$$\Delta Y_t = a_{0Y} + \sum_{i=1}^{k} b_{iY}\Delta Y_{t-i} + \sum_{i=1}^{k} c_{iY}\Delta X_{t-i} + \theta_{1Y}Y_{t-1} + \theta_{2Y}X_{t-i} + \varepsilon_{1t} \quad 4.32$$

$$\Delta X_t = a_{0X} + \sum_{i=1}^{k} b_{iX}\Delta X_{t-i} + \sum_{i=1}^{k} c_{iX}\Delta Y_{t-i} + \omega_{1X}X_{t-1} + \omega_{2X}Y_{t-i} + \varepsilon_{2t} \quad 4.33$$

where Δ is the differenced operator, k represents the lag structure, Y_t and X_t are the underlying variables, and ε_{1t} and ε_{2t} are serially independent random errors with mean zero and finite covariance matrix. In Equation (4.32), where ΔY_t is the dependent variable, the null and the alternative hypotheses are:

$H_0: \theta_{1Y} = \theta_{2Y} = 0$ [there exists no long-run equilibrium relationship]

$H_0: \theta_{1Y} \neq 0,\ \theta_{2Y} \neq 0$ [there exists long-run equilibrium relationship]

Similarly, for Equation (4.33), where ΔX_t is the dependent variable, the null and alternate hypotheses are:

$H_0: \omega_{1X} = \omega_{2X} = 0$ [there exists no long-run equilibrium relationship]

$H_0: \omega_{1X} \neq 0,\ \omega_{2X} \neq 0$ [there exists long-run equilibrium relationship]

These hypotheses are tested using the *F*-test and *t*-test. Nevertheless, these tests have non-standard distributions that depend on the sample size, the inclusion of intercept and trend variable in the equation, and the number of regressors.

In this study, we have used *F*-test. Pesaran et al. (2001) have discussed five cases with different restrictions on the trends and intercepts. The estimated ARDL test statistics are compared to two asymptotic critical values reported in Pesaran et al. (2001) rather than the conventional critical values. If the test statistic is above an upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of the orders of integration of the underlying variables. The opposite is the case if the test statistic falls below a lower critical value. If the sample test statistic falls between these two bounds, the result is inconclusive.

Once cointegration is confirmed, the long-run relationship between stock market and macroeconomic variables using the selected ARDL models are estimated. The last step of ARDL is to estimate the associated ARDL error correction models. Finally, to ascertain the goodness of fit of the ARDL model, the diagnostic tests of the residual and the stability tests of the parameters are conducted. The structural stability test is conducted by employing the Cumulative Sum (CUSUM) and Cumulative Sum Squares (CUSUMSQ) tests of recursive residuals.

4.4 Findings of the Study

In this section, we have reported our empirical findings based on the econometric methods outlined in the previous sections. Firstly, we have summarized the descriptive statistics and cross correlations of the research variables, then the results of different unit root tests are portrayed. Secondly, we have reported the results of cointegration test and interpreted the results of the long-term relationship. Thirdly, the findings of Vector Error Correction Model (VECM) have been presented. Fourthly, we have discussed the results of residual diagnostic tests. Fifthly, the results of Granger Causality test have been portrayed. Sixthly, the results of ARDL test to reexamine cointegration among the variables along with the viability and the stability test of this model have been reported. Finally, summary of the chapter has been drawn.

4.4.1 Descriptive Statistics of the Research Variables

In this research, we have considered monthly closing DSE General Index to represent the stock market and six macroeconomic variables have been selected which are industrial production index as a proxy of GDP, deposit interest rates to represent the interest rates, consumer price index to represent the inflation, exchange rates, money supply and gold price. The descriptive statistics of the research variables are reported in Panel A and Panel B of Table 4.2 for data at level and at first differences respectively.

The number of observations, the mean, the median, the maximum and the minimum values, the standard deviation are reported. In addition, the skewness, the kurtosis statistics are calculated to examine the symmetry of the distributions of the variables. Table 4.2 also portrays the results of the Jarque-Bera statistics and the associated *p*-values to indicate whether the distributions of the research variables are normal or not.

This study has considered monthly data of 25 years period. The period of the study is quite a long-time span (from January 1991 to December 2015), hence the results are not being specific to any particular time span when unusual stock market as well as economic conditions have prevailed. Several points have emerged from the analysis of the descriptive statistics of the first differenced data, which represent the growth of the research variables.

Table 4.2 Descriptive Statistics of the Research Variables

	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE
Panel A. Data at Level							
Observations	300	300	300	300	300	300	300
Mean	6.070862	5.492377	0.078983	5.222687	5.063380	6.307898	5.353208
Median	5.907646	5.401932	0.076868	5.121192	5.087665	6.216839	4.964467
Maximum	7.803729	6.622444	0.115469	6.046662	5.465296	8.212045	7.004141
Minimum	4.443474	4.409763	0.049647	4.605170	4.605170	4.605170	4.502510
Std. Dev.	0.889767	0.543795	0.016673	0.427009	0.257826	1.069237	0.860716
Skewness	0.095763	0.204078	0.534194	0.375855	-0.238259	0.191749	0.652920
Kurtosis	1.924437	2.010907	2.617901	1.908987	1.638059	1.796569	1.798436
Jarque-Bera	14.91896	14.31120	16.09315	21.94220	26.02439	19.94147	39.36220
Probability	0.000576	0.000780	0.000320	0.000017	0.000002	0.000047	0.000000
Panel B. Data at First Difference							
Observations	299	299	299	299	299	299	299
Mean	0.008816	0.006747	-0.000148	0.004821	0.002632	0.012063	0.006672
Median	0.004307	0.010174	0.000000	0.003749	0.000000	0.010461	0.000000
Maximum	0.569159	0.244355	0.035289	0.041139	0.062903	0.062209	0.325422
Minimum	-0.363551	-0.221820	-0.020508	-0.032365	-0.035045	-0.02523	-0.251314
Std. Dev.	0.090990	0.070792	0.003148	0.009440	0.009479	0.015189	0.045503
Skewness	0.726895	-0.190557	3.974944	0.022413	2.483159	0.537413	1.230682
Kurtosis	10.40957	3.164842	61.40010	4.513199	17.43277	3.704922	17.57458
Jarque-Bera	710.3143	2.148069	43277.41	28.55178	2902.408	20.58322	2721.857
Probability	0.000000	0.341627	0.000000	0.000001	0.000000	0.000034	0.000000

Notes: LDSEGEN is Log of DSE General Index, LIPI is Log of Industrial Production Index, LINT is Log of Interest Rate, LCPI is Log of Consumer Price Index, LEXR is Log of Exchange Rate, LM2 is Log of Money Supply, and LGDPRICE is Log of Gold Price.

Firstly, the statistics of first differenced data have indicated that the stock market has provided about 0.88% mean monthly return over the period. On the other hand, during the period the mean monthly growth of industrial production, interest rate, inflation, exchange rate, money supply, and gold price are approximately 0.67%, -0.015%, 0.48%, 0.26%, 1.2% and 0.67% respectively. These results reveal that out of the seven research variables, except interest rate, other six have positive mean monthly growth in the total sample period, while interest rate has negative mean monthly growth. These results have revealed that during the total sample period except interest rate other six variables have increased, while interest rate has decreased.

Secondly, the standard deviations of the variables reveal that during the study period monthly stock market return has the highest volatility (9.1%), whereas monthly growth of interest rate has the lowest volatility (0.315%). The highest volatility of the stock market return may be due to the catastrophes of 1996 and 2010.

Thirdly, monthly growth of industrial production is negatively skewed, which indicates the presence of some extreme negative values in the distribution. Conversely, the distributions of stock market return and the growth of remaining five macroeconomic variables are positively skewed suggesting some extreme positive values. The kurtosis value of industrial production is 3.164842, which is close to three, and the Jarque-Bera statistic of this variable shows very high *p*-value (30.21%), meaning that the distribution of growth of industrial production is normal. However, kurtosis and Jarque-Bera statistics of other six variables indicate that these distributions are not normal.

The correlations among the variables at level are reported in Table 4.3, which show that except interest rate, DSE General Index has high positive correlations with other macro variables, while DSE General index has negative correlation with interest rate. Also, except interest rate other macroeconomic variables are strongly positively correlated with each other, whereas interest rate is weakly correlated with other macroeconomic variables.

Table 4.3 Cross Correlations of the Research Variables

	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE
LDSEGEN	1.000000						
LIPI	0.898515	1.000000					
LINT	-0.085490	0.020353	1.000000				
LCPI	0.887416	0.986846	0.107323	1.000000			
LEXR	0.825535	0.957048	-0.024497	0.955099	1.000000		
LM2	0.895438	0.991336	0.040955	0.995526	0.971701	1.000000	
LGDPRICE	0.894303	0.938895	0.176117	0.958783	0.879330	0.947832	1.000000

Notes: LDSEGEN is Log of DSE General Index, LIPI is Log of Industrial Production Index, LINT is Log of Interest Rate, LCPI is Log of Consumer Price Index, LEXR is Log of Exchange Rate, LM2 is Log of Money Supply, and LGDPRICE is Log of Gold Price.

4.4.2 Unit Root Tests Results

The first step of Johansen cointegration test is to check the variables for the stationarity and determine the order of integration. The graphs of the variables at level and at first differences (Figure 4.1 to Figure 4.7) show that all the series seem to be nonstationary at level, while stationary at first difference. Also, the correlograms[3] of the variables show high autocorrelations up to 24 lags at level indicating series are nonstationary, while that for first difference data are decreasing for most of the variables with increasing lag indicating that those series are approaching towards stationarity.

Figure 4.1. Graphs of Log DSE General Index at Level and 1st Difference

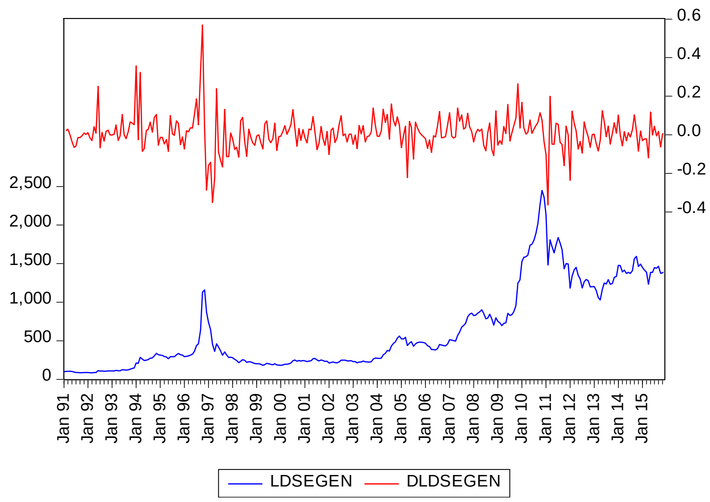
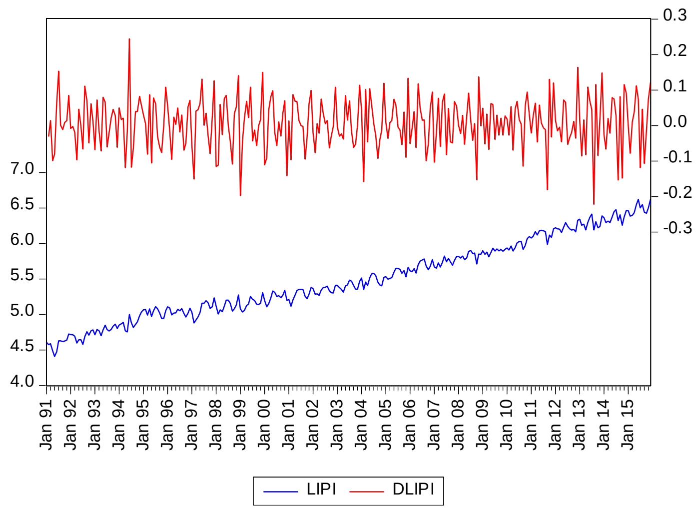


Figure 4.2. Graphs of Log Industrial Production Index at Level and 1st Difference



[3] See Appendix A

Figure 4.3. Graphs of Log Interest Rate at Level and 1st Difference

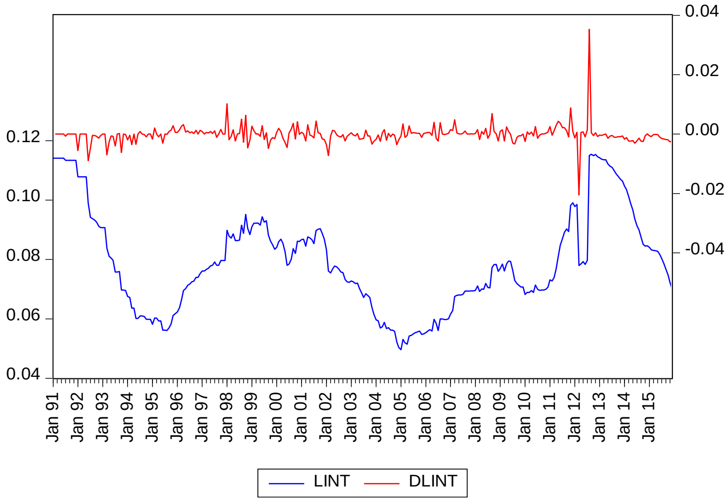


Figure 4.4. Graphs of Log Consumer Price Index at Level and 1st Difference

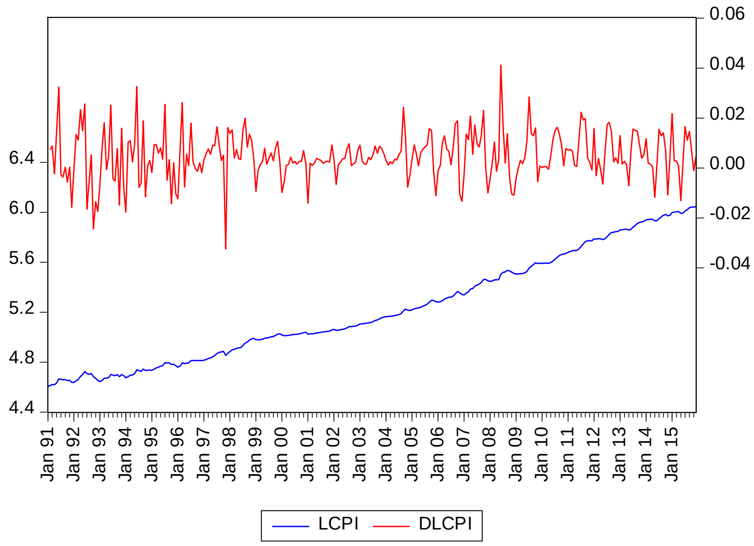


Figure 4.5. Graphs of Log Exchange Rate at Level and 1st Difference

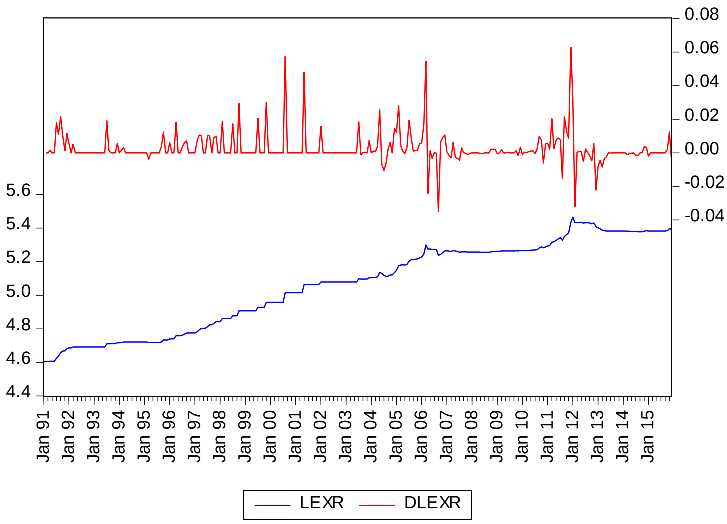


Figure 4.6. Graphs of Log Money Supply at Level and 1st Difference

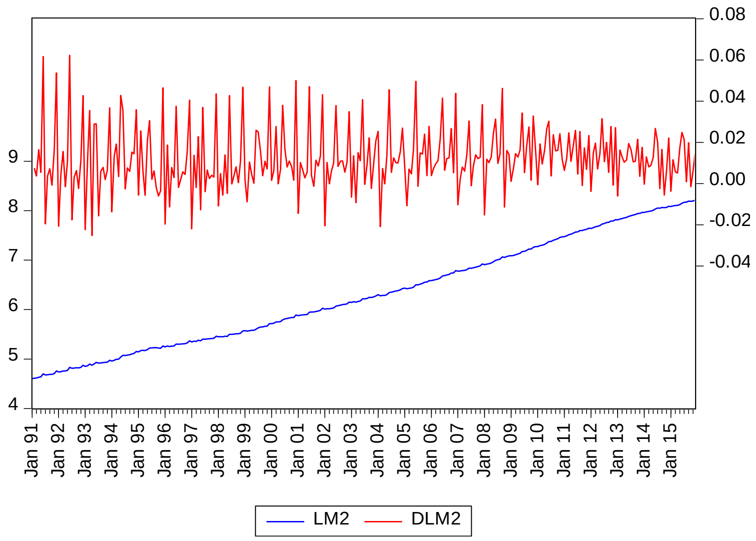
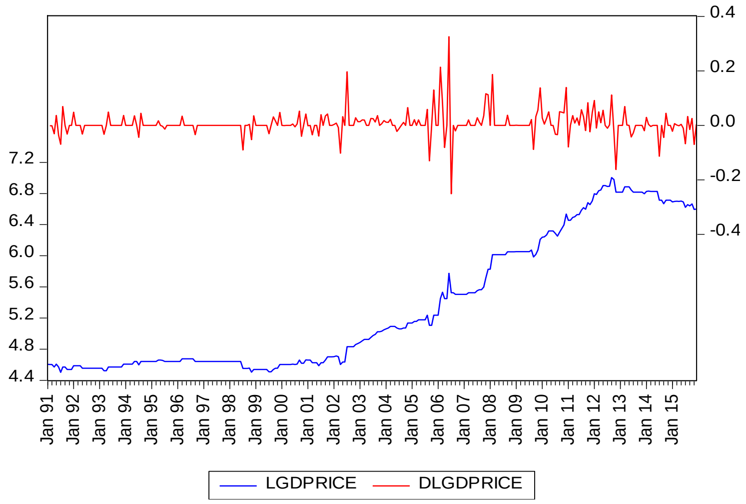


Figure 4.7. Graphs of Log Gold Price at Level and 1st Difference



In addition to the visual inspection of graphs and correlogram of the variables, ADF and KPSS unit root tests are carried out as per the procedure described in the methodology section to examine the stationarity and to determine the order of integration of the variables. If these two tests provide diverse results for any variable, then the PP unit root tests have been used for the final decision.

Before the unit root tests are applied, the stability of the VAR at level and at 1st difference for each variable are examined. Then the optimal lag lengths of each variable with exogenous variables trend and constant, and with constant only are determined. The summary of the results[4] are shown in Table 4.4, which shows that VAR is not stable with intercept only for LCPI, LM2 and LGDPRICE at level. So, unit root tests for those variables at level with intercept only are not carried out.

Table 4.4 Optimal Lag Lengths of the Research Variables

Variables	Data at Level		Data at 1st Difference	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept
LDSEGEN	2	2	1	1
LIPI	6	6	5	5
LINT	6	10	5	5
LCPI	10	VAR is Unstable	12	12
LEXR	1	1	0	0
LM2	13	VAR is Unstable	12	12
LGDPRICE	5	VAR is Unstable	4	4

Notes: LDSEGEN is Log of DSE General Index, LIPI is Log of Industrial Production Index, LINT is Log of Interest Rate, LCPI is Log of Consumer Price Index, LEXR is Log of Exchange Rate, LM2 is Log of Money Supply, and LGDPRICE is Log of Gold Price.

Table 4.5 shows the summary of ADF and KPSS unit root tests results[5]. Both ADF and KPSS tests reveal that all the series have unit root at level. So, we have concluded that the series are nonstationary at level. However, ADF test results show that except LM2 other series are stationary at first difference and LM2 is stationary at second difference. On the other hand, KPSS test results show that LCPI is stationary with trend and intercept but has unit roots with intercept at first difference, while LGDPRICE has unit root with trend and intercept but stationary with intercept at first difference. Nevertheless, both ADF and KPSS tests confirm that LCPI has significant trend and LGDPRICE has insignificant trend at first difference. So, we have accepted the KPSS test results with trend and intercept for LCPI and with intercept only for LDGPRICE and have concluded that both the series are stationary at first difference i.e. the series are *I(1)*. Now, both ADF and KPSS unit root tests confirm that except LM2 all variables are *I(1)*. On the other hand, ADF test results

[4] See Appendix B
[5] See Appendix C

indicate LM2 is *I(2)*, while KPSS test results show that the variable is *I(1)*.So, the diverse results are related to money supply (LM2) only.

Table 4.5 Results of Unit Root Tests

Variables	ADF Unit Roots Test		KPSS Unit Roots Test	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept
Panel A: Data at Level				
LDSEGEN	-2.263817	-1.262698	**0.716817***	
LIPI	-2.488473	0.044380	**0.704326***	
LINT	-2.483544	-2.827551	**0.412625***	
LCPI	-1.427023	VAR is Unstable	**0.644902***	
LEXR	-1.133125	-1.520495	**1.967746***	
LM2	-2.095373	VAR is Unstable	**0.533282***	
LGDPRICE	-1.794687	VAR is Unstable	**1.104973***	
Panel B: Data at First Difference				
LDSEGEN	**-10.92199***		0.065762	0.068174
LIPI	**-10.73396***		0.023075	0.069558
LINT	**-7.228364***		0.106635	0.173518
LCPI	**-3.659916***		0.065971	**0.781329***
LEXR	**-16.24530***		0.079713	0.266188
LM2	-2.557102	-2.409351	0.109546	0.109546
LGDPRICE	**-7.275343***		**0.209403***	0.410658
Panel C: Data at Second Difference				
LM2	**-9.670536***			

Notes: Critical values at 5% level for ADF test with trend and intercept is -3.424977and with intercept is -2.871029 and that for KPSS test at 5% level with trend and intercept is 0.146and with intercept is 0.463. * denotes that coefficient is significant at 5% level.

To resolve this, Phillips-Perron (PP) unit root tests have been applied on LM2. PP unit root test results (see Appendix C 3) indicate that LM2 has unit root at level (nonstationary) and stationary at first difference (Table 4.6), meaning that the series is *I(1)*.

Table 4.6 Results of Phillips-Perron Unit Root Tests for Money Supply

Variables	Data at Level		Data at 1st Difference	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept
LM2	-1.645240	VAR is Unstable	**-26.95416***	

Notes: Critical values at 5% level for PP test with trend and intercept is -3.424977and with intercept is -2.871029. * denotes that coefficient is significant at 5% level.

So, finally, we conclude that all the research variables have unit root at level and stationary at first difference, meaning that series are integrated of order 1, *I(1)*. Since the results of the unit root tests reveal that all the variables are *I(1)*, Johansen and Juselius (1990) Cointegration Approach has been applied to examine the long- and shot-run relationships.

4.4.3 Johansen and Juselius Cointegration Test Results

Apart from the unit root tests, the second pre-test for Johansen and Juselius (1990) Cointegration Approach (JJA) is to identify the most appropriate trend specification. The log-likelihood ratio test is used with the joint hypothesis of a unit root and deterministic linear trend for this purpose. In Table 4.7, we have reported the log-likelihood values of ADF unit root tests with a deterministic linear trend and with no deterministic trend (intercept only) in column 1 and column 2 respectively. Column 3 shows the log-likelihood ratio test statistics. This distribution follows Chi-square distribution and the critical value for one degree of freedom (as there is one restriction) is 3.841 at 5% significance level.

Table 4.7 Results of Log-Likelihood Ratio Test for Trend Specification

Variables	**Log-likelihood with joint hypothesis of a unit root**		Test Statistics
	with a deterministic trend	with no deterministic trend	
LDSEGEN (lag)	296.4765 (2)	294.6698 (2)	3.6134
LIPI (lag)	413.6999 (6)	410.4800 (6)	**6.4398***
LINT (lag)	1280.5650 (6)	1280.0490 (6)	1.0320
LCPI (lag)	971.2126 (10)	968.7989 (10)	**4.8274***
LEXR (lag)	967.5796 (1)	967.1976 (1)	0.7640
LM2 (lag)	972.6062 (13)	970.1265 (13)	**4.9594***
LGDPRICE (lag)	501.3234 (5)	499.2002 (5)	**4.2464***

Notes: This distribution follows Chi-square distribution and the critical value for one degree of freedom is 3.841 at 5% significance level.

The results show that the null hypothesis is rejected at 5% significance level for four variables (LIPI, LCPI, LM2 and LGDPRICE) at level. These results are also validated from our findings of ADF unit root tests (see Appendix C), where we have found that LIPI, LCP, LM2 and LGDPRICE have unit root with significant trend at level. Therefore, the cases 1, 2 and 3 of the cointegration models are highly unlikely, hence either model 4 or model 5 to be selected.

Now, the Pantula selection procedure has been applied to select the appropriate model for the cointegration test. For the purpose, the automatic lag length selection criteria are applied to select the preferred lag length. The lag order selection is based on different Information criteria. The result[6] shows that out of five selection criteria three have supported a lag length of 13, thus we have chosen 13 lags for the Johnsen and Juselius cointegration test.

The Trace and Max-Eigen statistics of the Johansen and Juselius cointegration test, for the two relevant models with lag length 13, have been reported in Table 4.8. R stands for the number of cointegrating vectors and the critical values for 5% significance level are in the parenthesis. Based on the Pantula selection procedure, the results of Table 4.8 indicate that Model 4 should be chosen because for this model the null hypothesis is rejected for the first time.

Table 4.8 Model Selection for Johansen and Juselius Cointegration Test

R	Trace Statistics		Max-Eigenvalue Statistics	
	Model 4	Model 5	Model 4	Model 5
0	193.8972* (150.5585)	188.3363* (139.2753)	54.19770* (50.59985)	53.97990* (49.58633)
1	139.6995* (117.7082)	134.3564* (107.3466)	38.39335 (44.49720)	38.22570 (43.41977)
2	101.3062* (88.80380)	96.13066* (79.34145)	34.91457 (38.33101)	34.39270 (37.16359)
3	66.39163* (63.87610)	61.73797* (55.24578)	24.02712 (32.11832)	23.02712 (30.81507)
4	42.36451 (42.91525)	38.71084* (35.01090)	18.38763 (25.82321)	16.71088 (24.25202)
5	23.97688 (25.87211)	21.99997* (18.39771)	16.35119 (19.38704)	16.29900 (17.14769)
6	7.625683 (12.51798)	5.700968* (3.841466)	7.625683 (12.51798)	5.700968* (3.841466)

The above-mentioned test results have indicated that the model 4 is the most appropriate model for the cointegration test. So, we have applied lag 13 and model 4 in Johansen and

[6] See Appendix D

Juselius Cointegration Approach. The summary of the Johansen and Juselius test result[7] is reported in Table 4.9. The test results show that the trace test rejects the null hypothesis of R ≤ 3 in favor of R = 4, and the Max-Eigenvalue test rejects the null of R ≤ 0 in favor of R = 1 at 5% significance level.

Table 4.9 Results of Johansen and Juselius Cointegration Test

Hypothesized Number of CE(s)	**Unrestricted Cointegration Rank Test (Trace)**			**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**		
	Trace Statistic	Critical Value at 5% Significance	Probability	Max-Eigen Statistics	Critical Value at 5% Significance	Probability
None	**193.8972***	150.5585	0.0000	**54.19770***	50.59985	0.0203
At most 1	**139.6995***	117.7082	0.0010	38.39335	44.49720	0.1981
At most 2	**101.3062***	88.80380	0.0047	34.91457	38.33101	0.1173
At most 3	**66.39163***	63.87610	0.0303	24.02712	32.11832	0.3468
At most 4	42.36451	42.91525	0.0567	18.38763	25.82321	0.3482
At most 5	23.97688	25.87211	0.0845	16.35119	19.38704	0.1308
At most 6	7.625683	12.5198	0.2838	7.625683	12.51798	0.2838

Notes: Trace test indicates 4 cointegrating equations and Max-eigenvalue test indicates 1 cointegrating equation at 5% level.

Gregory (1994) has shown through Monte Carlo simulation that although both tests exhibit size distortion but the maximum eigenvalue performs better, because it uses only one eigenvalue, whereas the trace test uses all the eigenvalues. Patterson (2000) has also mentioned that the maximum eigenvalue performs better. Considering these, we have accepted the test result of maximum eigenvalue and have concluded that there is one cointegration vector.

The long-run equation (Table 4.10), normalized on stock prices, shows that except interest rate (LINT), other variables contributing to the long-term relationship at 5% significance level based on *t*-statistics. The long-run equation also shows that the industrial production (LIPI), interest rate (LINT) and gold price (LGDPRICE) have positive coefficients

[7]See Appendix E

indicating a positive relation, whereas the consumer price index (LCPI), exchange rate (LEXR) and money supply (LM2) indicate negative relationship with stock prices. Also, the trend is significant at the 5% level, meaning that the trend has rightly included.

Table 4.10 Long-run Coefficients Normalized on Stock Market index

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@Trend (91M02)
1	**-4.0425***	-5.9958	**5.2392***	**6.9933***	**5.3292***	**-1.7386***	**-0.0797***
	(1.33278)	(3.99603)	(1.54830)	(0.90389)	(1.66524)	(0.32970)	(0.01499)
	[-3.0332]	[-1.5004]	[3.3838]	[7.7369]	[3.2003]	[-5.273]	[-5.319]

Notes: (value) gives standard error and [value] is relevant t-value. Asterisk denotes coefficient significance at 5% level.

To check the robustness of the results, we have also reexamined whether macroeconomic variables are significant components in the cointegrating equation using likelihood ratio test. The test is done by putting restrictions sequentially on each of the independent cointegrating coefficients. The null hypothesis of the test is that the coefficient is equal to zero. The *p*-value of the χ^2 distribution determines whether the null is rejected or not. The summary of the rest results (see Appendix E 2) is reported in Table 4.11. The results show that except interest rate, other macroeconomic variables have entered significantly in the cointegrating equation. So, both the *t*-statistics and the likelihood ratio test have provided the same results indicating the robustness of the results.

Table 4.11 Significance of Long-run Cointegrating Coefficients with LR Test

Restriction on	χ^2 Statistics	*p*-value
LIPI	**4.110282***	0.042623
LINT	1.291469	0.255777
LCPI	**6.333333***	0.011849
LEXR	**14.22177***	0.000162
LM2	**4.918124***	0.026576
LGDPRICE	**11.17695***	0.000828

Notes: Asterisk denotes the coefficient is significance at 5% level.

The cointegration equation shows that the relation between the DSE General Index and the industrial production index is positive and significant. This is what we have hypothesized. There are many evidences that stock prices are significantly positively related to the level of economic activity proxies by the industrial production index. Our finding is same as the findings of Mukherjee and Naka (1995) for Japan, Adrangi et al. (1999) for both South Korea and Mexico, and Humpe and Macmillan (2007) for both US and Japan. Fama (1981) has explained that the stock market makes rational forecasts of the real sector. Chen et al. (1986) have argued that the positive relation reflects the value of insuring against real systematic production risk. Besides, Maysami and Koh (2000) have pointed that the changes in productive activity, through their impact on expected dividends, should influence stock market returns.

Our finding shows that the DSE General Index is positively related to interest rate, which is contrary to our hypothesis. Although the relationship is not statistically significant. Theoretically, high interest rates on deposit lead investors to invest less in risky stocks and, consequently, lower stock prices are expected. But our converse result is not uncommon in the literature. Many Studies (Mukherjee and Naka, 1995; Maysami and Koh, 2000; Bulmash and Trivoli, 1991) have found a positive relationship between the short-term interest rates and stock market prices, and a negative relationship between long-term interest rates and stock prices.

In this study, the weighted average interest rate offered by commercial banks on three to six months fixed or term deposits has been used to represent the interest rate. So, this is a representation of short-term interest rate. The relationship between interest rate and stock prices in this study is, therefore, consistent with the results of the short-term interest rates. One possible explanation of this positive relation is that if the short-term interest rate is increased now, it means that it will fall in the near future. So, when investors find that the short-term interest rates have increased, they buy more stocks now with an expectation that falling interest rate in future would increase the stock prices. It is worth mentioning that our finding on relationship between interest rate and stock market index is similar to the finding of Khan and Yousuf (2013) on Bangladesh. They have used data from January 1992 to June 2011 and have found a positive relationship at 10% significance level (weakly significant) between stock market and short-term deposit interest rate.

The long-run cointegrating equation indicates that the relationship between inflation and stock prices is negative and significant. Earliest inference on positive relation between inflation and stock market is based on hypothesis presented by Irving Fisher (1930). On the other hand, Fama (1981) has proposed the proxy hypothesis which has illustrated that the negative relationship between inflation and stock prices are induced by the positive correlation between stock returns and real activity and the negative correlation between inflation and real activity.

Our result is in line with proxy hypothesis. Our finding of negative relationship between inflation and stock prices is consistent with the findings of Chan et al. (1985), Chen et al. (1986), Mukherjee and Naka (1995), and Mohammad et al. (2009). The study of Khan and Yousuf (2013) has also found negative relationship between stock market and consumer price index in their study on Bangladesh.

The results have indicated that exchange rate and the stock market index are significantly negatively related, which is contrary to our hypothesized relationship. Theoretically, it is expected that increasing exchange rate (depreciation of BDT against the U.S. Dollar) should attract foreign investment in the DSE stocks, hence there should be increase in stock prices. However, Ibrahim and Aziz (2003) have found a negative association between stock returns and the exchange rate for Malaysia. They have argued that currency depreciation encourages exports; conversely, it increases costs of production through increasing domestic prices of imported raw materials and capital goods. They have pointed that Malaysian economy is highly dependent on international trade, so the negative channel is prominent in Malaysia and showing this negative relationship.

Perhaps, this has happened in Bangladesh; depreciation of Bangladeshi currency (BDT) has resulted in increased imported raw materials cost leading to higher cost of production. Consequently, this has exerted a negative impact on expected cash flows from the stocks, hence lowers stock prices. This result is also similar to the finding of Khan and Yousuf (2013) on Bangladesh.

The relationship between money supply and stock price is negative and significant at 5% level. This is contrary to our hypothesized relationship. However, this finding is consistent with the findings of Ibrahim and Aziz (2003), Humpe and Macmillan (2007), Mohammad et al. (2009), and Singh et al. (2011). They have explained this negative relationship arguing that the expansionary effect of money supply on real economic activities may have created a positive relation between the stock market and money supply (Mukherjee and Naka, 1995); however, if the increase in money supply creates inflation as well as contributes to inflationary uncertainty, this may exert a negative influence on the stock prices. We think that our finding indicates the dominance of the negative channel.

But our finding on relationship between money supply and stock prices is opposite to the finding of Khan and Yousuf (2013) on Bangladesh. The probable reason for this may be Khan and Yousuf (2013) have considered data from January 1992 to June 2011, but we have considered data from January 1991 to December 2015 and during these two periods the trend of these two variables (DSE general index and money supply) are different. It is evident from Figure 4.8 that both DSE general index and money supply have increasing trend from January 1992 to June 2011; except during the falling market of 1996 which is from November 1996 to December 1999. Conversely, from July 2011 to December 2015 the money supply has sharp increasing trend but the DSE general index has decreasing trend, because of the catastrophe of 2010 (see figure 4.9). This prolonged opposite trend may have caused the negative relationship between money supply and stock market index in this study.

Figure 4.8. Log of DSE General Index and Money Supply (Jan 92 - June 11)

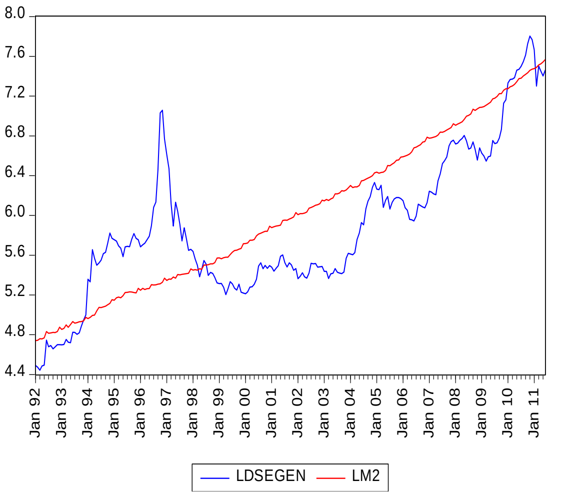
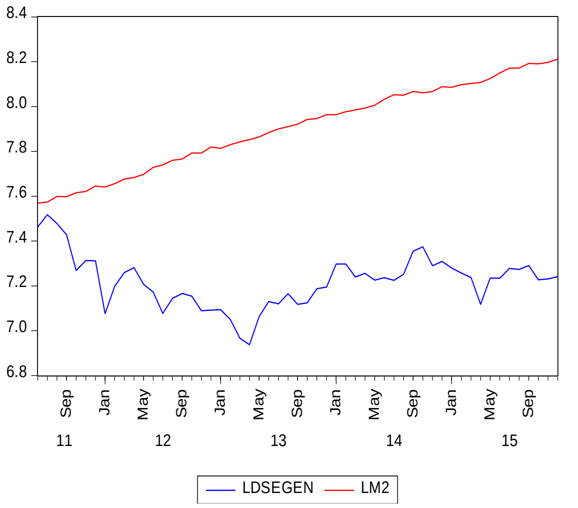
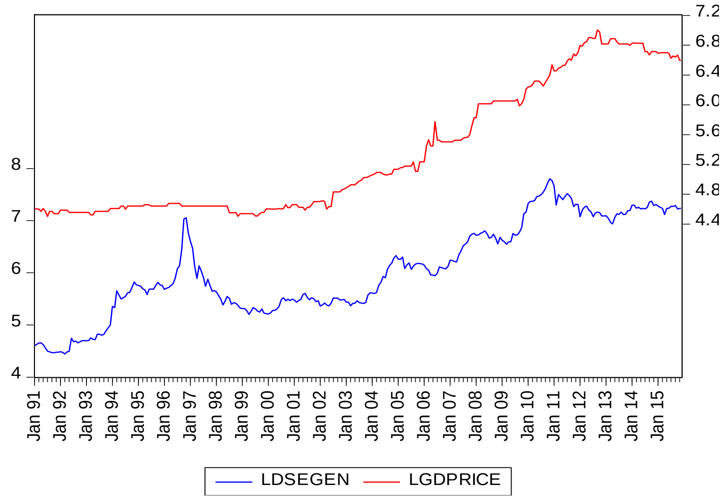


Figure 4.9. Log of DSE General Index and Money Supply (July 11 - Dec 15)



This study has found positive relationship between gold price and stock price at 5% significance level. This is contrary to our hypothesized relationship. Generally, gold is considered as an alternative to stock market investment, so should have a negative relationship. However, Mamipour and Jezeie (2015) have found a long-run direct relation between the stock price and the gold price in Iran. They have argued that this unexpected result may be due to the fact that the gold price in Iran is generally affected by world gold prices. Also, Ahmed and Imam (2007) have examined the impact of gold price on the stock market return along with other macroeconomic variables of Bangladesh by employing Johansen cointegration analysis and Vector Error Correction (VEC) model. Their findings have indicated a significant positive long-run relationship between gold price and stock market. One possible explanation of positive relationship between stock market and gold price is that gold price in Bangladesh mostly depends on international gold price. Furthermore, during our study period, the gold price has gone up due to the international factors, which is stated in an article of the Global Times[8] - "the price of gold in the country has gone up along with that in the international market[9]". At the same time, during this period stock market has also gone up (see figure 4.10) showing a positive relationship.

Figure 4.10 Graphs of DSE General Index and Gold Price



4.4.3.1 Results of Vector Error Correction Model

The Vector Error Correction Model (VECM) provides valuable information about the short-run relationship between variables, while a negative and significant error correction term signifies the speed of adjustment to the long-run equilibrium. The principle behind this model is that there often exists a long-run equilibrium relationship among variables, but in the short-run there may be disequilibrium.

The cointegration results have indicated that the variables tend to move together in the long-run. To further investigate the relationship, the VECM along with Ordinary Least Squares has been used. The summary of the results (see Appendix E 3) is reported in Table

[8] The Daily Chinese Newspaper http://www.globaltimes.cn/
[9] http://www.globaltimes.cn/content/753288.shtml

4.12. The Error Correction Term (ECT) is negative and significant at 5% level indicating that there exists a long-run equilibrium relationship between the stock market and the macroeconomic variables and the speed of convergence to equilibrium is about 15.30 percent. It confirms the long-run equilibrium relationship. The ECT value indicates that equilibrium agents remove a sizeable percentage of disequilibrium per month.

The R^2 value indicates that about 30 percent of the stock market return can be explained by the growth of selected macroeconomic variables along with the trend. The remaining 70 percent is explained by other factors, which have not been considered in this study. The Durbin Watson Statistic indicates the presence of non-autocorrelated residuals. We have also examined the short-run relationships between the stock market return and selected macroeconomic variables.

Table 4.12 Summary of Vector Error Correction Model Results

VECM Equation	D(DSEGEN) = C1*(LDSEGEN(-1) - 4.0425*LIPI(-1) - 5.9958*LINT(-1) + 5.2392*LCPI(-1) + 6.9933*LEXR(-1) + 5.3292*LM2(-1) - 1.7386*LGDPRICE(-1) - 0.0797*@Trend (91M01) – 58.4802)		
Variables	**Coefficient**	**t Statistics**	**Probability**
ECT (C1)	-0.153014	-3.618433	0.0004
R-Squared	0.299886		
F-statistic	0.898582		
Probability (F Stat)	0.715895		
Durbin-Watson stat	2.017233		

We have used the Wald Statistics to examine the significance of the short-run relationships running from different lag values of the growth of independent variables (macroeconomic variables) to dependent variable (stock market returns). The test statistics follow χ^2 distribution, so we have used Chi-square critical values. The summary of the short-run relationships (see Appendix E 3.2) is shown in Table 4.13. The results indicate that none of the macroeconomic variables up to 13 lags can jointly explain the stock market return at 5 percent significance level (as *p*-values are more than 0.05). So, we have concluded that there is no short-run relationship running from lag values of growth of macroeconomic variables to the stock market return.

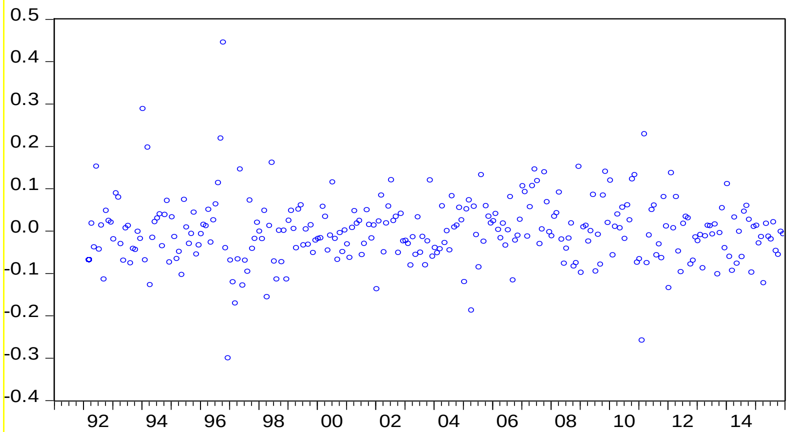
Table 4.13 Significance of Short-run Coefficients

Independent Variables	Null Hypothesis	χ^2 Statistics	p-value
DLIPI	C(15) = C(16) = C(17) = C(18) = C(19) = C(20) = C(21) = C(22) = C(23) =C(24) = C(25) = C(26) = C(27) = 0	9.396882	0.7424
DLINT	C(28) = C(29) = C(30) = C(31) = C(32) = C(33) = C(34) = C(35) = C(36) = C(37) = C(38) = C(39) = C(40) = 0	4.423925	0.9858
DLCPI	C(41) = C(42) = C(43) = C(44) = C(45) = C(46) = C(47) = C(48) = C(49) = C(50) = C(51) = C(52) = C(53) = 0	17.87379	0.1624
DLEXR	C(54) = C(55) = C(56) = C(57) = C(58) = C(59) = C(60) = C(61) = C(62) = C(63) = C(64) = C(65) = C(66) = 0	8.884263	0.7816
DLM2	C(67)= C(68) = C(69) = C(70) = C(71) = C(72) = C(73) = C(74) = C(75) = C(76) = C(77) = C(78) = C(79) = 0	13.83173	0.3858
DLGDPRICE	C(80) = C(81) = C(82) = C(83) = C(84) = C(85) = C(86) = C(87) = C(88) = C(89) = C(90) = C(91) = C(92) = 0	6.631300	0.9201

4.4.3.2 Viability and Stability Check of the Model

For a good regression model, the residuals of the VECM should be homoscedastic, not serially correlated and normally distributed. So, the tests of residuals for normality, autocorrelation, and heteroscedasticity are carried out to examine the viability of the model and the significance of the results. Firstly, we have plotted the residuals (see figure 4.11) to have a visual check of the homoscedasticity of the residuals. The graph indicates that the residuals seem to be homoscedastic.

Figure 4.11 Plot of Residuals



The correlogram of the residuals[10] is also estimated up to 36 lags. The Ljung-Box Q statistics are used to investigate the presence of autocorrelations. The high *p*-values for different lags indicate that residuals are not serially correlated. Therefore, we conclude that residuals are independent. To check the robustness of the findings, we have applied diagnostic tests of the residuals, such as Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic to further examine the serial correlation, homoscedasticity and normality of the residuals respectively.

The results of these diagnostic tests (see Appendix F) show that the residuals are not serially correlated and have no heteroskedasticity. But the Jarque-Bera statistic and its associated *p*-value indicate that the residuals are not normally distributed, which is a weakness of the model. However, it has been suggested by scholars that non-normality in the residual may not be a serious problem as the estimators are still consistent (Adeniji, 2015). Further, we have checked the stationarity of the residuals using ADF, PP and KPSS unit root tests. The summary of the test results is presented in Table 4.14. All the unit root tests have supported that the residuals are stationary at level indicating that the model is a good fit model. Therefore, we can conclude that the results are significant.

Table 4.14 Results of Unit Root Tests of Residuals at Level

ADF Test		PP Test		KPSS Test	
Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept
-16.98990*	**-17.01519***	**-16.99079***	**-17.01617***	0.089860	0.085402

Notes: Critical values at 5% level for ADF and PP test with trend and intercept is -3.424977and with intercept is -2.871029, that for KPSS test with trend and intercept is 0.146and with intercept is 0.463. * denotes that coefficient is significance at 5% level.

Finally, we have applied Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests developed by Brown et al. (1975) to check the stability of the parameters of the equation. The results of both CUSUM and CUSUMSQ tests (Figure 4.12

[10]See Appendix F

and 4.13) have indicated that the slope parameters (coefficients) and conditional variances of the parameters depicted by residuals are stable.

Figure 4.12 Cumulative Sum Control Chart of JJA

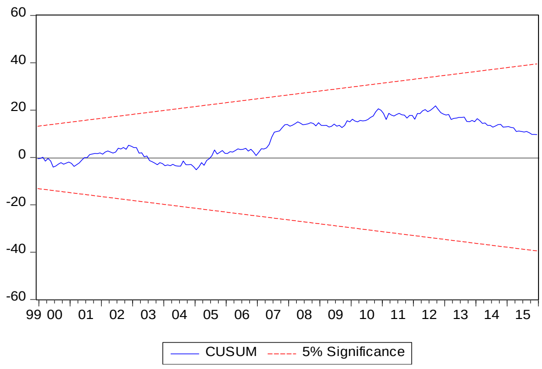
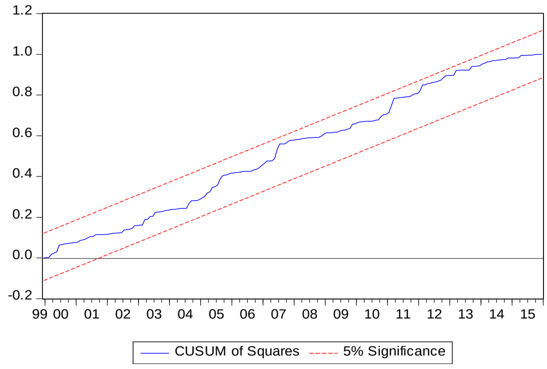


Figure 4.13 Cumulative Sum of Squares Control Chart of JJA



4.4.4 Granger Causality Results

As the variables are cointegrated, the Vector Error Correction (VEC) Granger-Causality test to be applied to examine whether the stock market return Granger-cause the growth of macroeconomic variables or vice versa. Since monthly data have been used in this research and one year is long enough for an efficient market to incorporate the effect of the news related to any change in a variable to other variables, we have used 12 lags in this test. Table 4.14 shows the summary of the results[11] of Granger causality test. The results reveal that stock market return can Granger-cause growth of two macroeconomic variables only, industrial production index and exchange rate, but opposite is not true. This implies that the performance of stock market is a good indicator to explain the future growth of both industrial production index and exchange rate. This result is consistent with the theory that stock market is used as a leading indicator of these two macroeconomic variables. But out of six macroeconomic variables, stock market return can Granger-cause only two macroeconomic variables. Therefore, we can conclude that stock market in Bangladesh is not a leading indicator for most of the macroeconomic factors.

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[11] See Appendix G

Table 4.15 Results of Granger Causality Test

Null Hypothesis	χ^2 Statistics	Probability
D(LIPI) does not Granger Cause D(LDSEGEN) **D(LDSEGEN) Does not Granger Cause D(LIPI)**	8.324574 **33.57122***	0.7593 0.0008
D(LINT) does not Granger Cause D(LDSEGEN) D(LDSEGEN) Does not Granger Cause D(LINT)	4.883428 17.24099	0.9618 0.1408
D(LCPI) does not Granger Cause D(LDSEGEN) D(LDSEGEN) Does not Granger Cause D(LCPI)	11.36160 12.33650	0.4982 0.4190
D(LEXR) does not Granger Cause D(LDSEGEN) **D(LDSEGEN) Does not Granger Cause D(LEXR)**	4.698369 **26.43632***	0.9673 0.0093
D(LM2) does not Granger Cause D(LDSEGEN) D(LDSEGEN) Does not Granger Cause D(LM2)	12.67572 13.93450	0.3930 0.3049
D(LGDPRICE) does not Granger Cause D(LDSEGEN) D(LDSEGEN) Does not Granger Cause D(LGDPRICE)	6.075535 4.725250	0.9122 0.9665

Notes: * denotes that coefficient is significant at 5% level.

4.4.5 Autoregressive Distributed Lags Test Results

We have used the ARDL Bounds testing procedure to check the robustness of the results of Johansen cointegration test. The results of Johansen Cointegration Approach have indicated that interest rate is insignificant in the long-run equation, so we have excluded interest rate from the ARDL test. Furthermore, we have found from section 4.4.2 and 4.4.3 that all the variables are *I(1)* and some of the variables have trend component respectively. So, we have applied the ARDL model with restricted trend.

First, we have estimated the lag specification of the dependent and the independent variables using AIC and SIC values. We have started with 12 lags for both dependent and independent variables. Then, we have estimated the AIC and SIC values for different combinations of lag values for dependent and independent variables. We have chosen the optimum lag length based on the lowest values of the AIC and SIC. Table 4.16 shows the AIC and SIC values for different lag specifications of the dependent and independent variables. From the results, we have found that the optimum lags for dependent and independent variables are 12 and 5 respectively.

Table 4.16 Lag Length Selection for ARDL Test

Lag Length		AIC Value	SIC Value
Dependent Variable	Independent Variables		
12	12	-1.730665	-0.725895
12	11	-1.748346	-0.807169
12	9	-1.782735	-0.968744
12	7	-1.811641	-1.124836
12	5	-1.860648	-1.301029
11	5	-1.752056	-0.825934

Now, we have applied ARDL test with above lags and restricted trend specification. The summary of the Pesaran Bounds Test with ARDL specification[12] is reported in Table 4.17.

Table 4.17 ARDL Specification and Bounds Test Results

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (12, 5, 5, 5, 5, 5)		
F Statistics	**3.729042**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.50	4.63
R-squared	0.212278	
Adjusted R-squared	0.073458	
F-statistic	1.529157	
Prob (F-statistic)	0.025220	
Durbin-Watson stat	1.968276	

The Bounds test result indicates that there exists a long-run relationship between stock market index and selected macroeconomic indices at 10 percent significance level. We have also examined the long-run relationships (see Appendix H 3) and the summary of the results is reported in Table 4.18. The long-run equation has indicated that except money supply other variables are significant at 5 percent level and trend is also significant. In

[12] See Appendix H

addition, industrial production and gold price have positive relation with stock market index, while inflation, exchange rate and money supply have negative relation with the stock market index. Except the significance of money supply (LM2) our ARDL results are similar to that of Johansen cointegration test.

Table 4.18 Long-Run Coefficients of ARDL Test

Independent Variables	Coefficient	Std. Error	*t*-Statistics	Probability
LIPI	2.805986	1.328399	2.112307	0.0357
LCPI	-5.331708	1.644792	-3.241570	0.0014
LEXR	-3.817657	1.419371	-2.689682	0.0076
LM2	-2.314113	2.009226	-1.151743	0.2506
LGDPRICE	1.433363	0.370913	3.864420	0.0001
@TREND	0.043799	0.017795	2.461358	0.0145

Although there exists a long-run equilibrium relationship between the variables, there could be a disequilibrium in the short-run. But the cointegration does not unfold these short-run relationships and the adjustment process to bring about equilibrium in the long-run. To examine the short-term relationships and this adjustment process, ECM has been applied. The size of the error-correction term in ECM indicates the speed of adjustment of the dependent variable to bring about the long-run equilibrium and it is also indicative of the intensity of the arbitrage activities to bring about equilibrium in the long-run.

4.4.5.1 Results of Error Correction Model

The summary of the results of Error Correction Model (ECM) i.e. the short-run relationships is reported in Table 4.19. The ECM results indicate that the error correction coefficient is -0.1262 (*p*-value 0.0000), which is highly significant and has the correct sign. This implies a moderate speed of adjustment to the equilibrium after a shock. Approximately 12.62% of disequilibria is removed per month. Finally, the *t*-statistics and *p*-value of the coefficients of the Δ (i.e. differenced) variables indicate whether the effects of the macroeconomic variables on stock index are significant or not in the short-run.

Table 4.19 Short-run Coefficients in ARDL Test

Variable	Coefficient	Std. Error	*t*-Statistics	*p*-value
D(LIPI)	-0.072473	0.102480	-0.707194	0.4801
D(LIPI(-1))	-0.269431	0.118456	-2.274533	0.0238
D(LIPI(-2))	-0.133302	0.109053	-1.222362	0.2228
D(LIPI(-3))	-0.207961	0.106198	-1.958240	0.0513
D(LIPI(-4))	-0.111237	0.100216	-1.109970	0.2681
D(LCPI)	-0.697106	0.652557	-1.068268	0.2865
D(LCPI(-1))	0.248424	0.659353	0.376769	0.7067
D(LCPI(-2))	0.962871	0.660809	1.457110	0.1464
D(LCPI(-3))	0.613004	0.659660	0.929272	0.3537
D(LCPI(-4))	1.415530	0.653387	2.166449	0.0312
D(LEXR)	0.029960	0.598264	0.050078	0.9601
D(LEXR(-1))	0.151044	0.606214	0.249159	0.8034
D(LEXR(-2))	0.431284	0.605819	0.711903	0.4772
D(LEXR(-3))	0.873915	0.604339	1.446067	0.1494
D(LEXR(-4))	-0.360146	0.596683	-0.603580	0.5467
D(LM2)	0.862471	0.454845	1.896188	0.0591
D(LM2(-1))	-0.252556	0.479456	-0.526756	0.5988
D(LM2(-2))	-0.595640	0.476573	-1.249839	0.2126
D(LM2(-3))	0.401219	0.484289	0.828471	0.4082
D(LM2(-4))	-0.339919	0.447149	-0.760191	0.4479
D(LGDPRICE)	0.042509	0.124678	0.340948	0.7334
D(LGDPRICE(-1))	-0.044104	0.126195	-0.349489	0.7270
D(LGDPRICE(-2))	-0.238801	0.122632	-1.947300	0.0526
D(LGDPRICE(-3))	-0.077468	0.123348	-0.628043	0.5306
D(LGDPRICE(-4))	-0.075939	0.123909	-0.612860	0.5405
C	4.818334	0.928736	5.188057	0.0000
D(LIPI)	-0.072473	0.102480	-0.707194	0.4801
CointEq(-1)	-0.126236	0.024410	-5.171574	0.0000

As the independent variables have multiple lags, so we have used the Wald Statistics to examine whether the lagged values of the growth of independent variables can jointly explain the stock market return significantly. The test statistics follow the χ^2 distribution, so we have used Chi-square critical values. The summary of the Wald Test results (see Appendix H 4) is shown in Table 4.20. The results show that none of the macroeconomic variables with their optimal lag values can jointly explain the shock market return in the short-run at 5% significance level, meaning that there is no short-run relationship between stock market and macroeconomic variables.

Table 4.20 Significance of Short-run Coefficients

Independent Variables	Null Hypothesis	χ^2 Statistics	p-value
LIPI	C(12) = C(13) = C(14) = C(15) = C(16) = 0	4.084552	0.5373
LCPI	C(17) = C(18) = C(19) = C(20) = C(21) = 0	10.61084	0.0597
LEXR	C(22) = C(23) = C(24) = C(25) = C(26) = 0	2.858767	0.7217
LM2	C(27) = C(28) = C(29) = C(30) = C(31) = 0	9.679108	0.0849
LGDPRICE	C(32) = C(33) = C(34) = C(35) = C(36) = 0	3.341163	0.6475

4.4.5.2 Viability and Stability Check of the Model

Like Johansen cointegration test, the tests of residual for normality, autocorrelation, and heteroscedasticity are carried out to examine the significance of the results of the ARDL test. The correlogram of the residuals[13] is estimated up to 36 lags. The Ljung-Box Q statistics is used to investigate whether there is autocorrelation or not. The high *p*-value indicates that there is no serial correlation. Therefore, we conclude that residuals are independent (stationary).

In addition to the correlogram of the residuals to investigate the robustness of the results related to viability of the model, we have used Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic to examine the serial correlation, homoscedasticity and normality of the residuals respectively. The results (see Appendix I) indicate that the residuals are not serially correlated and homoskedastic, but the distribution of the residuals is not normal. However, practically it is hard to find a model with completely white noise residuals. So, the non-normal distribution of the residuals does not significantly distort the viability of the model as the residuals are

[13]See Appendix I

stationery, homoskedastic and not autocorrelated. Furthermore, we have applied CUSUM and CUSUMSQ tests to check the stability of the regression parameters, developed by Brown, Durbin and Evans (1975). The results of CUSUM and CUSUMSQ tests (Figure 4.14 and 4.15) have indicated that the slope parameter (coefficients) are stable, however, there is an instability in conditional variance depicted by residuals.

Figure 4.14 Cumulative Sum Control Chart of ARDL Approach

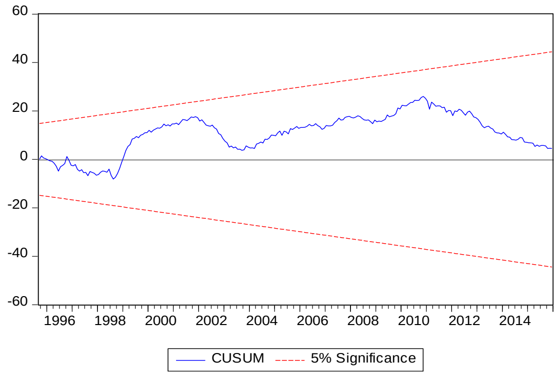
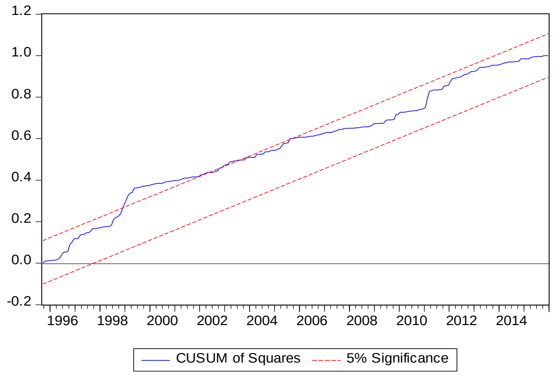


Figure 4.15 Cumulative Sum Squared Chart of ARDL Approach



4.5 Conclusion

In this chapter, the long- and short-term relationship between Dhaka Stock Exchange General Index (DSEGEN) and macroeconomic indices of Bangladesh has been investigated using Johansen and Juselius methodology of multivariate cointegration analysis and Vector Error Correction Model. Moreover, the ARDL cointegration test has been applied to check the robustness of the results of the Johansen and Juselius cointegration approach. The macroeconomic indices selected for this study are industrial production index, interest rate, consumer price index, exchange rate, money supply and gold price.

The Johansen and Juselius cointegration approach have revealed that there exists a long-run equilibrium relationship between the stock market index and the macroeconomic variables. The results have also indicated that except interest rate other macroeconomic variables have entered the long-run cointegrating equation significantly at 5% significance level. Although for some macroeconomic variables, the direction of long-run relationships between the stock market index and the macroeconomic variables are found opposite to the hypothesized relationships.

The industrial production index is positively related with the stock market, which is as expected. But the interest rate is positively related with the stock market index, which is unexpected as higher interest rates, theoretically, shift investors away from stock market. But this relationship is statistically insignificant in explaining the stock market. However, this positive relation is not uncommon in the literature. The exchange rate is negatively related with the stock market index, meaning that the depreciation of Bangladeshi currency might have increased the cost of imported raw materials and capital goods for the firms resulting lower stock prices. The consumer price index is found negatively related with stock market, which is consistent with the proxy hypothesis. The money supply is found negatively related with the stock prices, which has indicated that the increase in money supply has created inflation as well as inflationary uncertainty, which in turn has exerted a negative influence on the stock prices. The positive long-run relation between the stock market index and the gold price reveals that gold has not been considered as an alternative investment in Bangladesh and gold price in Bangladesh mostly depends on international gold price.

The VECM results have shown that none of the macroeconomic variables up to 13 lags can jointly explain the stock market return, meaning that there is a disequilibrium in the short-run between the stock market return and growth of macroeconomic variables. The significant error correction term has revealed that about 15.30 percent of the disequilibrium in the short-run is adjusted per month to bring about equilibrium in the long-run.

The results of Granger Causality have indicated that the stock market return has Granger-caused growth of two macroeconomic variables, industrial production and exchange rate, but the opposite is not true, meaning that there exist unidirectional casual relationships running from stock market return to the growth of these two macroeconomic variables. On the other hand, there is no causal relationship between stock market return and growth of other macroeconomic variables. The unidirectional causal relationships running from stock market return to the growth of only two macroeconomic variables imply that the stock market is not a leading indicator for most of the macroeconomic variables.

Residual diagnostic tests of the Johansen and Juselius model have showed that the model is a good fit model, hence the findings are reliable. The plots of CUSUM and CUSUMSQ are drawn to check the stability of the parameters of the cointegration equation. Both the CUSUM and CUSUMSQ plots are within the critical bounds indicating that the coefficients are structurally stable throughout the total sample period.

In addition, the ARDL cointegration test has been applied to examine the robustness of the findings of the Johannsen and Juselius cointegration approach. Since interest rate is found insignificant in the Johansen and Juselius long-run cointegration equation, it has been excluded in the ARDL cointegration test. The results of ARDL approach have also indicated that there exists a significant long-run equilibrium relationship between the stock market index and the macroeconomic variables. Although in the ARDL test money supply is found insignificant in the long-run equation, this variable has entered in the long-run equation significantly in Johansen test.

The error correction models of the two cointegration approaches have confirmed that the lagged values of the growth of macroeconomic variables are not significant in explaining the stock market return in the short-run. Furthermore, the error correction term is found negative and statistically significant in both tests. The coefficient of the error correction term in ARDL model suggests that adjustment process is moderate and about 12.62 percent of the disequilibrium in market index is corrected per month to bring about long-run equilibrium, which is 15.30 percent in Johansen test with an additional regressor, interest rate. So, the findings of ARDL model have confirmed the robustness of the results of the Johansen test. However, both the tests have indicated that only a small percentage of the stock market return can be explained by the selected macroeconomic variables indicating that there are other factors to be considered to increase the explanatory power of the independent variables to explain the stock market return of Bangladesh.

Residual diagnostic tests of the ARDL model have showed that the model is a good fit model and the findings are reliable. The plot of CUSUM is within the critical bounds of 5 percent indicating that the parameters are stable. However, the plot of CUSUMSQ indicates that there is an instability in conditional variance depict by residuals. This finding has indicated a structure instability in conditional variance around the catastrophe of 1996, which is not found in Johansen and Juselius approach.

However, Caporale and Pittis (2004) have mentioned that CUSUM and CUSUMSQ tests perform better in the context of a dynamic model of the ARDL type, which is not affected by serial correlation or nonpredetermined regressors even if over-specified. In this context, we have accepted the result of ARDL approach in relation to the structural instability in the conditional variance around 1996 and further investigations related to this issue have been carried out in the following chapters.

Chapter 5

Relationships During Bubble, Meltdown and Recovery Periods

5.1 Introduction

A bubble is a well-known empirical phenomenon in stock markets, but there is no consensus about the mechanisms behind it. Besides, a bubble is followed by a crash. As the impact of a large stock market crash is considerable on households, banks and finally on overall economy, bubbles and crashes are of profound importance to risk management in investment. Bangladesh stock market has experienced two major bubbles within a decade and a half, one in 1996 and other in 2010. However, our investigations in chapter 4 have revealed that only the catastrophe of 1996 has created a structural instability in the stock market. This has motivated us to examine the relationships between the stock market and the macroeconomic variables around the catastrophe of 1996 - that is during the bubble and meltdown period of 1996. These investigations have helped us describing the relationships during the crisis times. In addition, this study has also aimed to identify the factors responsible for creating the bubble and bubble crash of 1996.

On the other hand, after the catastrophe of 1996, the Capital Market Development Program (CMDP) was undertaken through a strong partnership between the government of Bangladesh and the Asian Development Bank, which became effective on 27 January 1998. The CMDP aimed to broaden market capacity and develop a fair, transparent, and efficient domestic capital market to attract larger amounts of investment capital to augment the capital resources provided through the banking system. The key agenda of the CMDP in achieving this objective was to restore investor confidence, which was significantly damaged when the Bangladesh stock market crashed in 1996 because of excessive speculations, allegedly aggravated by widespread irregular activities. Also, to fulfill the dream of transforming DSE into modern world class exchange, the stock market started its journey of automation on 10 August 1998 and yet is striving for continuous upgradation of its trading platform. As a result, the market capitalization of Dhaka Stock Exchange (DSE) to GDP has increased from 0.94% in June 1991 to about 30.95% in June 2009 (Wahab and Faruq, 2012).

In this backdrop, the scope of this study has been extended further to cover a period in between the two catastrophes of Dhaka Stock Exchange. This period has been named as the recovery period as the aforesaid reform measures for the development of the stock market as well as the automation initiatives to build up a state-of-the-art market surveillance system to increase the transparency of market transactions are supposed to enhance the investors' confidence and improve the efficiency of the stock market. In this context, it is expected that during the recovery period the stock market prices should more precisely reflect the risk generated by the underlying macroeconomic indices.

The relationships between the stock market index and the macroeconomic indices in the bubble, meltdown and recovery periods have been assessed separately to compare the influences of the priced factors across different conditions of the stock market. The remaining discussions of the chapter are presented in six sections. In section 5.2, we have outlined the empirical methods to be used in the analysis. The descriptive statistics of the research variables have been portrayed in section 5.3. In section 5.4, we have summarized the results of different unit root tests to determine the stationarity and order of integration of the variables. In section 5.5, we have reported the results of cointegration tests along with the interpretation of the long-term relationships. Also, the results of Error Correction

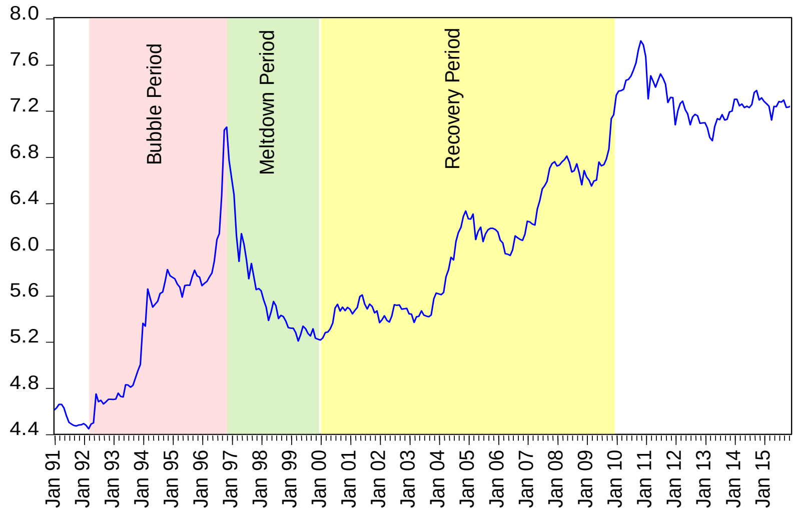
Model (ECM), the short-term relationships, the viability check of the models along with the stability tests of the parameters for different periods have been described in this section. Finally, conclusions are drawn in section 5.6.

5.2 Empirical Methods

The empirical investigations of this chapter have been made based on the econometric models outlined in the previous chapter. More specifically, the econometric models for unit root tests to check the order of integration of the variables, the Johansen and Juselius, and ARDL cointegration approaches to examine the long- and short-run relationships and the error correction model to investigate the short-run dynamics and significance of error correction term, which have been described in chapter 4, are used in this chapter.

To examine the relationships between the stock market index and the macroeconomic indices in different periods, we have precisely pointed out the periods of bubble starting and crashing of 1996 as well as the recovery period. From the aforesaid information and the visual inspection of the stock index graph (see Figure 5.1), we have considered the data from March 1992 to November 1996 as bubble period, from November 1996 to December 1999 as meltdown period and from January 2000 to December 2009 as recovery period.

Figure 5.1 Graph of Log DSE General Index with Demarcation of Different Periods



The Augmented Dickey-Fuller (ADF) and the Phillips and Perron (PP) unit root tests have been applied to check the stationarity and order of integration of the variables, as per the methodologies described in chapter 4. Whenever, these two tests have given diverse results for a variable, then we have used Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit root test for conclusion. Later, based on the order of integrations of the variables, cointegration test has been selected for the investigations. If all variables are integrated of order 1, *I(1)*, both the Johansen and ARDL approaches have been applied. But if there is a mix of *I(1)* and *I(0)*, only ARDL approach has been used. However, If a variable is integrated of order 2, *I(2)*, then that variable has been excluded from the cointegration analysis, as the ARDL test crashes in presence of *I(2)* variable.

5.3 Descriptive Statistics of the Variables

Table 5.1 has provided the descriptive statistics of the research variables for the bubble, meltdown and recovery periods. The statistics of Panel A are for the data at level, and that of Panel B are for data at first differences. As the variables are converted into natural logarithm, so the first difference of a variable represents the growth of that variable. Several points can be noted from the descriptive statistics of Panel B.

Firstly, the stock market has provided approximately 4.5% mean monthly return in the bubble period, and during that period the mean monthly growth of industrial production, interest rate, consumer price index, exchange rate, money supply and gold price are approximately 0.50%, -0.10%, 0.30%, 0.20%, 1.0% and 0.10% respectively. The results reveal that except interest rate other six variables have positive mean monthly growth, meaning that during the period these variables have increased, however, interest rate has decreased during the period. Notably, the mean monthly return from the stock market is very high compared to the other variables.

Table 5.1 Descriptive Statistics of the Research Variables in Different Periods

Description	Bubble Period (March 1992 to November1996)							Meltdown Period (November 1996 to December 1999)							Recovery Period (January 2000 to December 2009)						
	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE
Panel A: Data at Level																					
Observations	57	57	57	57	57	57	57	38	38	38	38	38	38	38	120	120	120	120	120	120	120
Mean	5.385	4.890	0.073	4.732	4.719	5.058	4.613	5.645	5.114	0.085	4.923	4.865	5.494	4.595	5.988	5.546	0.070	5.247	5.155	6.452	5.239
Median	5.584	4.882	0.070	4.732	4.718	5.076	4.643	5.477	5.121	0.086	4.916	4.860	5.482	4.643	6.058	5.526	0.070	5.221	5.142	6.426	5.121
Maximum	7.057	5.111	0.108	4.814	4.775	5.328	4.677	7.057	5.309	0.095	5.027	4.958	5.715	4.643	7.164	5.933	0.090	5.597	5.299	7.274	6.212
Minimum	4.443	4.577	0.056	4.646	4.691	4.759	4.522	5.205	4.881	0.074	4.812	4.775	5.328	4.504	5.212	5.107	0.050	5.011	4.958	5.716	4.586
Std. Dev.	0.607	0.148	0.015	0.050	0.024	0.179	0.045	0.462	0.094	0.006	0.069	0.054	0.105	0.053	0.526	0.229	0.011	0.183	0.101	0.444	0.509
Skewness	0.415	-0.214	0.933	0.154	0.696	-0.082	-0.313	1.473	-0.274	-0.213	-0.130	-0.149	0.300	-0.320	0.289	0.065	0.009	0.349	-0.284	0.135	0.385
Kurtosis	3.041	1.888	2.843	1.790	2.876	1.586	1.777	4.495	2.992	1.606	1.614	1.909	2.020	1.342	1.757	1.758	1.928	1.781	1.744	1.826	1.844
Jarque-Bera	1.642	3.373	8.325	3.701	4.640	4.817	4.484	17.266	0.477	3.364	3.148	2.025	2.092	5.001	9.390	7.796	5.748	9.861	9.508	7.258	9.644
Probability	0.440	0.185	0.016	0.157	0.098	0.090	0.106	0.000	0.788	0.186	0.207	0.363	0.351	0.082	0.009	0.020	0.056	0.007	0.009	0.027	0.008
Panel B: Data at 1st Difference																					
Mean	0.045	0.005	-0.001	0.003	0.002	0.010	0.001	-0.048	0.0091	0.0004	0.006	0.005	0.011	-0.001	0.016	0.005	0.000	0.005	0.003	0.013	0.013
Median	0.017	0.012	0.000	0.002	0.000	0.006	0.000	-0.040	0.0221	0.0001	0.006	0.0000	0.006	0.000	0.014	0.006	0.000	0.003	0.000	0.011	0.000
Maximum	0.570	0.244	0.003	0.033	0.019	0.062	0.049	0.240	0.150	0.010	0.020	0.030	0.047	0.047	0.264	0.137	0.007	0.041	0.057	0.050	0.325
Minimum	-0.086	-0.118	-0.009	-0.024	-0.004	-0.025	-0.044	-0.351	-0.197	-0.005	-0.032	0.000	-0.022	-0.090	-0.222	-0.158	-0.007	-0.014	-0.035	-0.021	-0.251
Std. Dev.	0.118	0.069	0.002	0.013	0.004	0.018	0.016	0.111	0.082	0.003	0.009	0.008	0.017	0.021	0.066	0.064	0.002	0.008	0.011	0.015	0.059
Skewness	2.375	0.442	-1.642	0.201	2.970	0.501	0.497	-0.271	-0.442	1.380	-2.172	1.726	0.713	-1.948	0.208	-0.151	0.230	0.809	2.555	0.559	1.248
Kurtosis	9.565	3.886	6.368	2.566	12.000	3.030	6.430	4.089	2.838	6.790	11.305	5.081	2.837	11.055	4.950	2.589	5.301	5.838	15.797	3.480	13.553
Jarque-Bera	155.97	3.716	52.54	0.831	276.1	2.387	30.290	2.345	1.279	34.78	139.08	25.720	3.2620	126.77	19.885	1.297	27.532	53.358	949.35	7.404	588.02
Probability	0.000	0.156	0.000	0.660	0.000	0.303	0.000	0.310	0.528	0.000	0.000	0.0000	0.1957	0.000	0.000	0.523	0.000	0.000	0.000	0.025	0.000

Notes: LDSEGEN is Log of DSE General Index, LIPI is Log of Industrial Production Index (IPI), LINT is Log of Interest Rate, LCPI is Log of Consumer Price Index (CPI), LEXR is Log of Exchange Rate (BDT per USD), LM2 is Log of Broad Money Supply (M2) and LGDPRICE is Log of Gold Price.

Secondly, during the meltdown period the stock market has provided very high negative mean return (monthly -4.8%), whereas during that period mean monthly growth of industrial production, interest rate, consumer price index, exchange rate, money supply and gold price are approximately 0.91%, 0.04%, 0.60%, 0.50%, 1.1% and -0.10% respectively. The results indicate that except gold price, other macroeconomic variables have positive mean monthly growth and these monthly growth rates are higher compared to that of the bubble period. Gold price has decreased during the period.

Thirdly, during the recovery period, the mean monthly return from stock market is 1.6% and except interest rate other macroeconomic variables show positive mean monthly growth rate. During this period mean monthly growth of industrial production, interest rate, consumer price index, exchange rate, money supply and gold price are approximately 0.50%, 0.0%, 0.50%, 0.30%, 1.30% and 1.30% respectively.

Fourthly, the standard deviations of monthly stock market return for the both bubble and meltdown periods are 11.8% and 11.1% respectively, indicating that the stock market has showed very high volatility during these periods. During the recovery period, the standard deviation of stock market return is 6.6%. On the other hand, the standard deviations of the selected macroeconomic variables are almost steady across the three periods.

Finally, for the level data, the Jarque-Bera statistics and the associated *p*-values have confirmed that except interest rate, the distributions of other six research variables are normal during the bubble period. During meltdown period, except DSE general index, the distributions of the six macroeconomic variables are normal. On the other hand, in the recovery period, only the distribution of interest rate is normal. For the first differences, which indicate the growth of the variables, three macroeconomic factors - namely industrial production, consumer price index and money supply, are normally distributed in the bubble period. In meltdown period stock market return and the growth of both industrial production and money supply are normally distributed. On the other hand, in the recovery period, only the growth of industrial production is normally distributed.

Table 5.2. Cross Correlations of the Research Variables at Level in Different Periods

	LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE
Panel A: Bubble Period (March 1992 to November1996)							
LDSEGEN	1						
LIPI	0.792408	1					
LINT	-0.679890	-0.769154	1				
LCPI	0.847163	0.789564	-0.549380	1			
LEXR	0.906854	0.730759	-0.531510	0.835114	1		
LM2	0.918397	0.918270	-0.750782	0.916811	0.882823	1	
LGDPRICE	0.829522	0.832504	-0.715493	0.834571	0.805667	0.901250	1
Panel B: Meltdown Period (November 1996 to December 1999)							
LDSEGEN	1						
LIPI	-0.490437	1					
LINT	-0.824683	0.321995	1				
LCPI	-0.871275	0.536405	0.827569	1			
LEXR	-0.895355	0.536072	0.814644	0.983922	1		
LM2	-0.822522	0.577986	0.735452	0.964552	0.969537	1	
LGDPRICE	0.650660	-0.353859	-0.777308	-0.855747	-0.808034	-0.794401	1
Panel C: Recovery Period (January 2000 to December 2009)							
LDSEGEN	1.0000						
LIPI	0.9171	1.0000					
LINT	-0.3240	-0.3561	1.0000				
LCPI	0.9551	0.9633	-0.2930	1.0000			
LEXR	0.8713	0.9334	-0.4795	0.9196	1.0000		
LM2	0.9417	0.9704	-0.3535	0.9917	0.9453	1.0000	
LGDPRICE	0.9265	0.9540	-0.2777	0.9836	0.9057	0.9802	1.0000

Notes: LDSEGEN is Log of DSE General Index, LIPI is Log of Industrial Production Index (IPI), LINT is Log of Interest Rate, LCPI is Log of Consumer Price Index, LEXR is Log of Exchange Rate, LM2 is Log of Money Supply (M2), and LGDPRICE is Log of Gold Price.

Table 5.2 provides the correlation coefficients amongst the research variables at level in different periods. The correlation figures of bubble period (Panel A) show that except interest rate, DSE General Index has very high positive correlations with other macroeconomic variables. Interest rate has high negative correlation with DSE index. On the other hand, except interest rate other macroeconomic variables are strongly positively correlated with each other, interest rate is negatively correlated with other macro variables.

The correlations in the meltdown period (Panel B) indicate that except gold price other macro variables are negatively correlated with stock index. Gold price is positively correlated with stock index. Also, gold price is negatively correlated with other macroeconomic variables, while the remaining macro variables are positively correlated with each other.

Cross correlations for the recovery period (Panel C) show that except interest rate other macroeconomic variables are positively correlated with the stock market index and interest rate is negatively correlated with the stock market index. Except interest rate other macroeconomic variables are positively correlated with each other. However, interest rate is negatively correlated with other macro variables.

5.4 Unit Root Tests Results

Unit root tests are applied as per the procedure described in chapter 4. Before applying unit root tests, the stability of the VAR of each variable under two conditions - with exogenous variables trend and intercept, and with intercept are checked. If VAR is found stable with any exogenous variable, then the optimal lag length of the variable for that condition is determined using lag selection criterion. The summary of the optimal lag lengths[14] is reported in Table 5.3. These lag lengths are used in unit root tests for different periods. The summary of the ADF and PP unit root tests[15] for are reported in Table 5.4.

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[14] See Appendix J

[15] See Appendix K

Table 5.3 Optimal Lag Lengths of the Research Variables in Different Periods

Variables	Bubble Period				Meltdown Period				Recovery Period			
	Level		1st Difference		Level		1st Difference		Level		1st Difference	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept
LDSEGEN	4	VAR is unstable	0	2	2	3	2	2	10	VAR is unstable	9	9
LIPI	1	5	4	4	2	1	3	3	12	12	11	11
LINT	1	1	0	1	2	2	1	1	9	9	8	8
LCPI	4	1	0	0	2	1	0	0	10	VAR is unstable	13	13
LEXR	1	VAR is unstable	0	0	1	3	2	2	10	10	9	9
LM2	3	3	8	8	1	VAR is unstable	3	3	13	VAR is unstable	12	12
LGDPRICE	1	3	2	2	1	1	0	0	5	VAR is unstable	6	6

Bubble Period: ADF test indicates that LDSEGEN, LINT, LCPI, LEXR and LGDPRICE are integrated of order one, *I(1)*, while LIPI is stationary at level, *I(0)* and LM2 is integrated of order two, *I(2).* On the other hand, PP test shows that LDSEGEN, LCPI, LEXR, LM2 and LGDPRICE are integrated of order 1, *I(1)*, while LIPI is stationary at level, *I(0)* and LINT is nonstationary with trend and constant but stationary with constant at level. In addition, PP test shows that LINT series has significant trend, so we accept the result with trend and conclude that LINT is *I(1).* Therefore, only for LM2 the results of two tests are different. Thus, the KPSS test is applied to check the order of integration of LM2. The KPSS test results (see Appendix K 1.3) indicate that LM2 is *I(1)*. So, we can conclude that the research variables are either *I(1)* or *I(0)*.

Meltdown Period: ADF and PP tests show that LDSEGEN and LIPI are stationary at level, *I(0)*, while LINT, LCPI, LEXR, LM2 and LGDPRICE are integrated of order 1, *I(1).* So, the research variables in the meltdown period are either *I(0)* or *I(1).*

Table 5.4 Results of Unit Root Tests in Different Periods

Variables	Bubble Period				Meltdown Period				Recovery period			
	ADF Test		PP Test		ADF Test		PP Test		ADF Test		PP Test	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept
Panel A: Data at Level												
LDSEGEN	-2.053	VAR is unstable	-1.298	VAR is unstable	-2.093	**-3.386***	-2.647	**-5.271***	-2.444	VAR is unstable	-2.248	VAR is unstable
LIPI	**-4.264***		**-4.495***		**-3.760***		**-3.594***		-1.594	0.736	**-6.954***	
LINT	-0.241	-2.772	-0.194	**-3.014***	-0.107	-2.772	-0.998	-1.764	-1.610	-1.591	-1.080	-1.433
LCPI	-3.361	-0.930	-2.696	-0.917	-2.857	-0.464	-2.457	-0.419	-2.935	VAR is unstable	-2.875	VAR is unstable
LEXR	-1.057	VAR is unstable	-1.108	VAR is unstable	-3.021	0.036	-3.355	0.059	-1.664	-1.587	-1499	-1.766
LM2	-1.643	-0.778	-3.000	-0.850	-1.865	VAR is unstable	-2.877	VAR is unstable	-0.727	VAR is unstable	-2.458	VAR is unstable
LGDPRICE	-2.830	-0.913	-3.058	-1.064	-1.272	-1.262	-1.410	-1.342	-2.783	VAR is unstable	-3.063	VAR is unstable
Panel B: Data at 1st Difference												
LDSEGEN	**-6.626***		**-6.626***						-3.053	**-2.986***	**-10.13***	
LIPI									**-7.480***		**-9.514***	
LINT	**-7.238***				**-5.019***		**-8.331***		-2.376	-2.493	**-6.848***	
LCPI	**7.061***		**-7.061***		**-5.391***		**-5.391***		-2.730	-1.517	**-6.224***	
LEXR	**-7.589***		**-7.589***		**-4.160***		**-7.472***		-2.744	-2.471	**-11.36***	
LM2	-2.191	-2.141	**-12.03***		**-4.782***		**-9.564***		-2.251	-1.851	**-21.35***	
LGDPRICE	**-5.080***		**-8.680***		**-6.178***		**-6.178***		**-4.703**		**-13.18***	
Panel C: Data at 2nd Difference												
LM2	**-3.954***								**-12.04***			
LINT									**-7.000***			
LCPI									**-8.971***			
LEXR									**-6.787***			

Notes: Critical values at 5% level for ADF test with trend and intercept is -3.424977and with intercept is -2.871029. Critical values at 5% level for KPSS with trend and intercept is 0.146and with intercept is 0.463. * denotes that coefficient is significant at 5%.

Recovery Period: ADF test indicates that LINT, LCPI, LEXR and LM2 are *I(2)*, while LGDPRICE, LIPI, and LGDPRICE are *I(1)*. Conversely, PP test reveals that LIPI is *I(0)* and other six variables are *I(1)*. So, we have checked whether LINT, LCPI, LEXR and LM2 are *I(1)* or *I(2)* using KPSS test. The results of the KPSS test (see Appendix K 3.3) indicate that these four series are *I(1).* So, we can conclude that the series are either *I(0)* or *I(1)*.

5.5 Cointegration Analysis for Different Periods

Like unit root test, the test for trend specification of each variable is another pre-test for cointegration analysis. To identify the most appropriate trend specification, log-likelihood ratio test for the joint hypothesis of a unit root and deterministic linear trend is used. The summary of the results of log-likelihood test is reported in Table 5.5.

Table 5.5 Results of LR Test for Trend Specification in Different Periods

Variable	Bubble Period			Meltdown Period			Recovery Period		
	Log-likelihood with joint hypothesis of a unit root and			Log-likelihood with joint hypothesis of a unit root and			Log-likelihood with joint hypothesis of a unit root and		
	with a deterministic linear trend	with no deterministic linear trend	Test Statistics	with a deterministic linear trend	with no deterministic linear trend	Test Statistics	with a deterministic linear trend	with no deterministic linear trend	Test Statistics
LDSEGEN	43.740	42.634	2.212	38.850	38.430	0.840	173.745	170.153	**7.184***
LIPI	81.346	74.234	**14.224***	50.435	46.584	**7.702***	212.278	210.694	3.168
LINT	275.703	273.366	**4.674***	174.294	174.140	0.308	591.291	591.149	0.284
LCPI	171.564	168.697	**5.734***	131.651	127.561	**8.180***	439.505	431.737	**15.536***
LEXR	234.429	233.256	2.346	133.640	129.040	**9.200***	389.000	388.069	1.862
LM2	155.094	153.747	2.694	106.058	104.002	**4.112***	413.069	412.707	0.724
LGDPRICE	161.281	157.909	**6.744***	94.579	94.265	0.628	182.423	177.915	**9.016***

Notes: This distribution follows Chi-square distribution and the critical value for one degree of freedom is 3.841 at 5% significance level.

The test follows Chi-squared distribution and the critical value for one degree of freedom (as there is one restriction) is 3.841 at 5% level of significance. The results show that for some of the variables in different periods the null hypothesis of “no deterministic trend” are rejected at 5% significance level, indicating that those variables have deterministic trend.

5.5.1 Cointegration Results for the Bubble Period

The results of the unit root tests indicate that in the bubble period the variables are either *I(0)* or *I(1)*. So, the ARDL model is applied to examine the long- and short-run cointegration relationships between the stock market index and macroeconomic indices. For this, we need to select the optimal lag lengths for both the dependent variable (LDSEGEN) and the regressors (LIPI, LINT, LCPI, LEXR, LM2 and LGDPRICE). From Table 5.3, we have found that at level the dependent variable LDSEGEN has 4 lags, and among the regressors, LINT has the highest 5 lags. So, we have set maximum lags for the dependent variable and the regressors at 4 and 5 respectively and then the automatic lag selection option is applied to allow the software to select the optimal lag length for each variable within the set limits.

Later, we need to select the trend specification for the model. Table 5.5 shows that during the bubble period LIPI, LINT, LCPI and LGDPRICE have significant trend. So, in ARDL test we have included trend in the cointegration equation. The results of ARDL specification along with the Pesaran Bounds Test[16] are summarized in Table 5.6. The Bounds test results indicate that null hypothesis of "no long-run relationship exists" is rejected and the alternative hypothesis "there exists long-run relationship" is accepted at 5% significance level, meaning that there exists a long-run relationship between stock market index (dependent variable) and six macroeconomic indices (independent variables) in the bubble period.

[16] See Appendix L

The Bounds test results have showed that R^2 is 0.5268, which indicates that about 52.68 percent of the variations in stock prices can be explained by the changes in macroeconomic indices along with the trend. The remaining 47.33 percent is explained by other factors, which have not been considered in this research. The F value is significant at 5% level, meaning that the regression coefficients are significant. The Durbin Watson statistic confirms the presence of non-autocorrelated residuals.

Table 5.6 ARDL Specification and Bounds Test Results for the Bubble Period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (1, 4, 0, 2, 5, 0, 0)		
F Statistics	**3.963162**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.5	4.63
R-squared	0.526781	
Adjusted R-squared	0.283777	
F-statistic	2.370647	
Prob (F-statistic)	0.013704	
Durbin-Watson stat	2.131741	

As there exists a cointegration relationship between the stock market and the macroeconomic variables, so we have examined the cointegrating form and long-run relationship (see Appendix L 1.3). The summary of the results is shown in Table 5.7. The results show that LIPI, LCPI, LEXR and LM2 are positively related with stock market index and LINT and LGDPRICE are negatively related with the stock market index. However, only LEXR is significant at 5% significance level and LIPI and LGDPRICE are significant at 10% significant level. Alongside, the pairwise graphs of each variable with the stock market index are shown in Figure 5.2 to Figure 5.7 show that there is a long-run co-movement of each macroeconomic variable with the stock market index.

Table 5.7 Cointegrating Form and Long-Run Coefficients in the Bubble Period

Independent Variables	Coefficient	Std. Error	*t*-Statistics	Probability
Cointegrating Form				
D(LIPI)	0.184394	0.231365	0.796981	0.4305
D(LIPI(-1))	-1.151429	0.267043	-4.311767	0.0001
D(LIPI(-2))	-0.316018	0.262300	-1.204795	0.2359
D(LIPI(-3))	-0.709270	0.252067	-2.813819	0.0078
D(LINT)	-2.913802	6.406871	-0.454793	0.6519
D(LCPI)	2.415683	1.173452	2.058613	0.0466
D(LCPI(-1))	-2.144393	1.244572	-1.722996	0.0932
D(LEXR)	6.513466	3.424108	1.902237	0.0649
D(LEXR(-1))	-9.215305	4.191567	-2.198534	0.0342
D(LEXR(-2))	-12.194122	3.948725	-3.088117	0.0038
D(LEXR(-3))	-4.275752	3.386559	-1.262565	0.2146
D(LEXR(-4))	-12.286713	3.347147	-3.670802	0.0008
D(LM2)	0.998090	0.791166	1.261543	0.2150
D(LGDPRICE)	-2.443402	0.951549	-2.567815	0.0144
C	-88.160887	14.494429	-6.082398	0.0000
CointEq(-1)	-0.260639	0.042842	-6.083670	0.0000
Cointeq = LDSEGEN - (4.7009*LIPI - 9.0076*LINT + 4.4548*LCPI + 69.5462 *LEXR + 2.2446*LM2 - 7.4229*LGDPRICE - 0.1122*@TREND)				
Long Run Coefficients				
LIPI	**4.701****	2.572	1.828	0.076
LINT	-9.008	7.023	-1.283	0.208
LCPI	4.455	3.656	1.219	0.231
LEXR	**69.546***	19.347	3.595	0.001
LM2	2.245	4.105	0.547	0.588
LGDPRICE	**-7.423****	3.705	-2.004	0.053
@TREND	**-0.112****	0.057	-1.965	0.057

Notes: * and ** denote the significance of the coefficient at 5% and 10% level respectively.

Figure 5.2 Graphs of Market Index and Industrial Production for Bubble Period

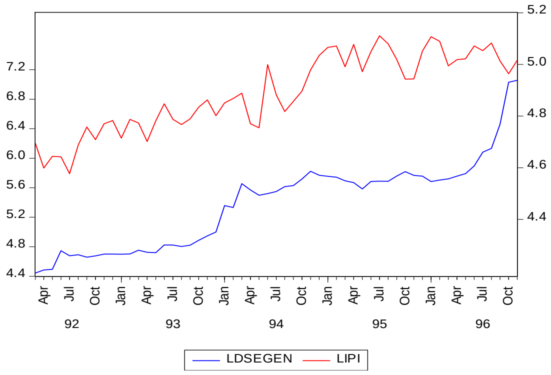


Figure 5.3 Graphs of Market Index and Interest Rate for Bubble Period

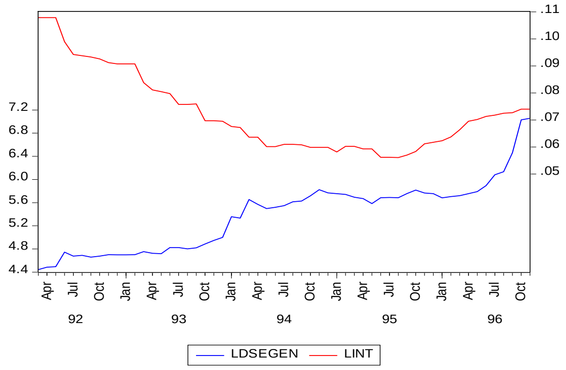


Figure 5.4 Graphs of Market Index and Consumer Price Index for Bubble Period

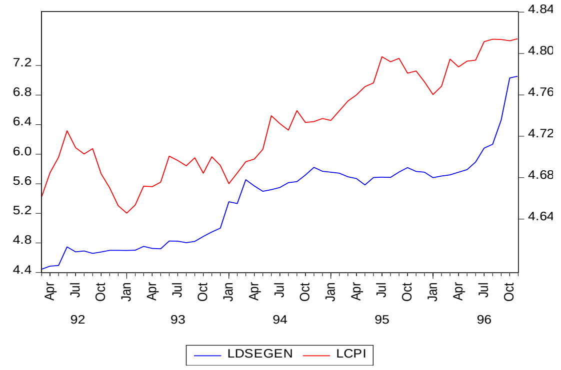


Figure 5.5 Graphs of Market Index and Exchange Rate for Bubble Period

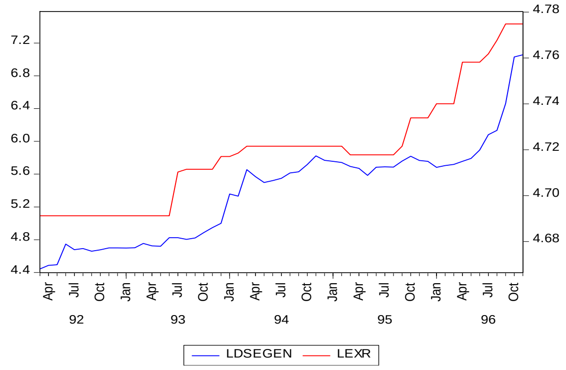


Figure 5.6 Graphs of Market Index and Money Supply for Bubble Period

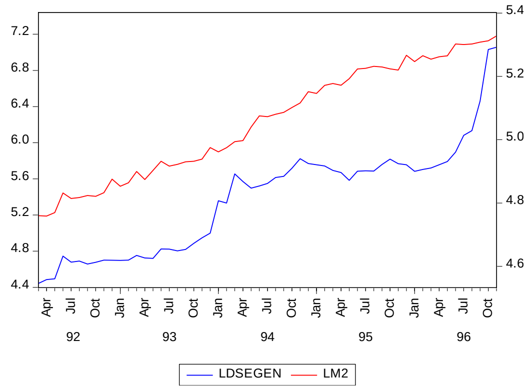
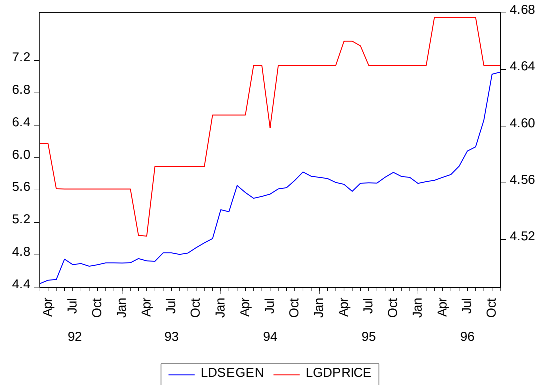


Figure 5.7 Graphs of Market Index and Gold Price for Bubble Period



During the bubble period, the long-run equation shows that the exchange rate is significantly positively related with the stock market index at 5 percent significance level. Also, the coefficient of exchange rate is significantly large compared to the coefficients of other macroeconomic variables indicating the dominance of exchange rate on stock prices. Moreover, the positive relation between stock market index and exchange rate specifies that the depreciation of Bangladeshi currency (BDT) with respect the US dollar may have attracted more foreign investment in the stock market, which has created higher demand for stock and thus the stock prices have increased.

Further investigations have revealed that during the bubble period, Bangladeshi currency (BDT) has depreciated by 8.93 percent and foreign investment in Bangladesh stock market has increased significantly (see Table 5.8). Also, the interest rate has decreased during the period, which has created a positive impact on stock prices. So, we can conclude that the exchange rate has played a key role in the bubble creation and the falling interest rate has further intensified it. This is an important finding of this research.

Table 5.8 Foreign Investment in Bangladesh Stock Market (July 92 – June 96)

Period	Purchase of Shares in Million BDT	Sale of Shares in Million BDT	Net Investment in Million BDT
April 92 – June 92	50.80	-	50.80
July 92 – June 93	387.50	81.20	306.30
July 93 – June 94	3101.80	965.10	2136.70
July 94 – June 95	2982.70	133.42	2849.28
July 95 – June 96	716.80	1877.10	-1160.30

Source: Bangladesh Securities and Exchange Commission (BSEC) Annual Report 2005 - 2006

The existence of the cointegration relationship indicates that there exists a long-run equilibrium relationship between the stock market index and the macroeconomic indices. However, there could be a short-run disequilibrium which may be adjusted by the error correction mechanism to bring the system back to the long-run equilibrium, but the cointegration does not unfold this short-run adjustment process. To understand the short-run relationships, we need to examine the error-correction process of the model. In the error correction model, the size of the coefficient of the error-correction term indicates the speed of adjustment of the disequilibrium in the dependent variable due to a shock to bring about long-run equilibrium. It is also indicative of the intensity of the arbitrage activities to bring the system back to equilibrium in the long-run.

5.5.1.1 Results of Error Correction Model

The short-run relationships between the macroeconomic variables and the stock market index are presented in Table 5.9. The error correction term (ECT) is -0.2606 and the corresponding *p*-value is 0.0 (see Table 5.7), which indicate that ECT is highly significant and has the correct sign. This ECT confirms a moderate speed of adjustment to equilibrium after a shock and indicates that approximately 26.06 percent of the disequilibria from the long-run equilibrium path is corrected per month. Finally, the *t*-statistics and the corresponding *p*-value of the coefficients of the 1st differences of the independent variables indicate whether these variables can significantly explain the stock market return in the short-run.

Table 5.9 Estimated Short-run Coefficients Using ARDL Approach in Bubble Period

Variable	Coefficient	Std. Error	*t*-Statistics	*p*-value
D(LIPI)	0.288372	0.313918	0.918620	0.3642
D(LIPI(-1))	-0.908279	0.461527	-1.967987	0.0566
D(LIPI(-2))	-0.403653	0.398482	-1.012978	0.3176
D(LIPI(-3))	-0.764019	0.323497	-2.361751	0.0236
D(LCPI)	2.300926	1.460061	1.575911	0.1236
D(LCPI(-1))	-1.758072	1.506494	-1.166996	0.2507
D(LEXR)	4.947807	4.593005	1.077248	0.2883
D(LEXR(-1))	-8.278757	4.763788	-1.737852	0.0906
D(LEXR(-2))	-12.34567	4.258267	-2.899224	0.0063
D(LEXR(-3))	-5.640530	3.873974	-1.456006	0.1538
D(LEXR(-4))	-13.41595	3.771929	-3.556789	0.0010
C	-81.00451	24.39265	-3.320858	0.0020
@TREND	-0.018506	0.017228	-1.074205	0.2897

Notes: * denote that coefficient is significant at 5%.

From Table 5.9, we have found that among the independent variables industrial production has 4 lags, interest rate has zero lag, inflation has 2 lags, exchange rate has 5 lags, and both money supply and gold price have zero lag. If an independent variable has zero lag, it indicates that the variable does not have relation with the dependent variable in the short-run. When a variable has one lag, then the significance of the variable in explaining the stock market return in short-run is determined by *t*-statistic and corresponding *p*-value. Whereas, if a variable has multiple lags, we have used the Wald Statistics to examine whether the coefficients of the lagged terms of that variable can jointly explain the stock market return.

The test statistics follow χ^2 distribution, so we have used Chi-squared critical value. Table 5.9 shows that LIPI, LCPI and LEXR have multiple lags, so the Wald Test has been used to check the significance of the variables in explaining stock market return. The summary of the Wald Test results (see Appendix L 1.4) is shown in Table 5.10. The results show that only exchange rate can explain the stock market return in the short-run. So, the results indicate that only exchange rate has both significant long- and shot-run relationships with stock market return.

Table 5.10 Significance of Short-run Coefficients in Bubble Period

Independent Variables	Null Hypothesis	χ^2 Statistics	p-value
LIPI	C(1) = C(2) = C(3) = C(4) = 0	6.872732	0.1428
LCPI	C(5) = C(6) = 0	2.883884	0.0895
LEXR	C(7) = C(8) = C(9) = C(10) = C(11) = 0	**18.02663**	**0.0029**

5.5.1.2 Viability and Stability Check of the Model

To check the viability of the model, we have used Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic to examine the serial correlation, homoscedasticity and normality of the residuals respectively. The results[17] indicate that the residuals are not serially correlated and homoscedastic, but the distribution of the residuals is not normal. However, practically it is hard to find a model with completely white noise residuals. The non-normal distribution of the residuals does not significantly distort the viability of the model as the residuals are homoscedastic and not autocorrelated. So, the model is a good fit model and results are significant.

We have also applied Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) test to check the stability of the parameters. The results of CUSUM and CUSUMSQ tests (Figure 5.8 and 5.9) indicate that the coefficients are almost stable over the period except there is a slight instability in conditional variance of the residuals at the 3rd quarter of 1996.

[17] See Appendix M

Figure 5.8 Cumulative Sum (CUSUM) Control Chart for Bubble Period

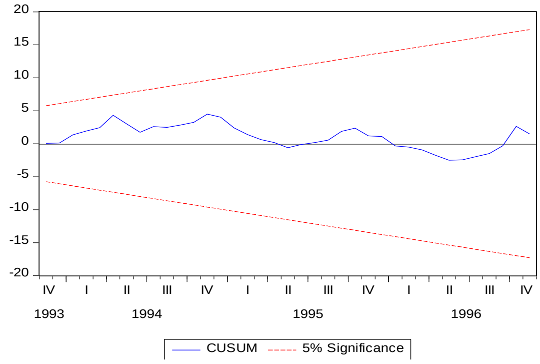
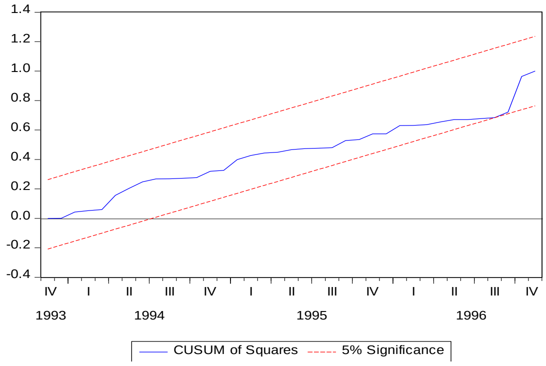


Figure 5.9 Cumulative Sum of Squares (CUSUMSQ) Control Chart for Bubble Period



5.5.2 Cointegration Results for the Meltdown Period

In section 5.4, we have already found that the research variables during the meltdown period are either *I(0)* or *I(1)*. So, the ARDL model is applied to examine the long- and short-run cointegration relationships between the stock market index and macroeconomic indices. First, we have selected the lag length for both the dependent variable (stock market index, LDSEGEN) and the regressors (macroeconomic indices: LIPI, LINT, LCPI, LEXR, LM2 and LGDPRICE). From Table 5.3, we have found that in the meltdown period the dependent variable LDSEGEN has maximum 3 lags, and among the regressors LEXR has the highest 3 lags at level. So, we have set maximum lags for the dependent variable and the regressors at 3. Then the automatic lag selection is applied to allow the software to select the optimal lags for each variable within the set limits.

Table 5.5 also shows that in the meltdown period, LIPI, LCPI, LEXR and LM2 have significant deterministic trend. So, in the ARDL test, we have included trend in the cointegration equation. The results of ARDL specification along with the Pesaran Bounds Test (see Appendix L 2.2) are summarized in Table 5.11. The Bounds test results indicate that null hypothesis of "no long-run relationship exists" cannot be rejected, meaning that there exists no long-run relationship between the stock market index and the six macroeconomic indices in the meltdown period.

Table 5.11 ARDL Specification and Bounds Test Results for the Meltdown Period

Dependent Variable: DLDSEEGEN		
ARDL Model Specification (2, 0, 0, 0, 0, 0, 0)		
F Statistics	**1.867293**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.5	4.63
R-squared	0.361423	
Adjusted R-squared	0.156166	
F-statistic	1.760830	
Prob (F-statistic)	0.121482	
Durbin-Watson stat	2.355889	

The R^2 value indicates that about 36.14 percent of the variations in stock prices can be explained by the variations of the macroeconomic variables (LIPI, LINT, LCPI, LEXR, LM2 and LGDPRICE) along with trend. The remaining 63.86 percent is explained by other factors, which have not been considered. The *F*-statistic is insignificant at 5% level, meaning that the regression coefficients are not significant. However, the Durbin Watson statistic indicates the presence of non-autocorrelated residuals.

Alongside, the pairwise graphs of macroeconomic variables with the stock market index (Figure 5.10 to Figure 5.15) also indicate that during the meltdown period stock market index and macroeconomic indices are not moving together.

Figure 5.10 Graphs of Market Index and Industrial Production for Melrdown Period

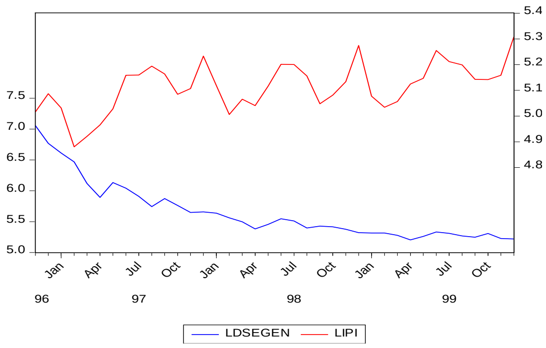


Figure 5.11 Graphs of Market Index and Interest Rate for Meltdown Period

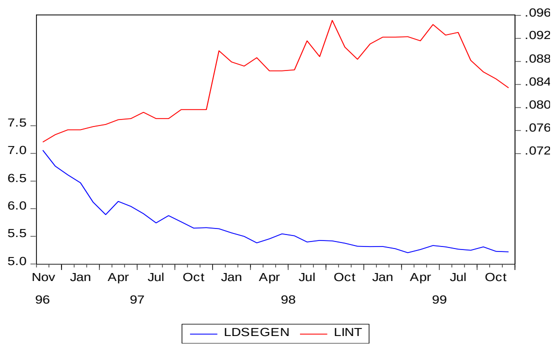


Figure 5.12 Graphs of Market Index and Consumer Price Index for Meltdown Period

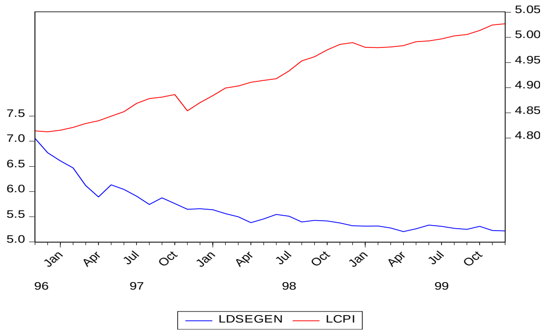


Figure 5.13 Graphs of Market Index and Exchange Rate for Meltdown Period

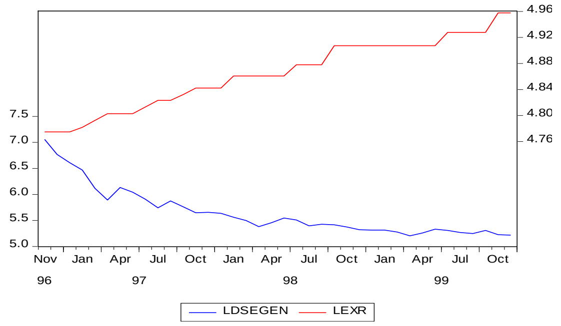


Figure 5.14 Graphs of Market Index and Money Supply for Meltdown Period

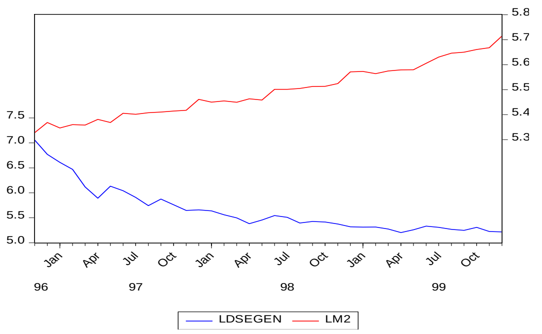
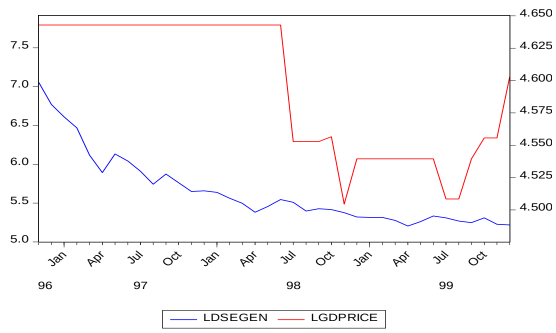


Figure 5.15 Graphs of Market Index and Gold Price for Meltdown Period



The cointegrating form and long-run coefficients are reported in Table 5.12.

Table 5.12 Cointegrating Form and Long-run Coefficients for the Meltdown Period

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Cointegrating Form				
D(LDSEGEN(-1))	**0.2640***	0.1099	2.4021	0.0232
D(LIPI)	0.0823	0.2191	0.3754	0.7102
D(LINT)	-6.3101	5.8297	-1.0824	0.2883
D(LCPI)	0.7090	1.8046	0.3929	0.6974
D(LEXR)	**-5.7660***	1.9414	-2.9701	0.0060
D(LM2)	-1.4900	1.0977	-1.3573	0.1855
D(LGDPRICE)	0.1054	0.7871	0.1338	0.8945
C	**21.2477***	4.8689	4.3640	0.0002
CointEq(-1)	**-0.2626***	0.0601	-4.3672	0.0002
Long Run Coefficients				
LIPI	0.1825	0.9503	0.1921	0.8491
LINT	-25.2840	20.6636	-1.2236	0.2313
LCPI	2.7415	6.5326	0.4197	0.6779
LEXR	**-15.6002****	9.0198	-1.7296	0.0947
LM2	-2.8238	6.4110	-0.4405	0.6630
LGDPRICE	-0.4256	2.5908	-0.1643	0.8707
@TREND	0.0660	0.0893	0.7383	0.4665

Notes: * and ** denote the significance of the coefficient at 5% and **10% level respectively.

From Table 5.12, it is evident that the coefficients of interest rate and exchange rate are higher compared to the other macroeconomic indices both in short- and long-term equations. Both the variables have negative impacts on stock prices. However, only exchange rate is significant at 5% significance level in the short-run and at 10% significance level in the long-run. During this period the interest rate and exchange rate have increased significantly (see Figure 5.11 and 5.13). We have also checked the foreign investments in Bangladesh stock market from 1996 to 1999 (see Table 5.13), which indicate withdrawals of significant foreign investments in 1995-1996 and 1996-1997.

Thus, the depreciation of domestic currency seems to be unsuccessful in attracting foreign investment, rather a significant foreign investment has been withdrawn in this period. This has contributed a negative impact on stock market. Conversely, depreciation of Bangladeshi currency has increased the cost of raw-materials and capital goods for firms, which has also created a negative impact on stock prices. So, the withdrawal of foreign investment and the increase in production cost have played a key role in the stock market fall from 1996 to 1999. At the same time, increase in interest rate has also worsen the situation a bit more.

Table 5.13 Foreign Investment in Bangladesh Stock Market (July 95 – June 99)

Period	Purchase of Shares in Million BDT	Sale of Shares in Million BDT	Net Investment in Million BDT
July 95 – June 96	716.8	1877.1	-1,160.30
July 96 – June 97	518.00	6,186.80	-5,668.80
July 97 – June 98	316.00	517.50	-201.50
July 99 – June 99	95.60	410.70	-315.10

Source: Bangladesh Securities and Exchange Commission (BSEC) Annual Report 2005 - 2006

5.5.2.1 Viability and Stability Check of the Model

For a good fit model, the residual should be homoscedastic, not serially correlated and normally distributed. So, we have used Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic to check the serial correlation, homoscedasticity and normality of the residuals respectively. The results (see Appendix M 2) indicate that the residuals are not serially correlated and homoscedastic, but the distribution of the residuals is not normal. However, practically it is hard to find a model with completely white noise residuals. So, the non-normal distribution of the residuals does not significantly distort the viability of the model as the residuals are homoscedastic and not autocorrelated.

Furthermore, we have applied Cumulative Sum (CUSUM) test to check coefficient stability and Cumulative Sum of Squares (CUSUMSQ) test to check variance stability developed by Brown, Durbin and Evans (1975). This is a recursive testing procedure that is meant to study the stability of regression relationships over time. The results of both CUSUM and CUSUMSQ tests (Figure 5.16 and 5.17) indicate that the slope parameter (coefficients) and the conditional variance are unstable. So, we conclude that during the post-bubble period the parameters are unstable.

Figure 5.16 Cumulative Sum (CuSum) Control Chart for Meltdown Period

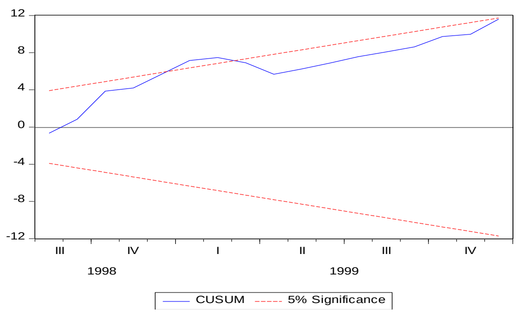
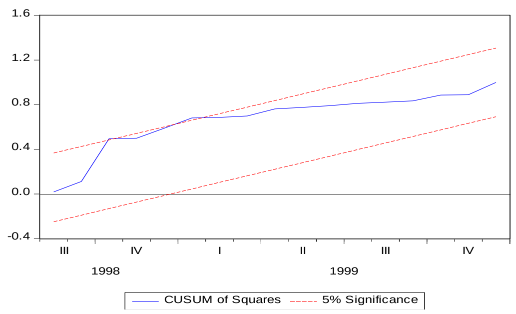


Figure 5.17 Cumulative Sum of Squares (CUSUMSQ) Control Chart for Meltdown Period



5.5.3 Cointegration Results for the Recovery Period

The results of the unit root tests for the recovery period (see Section 5.4) reveal that the research variables are either *I(0)* or *I(1)*. So, the ARDL model is applied to examine the long- and short-run relationships between the stock market index and selected macroeconomic indices. From Table 5.3, we have also found that at level the dependent variable LDSEGEN has 10 lags, and among the regressors LM2 has the highest 13 lags at level. However, EVIEWS software allows maximum 12 lags for the regressors. So, we have set maximum lags for the dependent variable at 10 and for the regressors at 12. Then, automatic lag selection is applied to allow the software to select the optimal lag for each variable within the set limits.

Later, we have selected the trend specification for the model. Table 5.5 shows that in the recovery period LDSEGEN, LCPI and LGDPRICE have significant trend. So, in ARDL test we have included trend in the cointegration equation. The results of ARDL specification along with the Pesaran Bounds Test (see Appendix L 3) are summarized in Table 5.14. The Bounds test results indicate that null hypothesis of "no long-run relationship exists" is rejected and the alternative hypothesis is accepted at 5% significance level, meaning that there exists a long-run relationship between stock market index (dependent variable) and six macroeconomic indices (independent variables).

Table 5.14 ARDL Specification and Bounds Test Results for the Recovery period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (7, 1, 0, 3, 6, 10, 0)		
F Statistics	**4.879556**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.5	4.63
R-squared	0.557041	
Adjusted R-squared	0.379858	
F-statistic	3.143866	
Prob (F-statistic)	0.000011	
Durbin-Watson stat	1.985193	

The R^2 value indicates that about 55.70 percent of the variations in stock prices can be explained by the changes in macroeconomic indices along with the trend and about 44.30

percent is explained by other factors, which have not been considered in this research. The *F*-statistic is significant at 5% level indicating that the coefficients of the regression are significant. The Durbin Watson statistic indicates that the residuals are not serially correlated. We have also examined the cointegrating form and long-run relationship (see Appendix L 3.3) and the summary of the result is shown in Table 5.15.

Table 5.15 Cointegrating Form and Long-Run Coefficients for the Recovery Period

Independent Variables	Coefficient	Std. Error	*t*-Statistics	Probability
Cointegrating Form				
D(LDSEGEN(-1))	-0.0131	0.0859	-0.1529	0.8788
D(LDSEGEN(-2))	-0.1577	0.0835	-1.8886	0.0624
D(LDSEGEN(-3))	0.0989	0.0848	1.1672	0.2464
D(LDSEGEN(-4))	0.0877	0.0814	1.0773	0.2844
D(LDSEGEN(-5))	0.2076	0.0831	2.4990	0.0144
D(LDSEGEN(-6))	0.3710	0.0886	4.1869	0.0001
D(LIPI)	-0.0228	0.0896	-0.2546	0.7996
D(LINT)	-5.9377	2.7771	-2.1381	0.0354
D(LCPI)	0.3820	0.7245	0.5273	0.5993
D(LCPI(-1))	-1.8334	0.7799	-2.3510	0.0210
D(LCPI(-2))	-1.8553	0.7742	-2.3964	0.0187
D(LEXR)	0.0895	0.4613	0.1941	0.8466
D(LEXR(-1))	-0.5424	0.4562	-1.1891	0.2377
D(LEXR(-2))	-0.8031	0.4402	-1.8242	0.0716
D(LEXR(-3))	-0.1354	0.4720	-0.2869	0.7749
D(LEXR(-4))	-0.8801	0.4555	-1.9322	0.0567
D(LEXR(-5))	0.8681	0.4705	1.8449	0.0685
D(LM2)	2.2774	0.4716	4.8287	0.0000
D(LM2(-1))	-2.5512	0.5606	-4.5507	0.0000
D(LM2(-2))	-1.7982	0.5332	-3.3726	0.0011
D(LM2(-3))	-1.7865	0.5216	-3.4253	0.0009
D(LM2(-4))	-2.8047	0.5178	-5.4165	0.0000
D(LM2(-5))	-1.7726	0.5484	-3.2324	0.0017
D(LM2(-6))	-3.3342	0.5583	-5.9723	0.0000
D(LM2(-7))	-1.5397	0.5620	-2.7395	0.0075
D(LM2(-8))	-1.7688	0.5357	-3.3016	0.0014
D(LM2(-9))	-0.9276	0.5186	-1.7886	0.0772
D(LGDPRICE)	-0.2183	0.0856	-2.5496	0.0126
C	-14.2468	2.0389	-6.9876	0.0000

Table 5.15 Cointegrating Form and Long-Run Coefficients for the Recovery Period (cont'd)

Independent Variables	Coefficient	Std. Error	*t*-Statistics	Probability
CointEq(-1)	-0.1943	0.0278	-6.9946	0.0000
Cointeq = LDSEGEN - (0.7988*LIPI - 31.4197*LINT + 8.5894*LCPI - 1.2037 *LEXR + 11.1053*LM2 - 1.0625*LGDPRICE - 0.1591*@TREND)				
Long-run Coefficients				
LIPI	0.7988	0.7704	1.0368	0.3028
LINT	**-31.4197***	13.1868	-2.3827	0.0194
LCPI	**8.5894***	1.9635	4.3746	0.0000
LEXR	-1.2037	1.1497	-1.0470	0.2981
LM2	**11.1053***	5.4306	2.0449	0.0440
LGDPRICE	**-1.0625***	0.3630	-2.9268	0.0044
@TREND	**-0.1591***	0.0737	-2.1583	0.0337

Notes: * and ** denote the significance of the coefficient 5% and 10% level respectively.

From Table 5.15, we have found that in the long-run LINT, LEXR and LGDPRICE are negatively related with stock market index and LIPI, LCPI and LM2 are positively related with the stock market index. However, LINT, LCPI, LM2 and LGDPRICE are statistically significant at 5% significance level. The long-run coefficients of LINT, LCPI and LM2 are higher compared to other macroeconomic variables indicating their dominance on stock market index. The pairwise graphs of each macroeconomic variable with the stock market index (Figure 5.18 to Figure 5.22) indicate the existence of long-run relationship between macroeconomic variables and stock market index.

Figure 5.18 Graphs of Stock Market Index and Industrial Production of Recovery Period

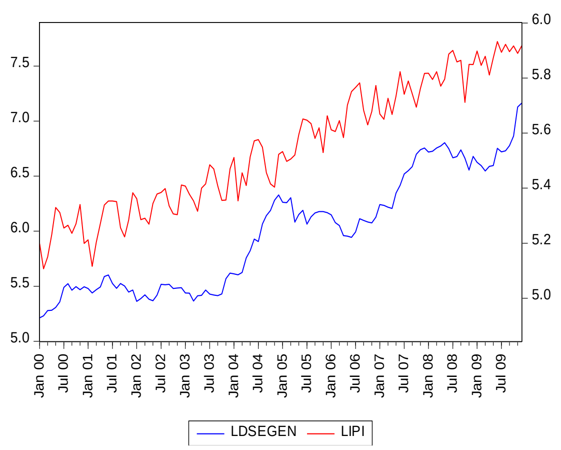


Figure 5.19 Graphs of Stock Market Index and Interest Rate of Recovery Period

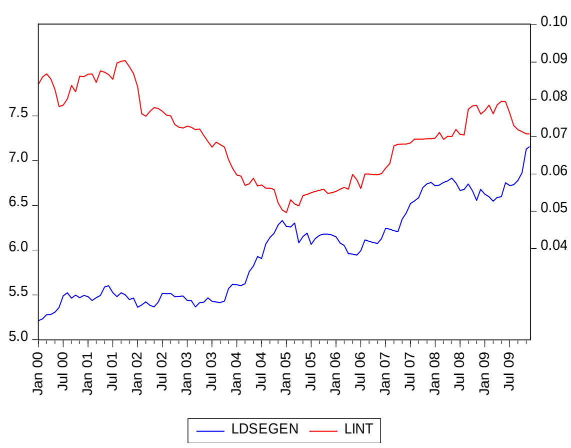


Figure 5.20 Graphs of Stock Market Index and Consumer Price Index of Recovery Period

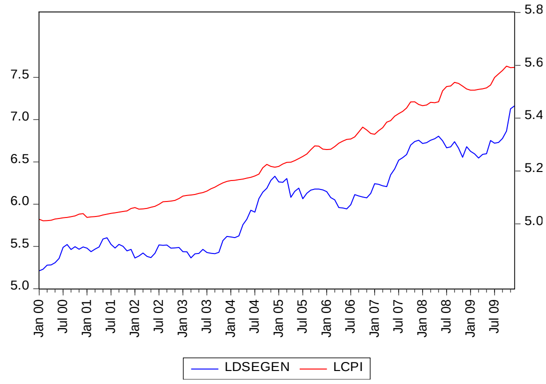


Figure 5.21 Graphs of Stock Market Index and Exchange Rate of Recovery Period

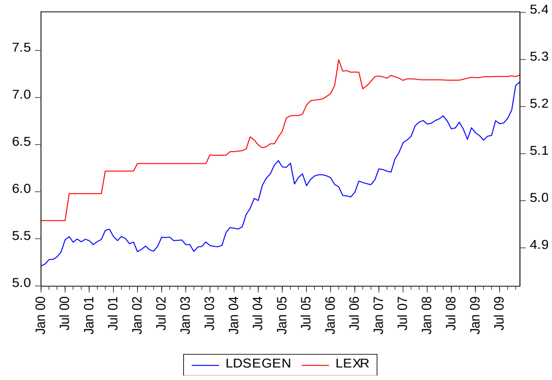


Figure 5.22 Graphs of Stock Market Index and Money Supply of Recovery Period

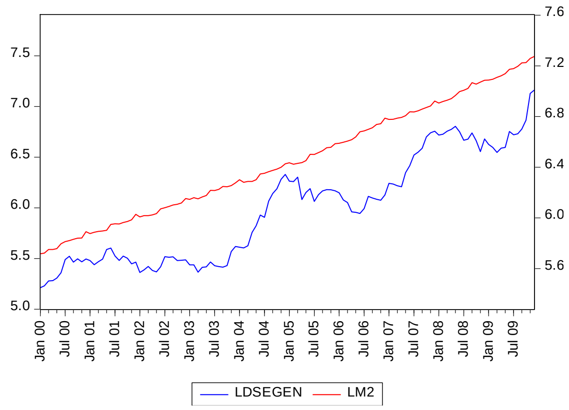
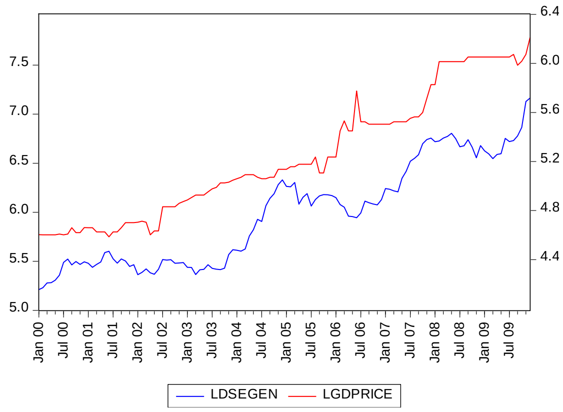


Figure 5.23 Graphs of Stock Market Index and Gold Price of Recovery Period



We have examined the error-correction process of the model to examine the existence of short-run relationships as well as the error-correction mechanism.

5.5.3.1 Results of Error Correction Model

The short-run relationships between the macroeconomic variables and the stock market index are presented in Table 5.16. The results of Error Correction Model (see Appendix L 3.4) show that the error correction coefficient is -0.1943 (*p*-value 0.0000), which indicates that the error-correction term (ECT) is highly significant and approximately 19.43 percent of disequilibria from the long-run equilibrium is adjusted per month. Finally, the *t*-statistics and the corresponding *p*-values of the coefficients of the 1st differences of the independent variables indicate whether the growth of the variables can significantly explain the stock market return in the short-run.

Table 5.16 Short-run Coefficients using ARDL Approach for the Recovery Period

Variable	Coefficient	Std. Error	*t*-Statistics	*p*-value
D(LDSEGEN(-1))	-0.0045	0.1015	-0.0444	0.9647
D(LDSEGEN(-2))	-0.1546	0.0988	-1.5655	0.1212
D(LDSEGEN(-3))	0.0943	0.0998	0.9448	0.3474
D(LDSEGEN(-4))	0.0758	0.0948	0.7996	0.4262
D(LDSEGEN(-5))	0.1580	0.0924	1.7103	0.0909
D(LDSEGEN(-6))	0.3077	0.0997	3.0864	0.0027
D(LIPI)	0.0028	0.1251	0.0221	0.9824
D(LCPI)	0.1925	0.8249	0.2333	0.8161
D(LCPI(-1))	-1.2932	0.8337	-1.5513	0.1246
D(LCPI(-2))	-1.6517	0.8690	-1.9007	0.0607
D(LEXR)	-0.0973	0.5394	-0.1803	0.8574
D(LEXR(-1))	-0.4582	0.5329	-0.8599	0.3923
D(LEXR(-2))	-0.7168	0.5127	-1.3979	0.1658
D(LEXR(-3))	-0.6500	0.5184	-1.2538	0.2134
D(LEXR(-4))	-0.7229	0.5096	-1.4184	0.1597
D(LEXR(-5))	0.7280	0.5172	1.4076	0.1629
D(LM2)	1.9831	0.5447	3.6408	0.0005
D(LM2(-1))	-2.8830	0.8969	-3.2142	0.0018
D(LM2(-2))	-1.9531	0.8004	-2.4403	0.0168
D(LM2(-3))	-1.7701	0.7927	-2.2329	0.0282
D(LM2(-4))	-2.8941	0.8505	-3.4026	0.0010
D(LM2(-5))	-1.8878	0.8215	-2.2980	0.0240
D(LM2(-6))	-3.2281	0.7405	-4.3594	0.0000
D(LM2(-7))	-1.5306	0.7350	-2.0825	0.0403
D(LM2(-8))	-2.0200	0.6866	-2.9419	0.0042
D(LM2(-9))	-1.2408	0.6026	-2.0592	0.0425
C	-13.3009	3.9010	-3.4096	0.0010
@TREND	-0.0322	0.0112	-2.8723	0.0051

Notes: * denote that coefficient is significant at 5%.

From Table 5.16, we have found that among the independent variables industrial production has 1 lag, interest rate has zero lag, inflation has 3 lags, exchange rate has 6 lags, money supply has 10 lags and gold price has zero lag. If an independent variable has zero lag, it indicates that the variable does not have short-run relationship with the dependent variable. When a variable has one lag, then the significance of the variable in explaining the stock market return in short-run is determined by *t*-statistic and corresponding *p*-value. However, when a variable has multiple lags, then the Wald Test is applied to examine whether the coefficients of lagged terms of that variable can jointly explain the stock market return. Table 5.16 shows that LIPI, LCPI and LEXR have multiple lags, so the Wald Test has been applied to check the significance of those variables in explaining stock market return. The summary of the Wald Test (see Appendix L 3.4) is shown in Table 5.17. The results show that only money supply can significantly explain the shock market return in the short-run. So, except money supply other macroeconomic variables show disequilibrium in the short-run.

Table 5.17 Significance of Short-run Coefficients in the Recovery Period

Independent Variables	Null Hypothesis	χ^2 Statistics	p-value
LCPI	C(8) = C(9) = C(10) = 0	7.556038	0.0561
LEXR	C(15) = C(12) = C(12) = C(13) = C(14) = C(15) = C(16) = 0	8.563479	0.1997
LM2	C(17) = C(18) = C(19) = C(20) = C(21) = C(22) = C(23) = C(24) = C(25) = C(26) = 0	**43.04306**	**0.0000**

5.5.3.2 Viability and Stability Check of the Model

The tests of residuals for normality, autocorrelation, and heteroscedasticity are important to check the viability of the model and the significance of the results. So, we have applied Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic (see Appendix M 3) to check the residuals for serial correlation, homotheticity and normality respectively. The results indicate that the residuals are normally distributed, not serially correlated and homoscedastic. So, the model is a good fit model as the residuals have satisfied all the conditions.

Moreover, we have applied Cumulative Sum (CUSUM) test to check coefficient stability and Cumulative Sum of Squares (CUSUMSQ) test to check variance stability. The results of both tests (Figure 5.23 and 5.24) indicate that the coefficients are stable.

Figure 5.24 Cumulative Sum (CUSUM) Control Chart for Recovery Period

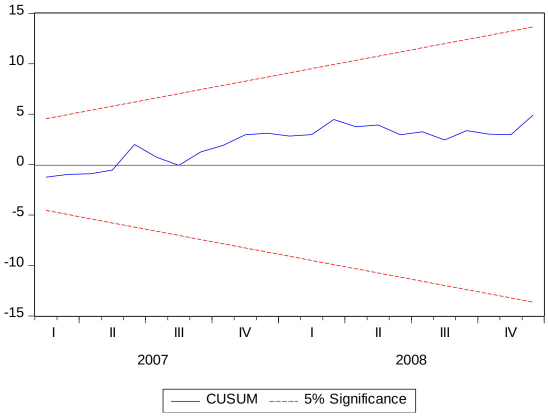
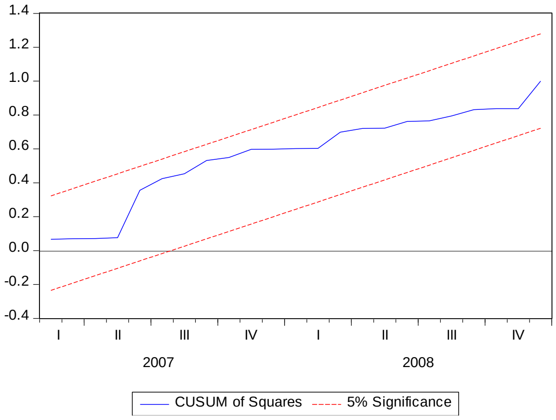


Figure 5.25 Cumulative Sum of Squares (CUSUMSQ) Control Chart for Recovery Period



5.6 Conclusion

In this chapter, we have investigated the long- and short-term relationships between the stock market and the macroeconomic indices in different periods, viz.; bubble, meltdown and recovery periods. Considering the stock market situations as well as the timing of the reform measures initiated for the development of Dhaka Stock Exchange (DSE), we have represented March 1992 to November 1996 as the bubble period, November 1996 to December 1999 as the meltdown period and January 2000 to December 2009 as the recovery period. The relationships in these periods are separately assessed to compare the influences of the priced factors in different conditions of the stock market.

We have found a long-run relationship between the stock market and the macroeconomic indices at 5 percent significance level in the bubble period and about 52.68 percent of the of the stock market return can be explained by the growth of the macroeconomic indices in this period. The results have shown that industrial production index, consumer price index, exchange rate and money supply are positively related with the stock market index. On the other hand, interest rate and gold price are negatively related with the stock market index. However, only exchange rate is found significant at 5 percent level and industrial production and gold price are significant at 10 percent level. The results of Error

Correction Model (ECM) have shown that approximately 26.06 percent of the disequilibria is adjusted per month to bring about equilibrium in the long-run. The results of CUSUM and CUSUMSQ tests indicate that the slope parameter (coefficients) are almost stable over the entire period, only there is a negligible instability in conditional variance depicted by residuals at the 3rd quarter of 1996.

Additionally, during the bubble period, the long-run equation shows that the coefficient of exchange rate is very large compared to the coefficients of other independent variables, which indicates the dominance of exchange rate on stock prices. Further investigations have revealed that both exchange rate and foreign investments in Bangladesh stock market have increased significantly during this period. These results indicate that the depreciation of domestic currency has attracted significant foreign investment in the stock market, which has increased the demand of stocks and has increased the prices. So, the exchange rate has played a key role in bubble creation. Moreover, from the starting of 1992 to the end 1995, there has been a continuous fall in the interest rate, which has created a positive impact on equity prices. Therefore, we can conclude that exchange rate and interest rate are at least partly responsible for the bubble creation in the stock market in 1996.

The investigations of the meltdown period have revealed that there exists no long-run relationship between the stock market index and the macroeconomic indices. The results have also shown that about 36.14 percent of the stock market return can be explained by the variations of the macroeconomic indices. The remaining 63.86 percent is explained by other factors, which have not been considered in this research. Although the diagnostic tests of the residuals have revealed that the model is a good fit model, both the CUSUM and CUSUMSQ tests indicate that the coefficients and the conditional variance of the parameters are unstable in the period.

The long-run equation of the meltdown period has shown that the coefficients of interest rate and exchange rate are larger compared to other macroeconomic indices, also the signs of these two coefficients have indicated that both the variables have negative impact on stock prices. Furthermore, during the period interest rate and exchange have increased significantly. But depreciation of the domestic currency has not been successful in attracting foreign investment, rather a significant foreign investment has been withdrawn in this period implying a negative impact on stock market. Moreover, depreciation of domestic currency has increased the cost of raw-materials and capital goods for the firms, contributing a negative impact on equity prices. Increase in interest rate also has created a negative impact on stock market. Therefore, we can conclude that exchange rate and interest rate are at least partially responsible for the bubble crash of 1996.

In the recovery period, the test results have indicated that there exists a long-run relationship between the stock market index and the selected macroeconomic indices. Also, about 55.70 percent of the stock market return can be explained by the changes in macroeconomic indices. The results of error correction model have shown that approximately 19.43 percent of disequilibria is adjusted per month to bring about long-run equilibrium. The viability tests of the model have indicated that the model is a good fit model, thus the results are significant. The results of both CUSUM and CUSUMSQ tests have indicated that the coefficients are stable.

During this period, we have found that industrial production index, inflation and money supply are positively related with stock market index. On the other hand, interest rate, exchange rate and gold price are negatively related with the stock market index. However, impact of interest rate, inflation, and money supply are found statistically significant. Moreover, interest rate, money supply and inflation have larger impact on stock prices compared to other macroeconomic factors. At the same, changes in the money supply is also found significantly related to the stock market return in the short-run.

The findings on relationships between stock market index and macroeconomic indices reveal that the relationships are different in different periods. Furthermore, the sign as well as the magnitude of the impact of a macroeconomic variable on stock market index vary across periods. In addition, the explanatory power of the macroeconomic variables to explain the stock market return also vary across different market conditions indicating that sometimes the stock prices are partially driven by fad and fashions, which may be unrelated to the economic conditions.

The cross-sectional analyses of the relationships between the stock market index and the macroeconomic variables in Bangladesh across different periods have revealed that the relationship is more consistent with the financial theories in the recovery period and least consistent with the financial theories in the meltdown period. During the bubble period, there exists a long-run relationship and a significant percentage of the market return can be explained by the macroeconomic variables. Alongside, the important outcome of the study is that exchange rate and interest rate are found at least partially responsible for the bubble creation as well for bubble crash of 1996.

Chapter 6

Relationship between Stock Market and Macroeconomic Volatilities

6.1 Introduction

Traditional research in financial economics has concentrated on relationship between stock market and macroeconomic variables. However, considering the number of crashes in stock markets and the size of their impact on households, banks and finally on overall economy have increased the interest of practitioners, regulators and researchers towards the relationship between stock market and macroeconomic volatilities. Theoretically, stock prices are the discounted present value of expected future cash flows. Besides, future macroeconomic condition obviously has impact on the future cash flows of a firm. Hence the volatility of stock market return changes when there is uncertainty about the future health of the economy (Chowdhury et al., 2006). In other words, stock markets may be volatile simply because economic activities fluctuate (Zukarnain and Sofian, 2012).

The dividend discount model (DDM), capital asset pricing model (CAPM) and arbitrage pricing theory (APT) provide important theoretical frameworks which show the conduits through which macroeconomic variables are factored into stock prices. These models predict that any shock to macroeconomic variables is a major source of systematic risk and there is no way that even a well-diversified portfolio like market portfolio constructed from stock market index can shift it to anywhere else, hence it is obvious that shock to macroeconomy must influence the stock market return (Chowdhury et al., 2006).

Since macroeconomic variables have been considered as the powerful tool to forecast the volatility of stock market return all over the globe, knowledge on the nexus between stock market volatility and macroeconomic volatility is crucial to the investors as well as to the policy makers. Additionally, the risk return behavior analysis of stock market is more important in developing countries, like Bangladesh, because these markets are very volatile. The higher volatility of these stock markets compels the investors to demand higher risk premium, which creates higher cost of capital and slows down the economic development (Mala and Reddy, 2007).

Alongside, Bangladesh stock market has experienced two major irrational fluctuations within a decade and a half, one in 1996 and other in 2010. Siddikee and Begum (2016) have mentioned that the stock market volatility in Bangladesh is mostly influenced by trade syndication or the decisions of other regulatory bodies like Bangladesh Bank. In this backdrop, it is very important to study the relationship between stock market volatility and macroeconomic volatility in Bangladesh to examine whether the expected changes in the macroeconomic volatility over time, measured by the conditional variances, can be used to explain the time-varying conditional volatility of the stock market return or some other factors are creating the market volatility.

There are five sections in this chapter. In section 6.2, we have described the methodologies to be used in the analysis. The findings of the empirical investigations have been portrayed in section 6.3. Also, we have outlined the diagnostic and stability tests of the residuals of the model to check the significance of the results. Finally, in section 6.4, we have summarized the findings in the conclusion.

6.2 Methodology

To forecast the stock market return and its relation to the growth of macroeconomic factors need modern econometric techniques and models. This issue has been addressed by the recent advancement in the econometric literatures with the introduction of Autoregressive Conditional Heteroskedasticity (ARCH) family models which are capable of forecasting volatility of stock market returns. The ARCH family models can be used for various statistical problems with time series data and these models are particularly valuable for financial time series where returns are unpredictable and have a substantial number of extreme values and both the extremes and calm periods are clustered in time.

The ARCH model defines the current conditional variance as a function of the past squared error terms (Engle, 1982), which is consistent with volatility clustering. Later, Bollerslev (1986) has generalized the ARCH (GARCH) model in such a way that the current conditional variance is a function of the past conditional variances and the preceding squared error terms. The GARCH(1,1) specification is the workhorse of financial applications and it is remarkable that this single model can be used to explain the volatility dynamics of almost every financial return series (Engle, 2004).

However, the GARCH model has some weaknesses, the main one of which is that it does not capture asymmetry, which normally characterizes stock markets (Chinzara, 2010). With this implication, there are modifications to the GARCH model. The exponential GARCH (EGARCH) proposed by Nelson (1991) is the first asymmetric GARCH model and followed by the threshold GARCH (TARCH) model proposed by Zakoian (1994). It is also known as the GJR (Glosten, Jagannathan, and Runkle) model, which has been proposed by Glosten et al. (1993).

In this section, the evolution of different GARCH models has been discussed. We have also defined the research variables which have been used for the investigations. The econometric models for the estimation of conditional variances of the research variables and to examine the relationship between the conditional variances of stock market return and that of macroeconomic variables have been detailed in this section.

6.2.1 Sample Data

Monthly data of DSE General Index, industrial production index, interest rate, inflation, exchange rate, money supply and gold price for the period from January 1991 to December 2015 have been considered in this study. The data of the DSE General Index has been collected from the Dhaka Stock Exchange Library. The data of six macroeconomic variables are obtained from Monthly Statistical Bulletin of Bangladesh Bureau of Statistics, Economic Trends published by Statistical Department of Bangladesh Bank and various editions of Economic Survey of Bangladesh. We have collected monthly data for longer period to capture long-term movements and to avoid the effects of settlement and clearing delays which are known to significantly affect returns over shorter sampling intervals (Faff el al., 2005; Liow et al., 2006).

Then, data on stock market index are converted into continuously compounded returns by subtracting the logarithm of the previous month's index from the logarithm of the current month's index. Consistent with the relevant literature (Beltratti and Morana, 2006; Diebold and Yilmaz, 2007), the same logarithmic transformation is applied to the selected macroeconomic variables to capture the growth of the macroeconomic variables. In the empirical analysis, these transformed data have been used. The conditional volatility of stock market return and that of the growth of the macroeconomic variables are estimated using GARCH family models. Later, these conditional variances are used to fit in the cointegration approach to examine the long- and short-run relationships between the stock market and macroeconomic volatilities. The descriptions of our research variables are given in Table 6.1.

Table 6.1. Definition of Research Variables

Symbol	Variable	Measurement
DLDSEGEN	Monthly Stock Market Returns	First difference of natural logarithm of normalized month end Dhaka Stock Exchange General Index (DSEGEN).
DLIPI	Monthly Growth of Industrial Production Index	First difference of natural logarithm of normalized monthly industrial production index of medium to large scale manufacturing industries.
DLINT	Monthly Growth of Interest Rate	First difference of natural logarithm of 1 plus month end deposit interest rate in percent.
DLCPI	Monthly Growth of Consumer Price Index	First difference of natural logarithm of normalized month end consumer price index.
DLEXR	Monthly Growth of Exchange Rate	First difference of natural logarithm of normalized month end price of US dollar in Bangladeshi taka (BDT).
DLM2	Monthly Growth of Money Supply	First difference of natural logarithm of normalized month end broad money supply (M2).
DLGDPRICE	Monthly Growth of Gold Price	First difference of natural logarithm of normalized month end gold price in Bangladesh.
Conditional Variance Data		
VDLDSEGEN	Variance of Stock Market Return	Conditional Variance of Monthly Stock Market Return.
VDLIPI	Variance of growth of Industrial Production Index	Conditional Variance of Growth of Industrial Production Index.
VDLINT	Variance of growth of Interest Rate	Conditional Variance of Growth of Interest Rate.
VDLCPI	Variance of growth of Consumer Price Index	Conditional Variance of Growth of Consumer Price Index.
VDLEXR	Variance of growth of Exchange Rate	Conditional Variance of Growth of Exchange Rate.
DLM2	Variance of growth of Money Supply	Conditional Variance of Growth of Money Supply.
VDLGDPRICE	Variance of growth of Gold Price	Conditional Variance of Growth of Gold Price.

6.2.2 Pre-tests of Variables for Econometric Models

Advancements in econometrics have exposed that most of the economic and financial time series are nonstationary and to scrutinize such series with ordinary least squares (OLS) leads to incorrect conclusion. So, it is important to check for stationarity of variables before moving further towards model estimation. There are many tests to check the stationarity of the variables, but we have used Augmented Dickey-Fuller Test (ADF) and Philips and Perron (PP) Test for this purpose. The methodologies of these tests have been described in section 4.3. In addition to the stationarity of the variables, presence of autocorrelation and heteroscedasticity in the residuals of the ordinary least squares estimation are also required pre-conditions for GARCH model. For this purpose, the Breusch-Godfrey Serial Correlation LM test and Autoregressive Conditional Heteroscedasticity (ARCH) test have been used to examine the presence of autocorrelation and heteroskedasticity respectively in the residuals of the ordinary least squares estimation.

6.2.3 Autoregressive Conditional Heteroskedasticity (ARCH) Model

Engle (1982) has recommended the Autoregressive Conditional Heteroskedasticity (ARCH) Model as a choice to handle the typical time series. The model allows the conditional variance to vary with time and implies that variance at present time relies on the preceding squared error terms. The basic ARCH(q) model has two equations, the mean equation and the conditional variance equation. Both equations must be estimated simultaneously as the variance is a function of the mean. The presence of ARCH means the normal distribution is not always the best approximation to be used. The mean and variance equations of an ARCH(q) process can be given as follows:

Mean equation: $Y_t = \pi_0 + \sum_{i=1}^{q} \pi_i Y_{t-i} + \varepsilon_t$ where $\varepsilon_t \sim iid(0, \sigma_t^2)$ 6.1

Variance equation: $\sigma_t^2 = \gamma_0 + \sum_{j=1}^{q} \gamma_j \varepsilon_{t-j}^2$ 6.2

where, Y_{t-i} is a set of regressors, and π_i and γ_j are coefficients and ε_t is independently distributed residual terms. One shortcoming of the ARCH model is that it resembles extra moving average pattern than autoregression.

6.2.4 Generalized ARCH (GARCH) Model

A useful generalization of ARCH model is GARCH model introduced by Bollerslev (1986). The GARCH model has been considered as the most commonly employed class of time series model in the recent finance literature for studying volatility. The appeal of this model is its ability to capture both volatility clustering and unconditional return distribution with heavy tails. GARCH model considers conditional variance to depend on both autoregressive (AR) and moving average (MA) terms. In general, the GARCH(*p*,*q*) in the simplest form can be written as:

Mean equation: $Y_t = \lambda_0 + \sum_{i=1}^{k} \lambda_i Y_{t-i} + \varepsilon_t \, ; \qquad \varepsilon_t \sim N(0, \sigma_t^2)$ 6.3

Variance equation: $\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$ 6.4

Equation (6.3), the conditional mean equation, is an autoregressive process of order *k*, AR(*k*). Parameter λ_0 is the constant, *k* is the lag length, ε_t is the heteroskedastic error terms with its conditional variance given in Equation (6.4). In the conditional variance equation *q* is the number of ARCH terms, and *p* is the number of GARCH terms.

6.2.5 Exponential GARCH (EGARCH) Model

Nelson (1991) has developed non-linear GARCH model, which is known as Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. The mean equation of EGARCH model is same as the mean equation of GARCH model. However, the variance equation of EGARCH model is expressed in logarithmic term. This model is superior to GARCH model because it ignores the non-negativity constraint and it doesn’t impose any constraint on the parameters. The variance equation of EGARCH model can be written as:

Variance equation: $ln\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| + \sum_{i=1}^{q} \gamma_j \frac{\varepsilon_{t-i}}{\sigma_{t-i}} + \sum_{j=1}^{p} \beta_j ln\sigma_{t-j}^2$ 6.5

In the variance equation α, γ and β are the parameters. On the left side of equation natural logarithm of series is taken to compose exponential leverage effect. The model is symmetric, if $\gamma_1 = \gamma_2 = \cdots = \gamma_q = 0$, meaning that there is no leverage effect. However,

$\gamma_j < 0$ indicates more impact of negative news on next period's volatility than positive news, which indicates leverage effect, while $\gamma_j > 0$ represents the other way around.

6.2.6 Threshold GARCH (TGARCH) Model

The threshold GARCH (TGARCH) model proposed by Zakoian (1994), which is also similar to GJR GARCH model studied by Glosten et al. (1993), is simply a re-specification of the GARCH (1,1) model with an additional term in the conditional variance equation to account for asymmetry. The mean equation of TGARCH model is same as GARCH(1,1) model. However, the variance equation can be written as follows:

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \gamma D_{t-1} \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \qquad 6.6$$

where D_{t-1} is the indicator function having the following values:

$$D_{t-1} = \begin{cases} 1, & \varepsilon_{t-1} < 0 \\ 0, & \varepsilon_{t-1} \geq 0 \end{cases}$$

The γ is known as the asymmetry or leverage parameter. For good news ($\varepsilon_{t-1} > 0$) and for bad news ($\varepsilon_{t-1} < 0$). So, the good or bad news have differential effect on conditional variance. While good news has an impact of α_1, bad news has an impact of $\alpha_1 + \gamma$. Thus, if γ is significant and positive, then negative shocks have a larger effect on σ_t^2 than the positive shocks, while the other way around if γ is significant and negative.

The first step of modeling volatility is to estimate the mean and variance equations simultaneously using the best fitted GARCH model. The selection of model is an important issue in the estimation process. In this study, we have used the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) as a goodness-of-fit tests to rank the different GARCH models as discussed earlier to choose the best fitted GARCH model for our purpose.

6.2.7 Measuring the Volatility

The second objective of this chapter is to investigate whether the changes in Bangladesh stock market volatility over time, as measured by the conditional variance of stock market return, can be explained by the time-varying conditional volatility of the growth of macroeconomic variables or the vice versa. For this purpose, the conditional variances of the research variables are estimated using best fitted GARCH model.

Several literatures (Akgiray, 1989; Baillie and DeGennaro, 1990; Bera and Higgins, 1993; Floros, 2008) have showed that a simple GARCH model is parsimonious and generally gives significant results. Therefore, the best fitted GARCH model has been used with or without autoregressive term of order 1 to estimate the conditional variances of the research variables based on the presence of significant asymmetric term and information criterion.

6.2.8 Estimation of Cointegration Relationship

We have also examined the cointegration relationship between conditional volatility of the stock market return and the conditional volatilities of the selected macroeconomic variables using cointegration test. If the conditional volatilities of all the research variables are *I(1)*, the Johansen and Juselius cointegration test has been applied. In addition, to check the robustness of the results, the Autoregressive Distributed Lags cointegration (ARDL) cointegration approach has been used. If there is a combination of *I(1)* and *I(0)*, only ARDL approach has been applied. The empirical methods for these cointegration tests have been described in chapter 4.

6.3 Findings of the Study

In this section, empirical findings based on the econometric methods outlined in the earlier section have been reported. Firstly, we have reported the results of GARCH model, where the mean and the variance equations are estimated simultaneously. Then, we have selected the best model to estimate the conditional variance of each research variable. Finally, we have used the cointegration approach to examine the long- and short-term relationships between the stock market volatility and the volatilities of the macroeconomic variables.

6.3.1 Results of Volatility Modeling with GARCH Model

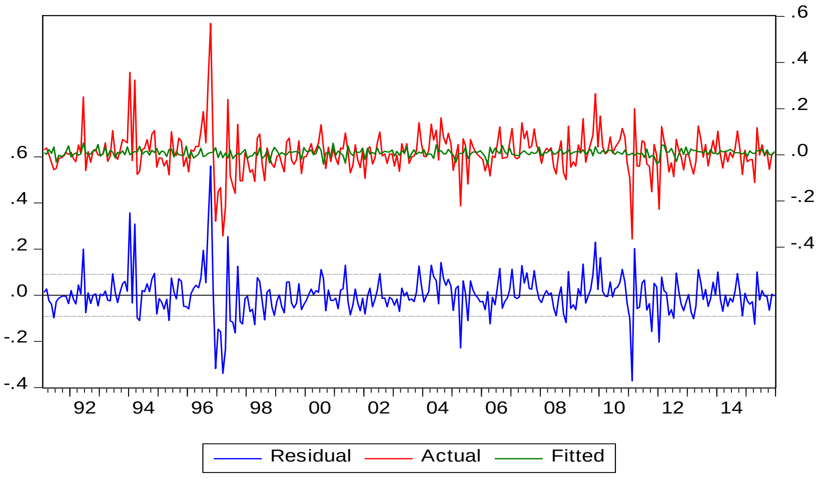
The first step of volatility modeling is to estimate the mean and variance equations simultaneously with stock market return as dependent variable and growth of the selected macroeconomic variables as independent variables. The 1st difference of each variable represents the growth of that variable. We have already found that the first differences of the research variables are stationary (see section 4.4.2), which is the first pre-condition for the volatility estimation.

The second pre-test of the estimation is to examine the residuals of the ordinary least squares (OLS) estimation for the presence of serial correlation and heteroskedasticity, because the GARCH model can only be applied if the residuals of the Ordinary Least Squares (OLS) show serial correlation and heteroskedasticity. To check the serial correlation and heteroscedasticity of the residuals, we have fitted the research variables into Ordinary Least Squares (OLS) with the stock market return as dependent variable and the growth of six macroeconomic variables as independent variables. Then the residuals are tested for autocorrelation and heteroskedasticity using Breusch-Godfrey Serial Correlation LM Test and Autoregressive Conditional Heteroscedasticity (ARCH) Test respectively. The results of these tests[18] show that the null hypotheses that the residuals are “not serially correlated” and have “no heteroskedasticity” are rejected at 5 percent

[18] See Appendix N

significance level, indicating that the residuals are serially correlated and heteroskedastic. The plot of residuals (see Figure 6.1) also confirms the volatility clustering of the residuals, meaning that the variance appears to be high during certain periods and low in other periods. These results have revealed that the nonlinear GARCH model to be applied for estimation of the mean and variance equations.

Figure 6.1. Residuals of Ordinary Least Squares Estimation



Now, we need to select the best fitted GARCH model for volatility modeling. For this purpose, we have used the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Loglikelihood test. Table 6.2 shows these values for different GARCH models, which have been considered for the estimation. As per the selection procedure, the best fitted model has been chosen based on the lowest values of AIC and SIC, and the highest Loglikelihood statistic. The values of Table 6.2 have indicated that EGARCH(1,1,1) is the best model for our purpose. So, we have used EGARCH(1,1,1) model to estimate the mean and variance equations.

Table 6.2 Test Statistics for Selection of Best Fitted GARCH Model

Model	AIC Value	SIC Value	Loglikelihood Value
GARCH(1,1)	-2.195368	-2.071607	338.2075
EGARCH(1,1,1)	**-2.258027**	**-2.121891**	**348.5751**
TGARCH(1,1,1)	-2.194906	-2.058770	339.1385

Table 6.3 shows the summary of the results of EGARCH model[19], the mean and variance equations are estimated with the stock market return as dependent variable and growth of the macroeconomic variables as independent variables.

Table 6.3 Results of EGARCH(1,1,1) Model

Mean Equation				
Variables	**Coefficient**	**Std. Error**	**z-Statistic**	**Probability**
DLIPI	-0.0369	0.0603	-0.6128	0.5400
DLINT	-0.2606	1.1484	-0.2269	0.8205
DLCPI	1.1277	0.3442	3.2758	0.0011
DLEXR	-0.7049	0.3249	-2.1696	0.0300
DLM2	1.4038	0.2299	6.1049	0.0000
DLGDPRICE	0.1014	0.0596	1.7021	0.0887
Constant	-0.0077	0.0043	-1.7931	0.0730
Variance Equation				
ω (Constant)	1.82E-05	0.0137	0.0013	0.9989
α (ARCH effect)	-0.0665	0.0131	-5.0913	0.0000
γ (asymmetry effect)	0.1513	0.0171	8.8658	0.0000
β (GARCH effect)	0.9889	0.0000	26729.38	0.0000
α + β	0.9224			
Diagnostic Test				
Heteroskedasticity Test: ARCH LM Test				
F Statistics	0.202596	Probability of F Statistics		0.6530
Prob. Chi-squared				0.6751

Several points can be noted from the results of EGARCH(1,1,1) model of Table 6.3. Firstly, the mean equation shows that the coefficients of growth of consumer price index (DLCPI) and money supply (DLM2) are positively related with the stock market return at 1 percent level of significance, while growth of exchange rate (DLEXR) is negatively related to the stock market return at 5 percent significance level. On the other hand, growth of gold price (DLGDPRICE) is positively related with the stock market return at 10 percent significance level. Whereas the coefficients of growth of industrial production (DLIPI) and interest rate (DLINT) are statistically insignificant in explaining the stock market

[19] See Appendix O

return. So, the results have confirmed that most of the selected macroeconomic variables can significantly explain the stock market return.

Secondly, the conditional variance equation reveals the following facts:

- The ARCH term (α), and the GARCH term (β) are significant at 1 percent level, meaning that the conditional variance of the stock market return depends on both autoregressive (AR) and moving average (MA) terms;
- The estimated β is considerably higher than the α, which reveals that the stock market volatility is more sensitive to its lagged values than to new surprises;
- The sum of α and β is 0.9253 which indicates that a shock persists over many future periods;
- The coefficient $\gamma \neq 0$ and is significant at 1 percent level, this result indicates the presence of asymmetric effect of good and bad news on the stock market volatility;
- The coefficient γ is positive, which discloses that the positive shock, created by good news, implies a higher next period conditional variance in the stock market return compared to the negative shock of same magnitude created by the bad news.

Finally, the ARCH-LM test results show that the null hypothesis of “no ARCH effect” can’t be rejected at 5 percent significance percent level indicating that the mean and variance equations are well specified.

6.3.2 Estimation of Conditional Variances of Research Variables

To estimate the conditional variance of each research variable, two sets of univariate models are considered. In the first set, we have applied three univariate GARCH models - namely GARCH(1,1), EGARCH(1,1,1) and TGARCH(1,1,1), with constant only in the mean equation. In the second set, the mean equation includes a constant and a autoregressive term of order 1, *AR(1)*, of the same variable. The summary of the results for the model selection[20] is shown in Table 6.4. The best model for estimation of the conditional volatility of growth of each research variable is chosen based on the Akaike Information Criterion (AIC) and the following conditions:

- If asymmetry coefficient (γ) is found significant for a variable, then the GARCH(1,1) model is not considered for that variable because GARCH(1,1) does not capture the asymmetry in the variable;
- If for any model ($\alpha + \beta$) > 1 for a research variable, then the series becomes explosive. As an explosive series cannot be considered in the estimation process, so the model for that variable is excluded from the choice;
- The presence of heteroskedasticity in the residuals means the model is not well specified. So, if the residuals for any model shows heteroskedasticity, then that model is excluded from the choice. ARCH Lagrange Multiplier Test is used to examine the presence of heteroskedasticity in the residuals.

Based on the above-mentioned conditions and the lowest AIC value, model to estimate conditional variance of each variable has been selected. Based on the results, the models chosen (see Table 6.4) for different variables are as follows - TGARCH(1,1,1) model for the stock market return; AR(1)-GARCH(1,1) for the growth of both production index and inflation rate; AR(1)-TGARCH(1,1,1) for changes in both interest rate and money supply; AR(1)-EGARCH(1,1,1) for growth of exchange rate; EGARCH(1,1,1) for growth of gold price. Then, EVIEWS software is used to estimate these conditional variances of the growth of different research variables.

[20] See Appendix P

Table 6.4 Model Selection for Estimation of Conditional Variances of Growth of Research Variables

	DLDSEGEN	DLIPI	DLINT	DLCPI	DLEXR	DLM2	DLGDPRICE
GARCH(1,1)							
ω	0.0021**	0.0031	6.3E-07**	1.51E-06*	2.9E-06**	Coefficients are not Unique	0.0003**
α	0.3104**	0.0429	0.2012**	0.0502**	0.2454**		0.4612**
β	0.4248**	0.3352	0.7719**	0.9312**	0.8095**		0.5287**
α + β	0.7352	0.3781	0.9731	0.9814	**1.0550**		0.9899
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH		No ARCH
AIC	-2.1899	-2.4379	-9.0269	-6.5454	-6.6595		-3.7305
AR(1)-GARCH(1,1)							
ω	0.0021**	0.0011	6.7E-07**	1.4E-06**	2.7E-06**	0.0001	0.0003**
α	0.2789**	-0.0032	0.2237**	0.0487**	0.2618**	-0.0398	0.4586**
β	0.4454**	0.7696	0.7494**	0.9311**	0.8020**	0.4710	0.5301**
α + β	0.7243	0.7664	0.9731	0.9798	**1.0638**	0.4313	0.9887
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH
AIC	-2.1865	-2.4532	-9.0427	-6.6278	-6.6743	-5.6156	-3.7185
EGARCH(1,1,1)							
ω	-1.1734**	-5.705	-13.346**	-0.3102**	-0.636**	-10.714**	-7.993**
α	0.3549**	0.0324	1.0118**	0.1009**	-0.0543**	-0.0414	-0.1053
γ	**0.1147****	0.0456	**0.8235****	**0.0864****	**0.3544****	**0.3636****	**0.3680****
β	0.8178**	-0.0714	-0.0766*	0.9757**	0.9416**	-0.2720	-0.2773**
α + β	**1.1727**	-0.0390	0.9352	**1.0765**	0.8873	-0.3134	-0.3826
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH
AIC	-2.1903	-2.4293	-8.8202	-6.5727	-6.9097	-5.5854	-3.4264
AR(1)-EGARCH(1,1,1)							
ω	-1.479**	-10.220**	-12.703**	-0.296**	-0.5684**	Coefficients are not Unique	-7.910525**
α	0.4250**	-0.1355	1.0516**	0.0953**	-0.1006**		-0.1095
γ	**0.0901***	-0.0181	**0.7774****	**0.1023****	**0.4543****		**0.3756****
β	0.7666**	-0.9365**	-0.0215	0.9767**	0.9493**		-0.2654**
α + β	**1.1916**	**-1.0720**	**1.0301**	**1.0720**	0.8487		-0.3749
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH		No ARCH
AIC	-2.1813	-2.4657	-8.8184	-6.6561	-6.9360		-3.4168
TGARCH(1,1,1)							
ω	0.0017**	0.001932	6.6E-07**	1.0E-06**	1.0E-06**	0.0002**	0.0013**
α	0.3243**	0.0056	0.1790**	0.1069**	0.3148**	0.2854	0.1500
γ	**-0.1642***	0.0588	0.0432	**-0.1152****	**-0.5961****	-0.3716	**-0.2839****
β	0.5384	0.5783	0.7694**	0.9383**	0.8667**	-0.0950	0.6000**
α + β	0.8627	0.5839	0.9484	**1.0452**	**1.1815**	0.1903	0.7500
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH
AIC	-2.1877	-2.4317	-9.0215	-6.5656	-6.9130	-5.5825	-3.2966
AR(1)-TGARCH(1,1,1)							
ω	0.0020**	0.0010	6.7E-07**	1.0E-06**	9.7E-07**	-1.99E-07	0.0012**
α	0.3084**	-0.0171	0.2181**	0.1048**	0.3172**	-0.0247*	0.1443*
γ	-0.0970	0.0342	0.0105	**-0.1037****	**-0.5975****	0.0281	**-0.2684****
β	0.4845**	0.7988	0.7494**	0.9346**	0.8652**	1.0122**	0.5906**
α + β	0.7928	0.7817	0.9675	**1.0393**	**1.1825**	0.9875	0.7349
ARCH LM	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH	No ARCH
AIC	-2.1814	-2.4471	-9.0360	-6.6383	-6.9092	-5.7412	-3.3575

Notes: * and ** denote the significance of the coefficients at 1% and 5% level respectively.

6.3.3 Descriptive Statistics of the Conditional Variances

The descriptive statistics of the conditional variances of the monthly stock market return and the monthly growth of the macroeconomic variables are presented in Table 6.5.

Table 6.5 Descriptive Statistics of Conditional Variances

Description	VDLDSEGEN	VDLIPI	VDLINT	VDLCPI	VDLEXR	VDLM2	VDLGDPRICE
Observations	298	298	298	298	298	298	298
Mean	0.008187	0.004863	1.17E-05	8.29E-05	0.000101	0.000181	0.001966
Median	0.005327	0.00486	5.50E-06	7.05E-05	7.11E-05	0.0002	0.001812
Maximum	0.126459	0.005727	0.0003	0.000182	0.000844	0.000349	0.010769
Minimum	0.003123	0.004701	1.11E-06	2.58E-05	6.88E-07	7.15E-05	0.000226
Std. Dev.	0.010412	8.50E-05	2.79E-05	4.00E-05	0.000113	6.96E-05	0.000889
Skewness	6.682812	6.189831	7.14885	0.627003	3.198088	-0.19478	5.051623
Kurtosis	63.90082	55.40078	61.80473	2.22551	17.99147	2.019498	42.66837
Jarque-Bera	48270.41	35997.13	45475.06	26.97	3298.55	13.82	20806.05
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000

Statistics of Table 6.5 reveal that the conditional variance of stock market return has the highest mean value (0.81%), this may be due to the catastrophes in the stock market during the study period. On the other hand, except money supply, the conditional variances of the growth of the other research variables exhibit positive skewness indicating extreme positive values, while opposite is true for money supply. Also, the Kurtosis values indicate that the distributions of all the conditional variances of the growth of research variables are not normal. Moreover, the Jarque-Bera statistics of the conditional variances confirm that the null hypothesis of "distribution is normal" are rejected at 1% significance level for all research variables, meaning that the distributions of the conditional variances of the growth of research variables are not normal.

6.3.4 Unit Root Test Results

ADF and PP unit root tests are used as per the procedure described in section 4.3 to check the stationarity of the conditional variances. For this purpose, the lag length of each variable to be used in unit root tests are determined using automatic lag selection criterion of VAR model. The summary of the results of optimal lag length selection[21] and unit root tests[22] are depicted in Table 6.6 and Table 6.7 respectively.

Table 6.6 Optimal Lag Lengths of Conditional Variances

Variables	Data at Level		Data at 1st Difference	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept
VDLDSEGEN	1	1	4	1
VDLIPI	1	1	3	3
VDLINT	6	6	5	5
VDLCPI	1	1	0	0
VDLEXR	3	3	8	8
VDLM2	7	7	13	13
VDLGDPRICE	4	4	7	7

Table 6.7 Results of Unit Root Tests of Conditional Variances

Panel A: Data at Level				
Variables	ADF Unit Root Test		PP Unit Root Test	
	Trend and Intercept	Intercept	Trend and Intercept	Intercept
VDLDSEGEN	**-6.378835***		**-6.980231***	
VDLIPI	**-11.98728***		**-15.06333***	
VDLINT	**-4.414721***		**-5.793349***	
VDLCPI	-2.191389	-1.895569	-2.154714	-1.922078
VDLEXR	**-4.531100***		**-6.273207***	
VDLM2	-2.164867	-1.177264	-3.113696	-1.739278
VDLGDPRICE	**-6.573112***		**-21.05608***	
Panel B: Data at First Difference				
VDLDSEGEN				
VDLIPI				
VDLINT				
VDLCPI	**-16.56358**		**-16.56358***	
VDLEXR				
VDLM2	**-3.679422**		**-21.54431**	
VDLGDPRICE				

Notes: Critical values at 5% level for ADF and PP tests with trend and intercept is -3.424977and with intercept is -2.871029. * denotes that significance of coefficient at 5%.

[21] See Appendix Q
[22] See Appendix R

The results of ADF and PP tests reveal that conditional variances of both inflation (VDLCPI) and money supply (VDLM2) are *(1)*, while other conditional variances are *I(0)*.

6.3.5 Cointegration Test Results

The results of the unit root tests indicate that the conditional variances of the research variables are either *I(0)* or *I(1)*. So, the ARDL cointegration approach has been applied to examine the long- and short-run relationships between the conditional variance of the stock market return and the conditional variances of the growth of macroeconomic indices. From Table 6.6, we have found that the dependent variable, conditional variance of the stock market return, has 1 lag, while among the regressors conditional variance of the growth of money supply has the highest 7 lags. So, in the ARDL approach, we have set maximum 1 lag for dependent variable and 7 lags for regressors and then we have allowed the EVIEWS software to choose the optimal lag length for each variable within the set limits.

Later, the log-likelihood ratio test for the joint hypothesis of unit root and deterministic linear trend is used to identify the trend specification of the variables. This distribution follows Chi-squared distribution and the critical value for one degree of freedom (as there is one restriction) is 3.841 at 5% significance level. The results of the log-likelihood ratio test are reported in Table 6.8, which show that none of the variables has trend. So, in ARDL test we include constant in the cointegration equation.

The results of ARDL specification along with the Pesaran Bounds Test[23] are summarized in Table 6.9. The bounds test results indicate that the null hypothesis of "no long-run relationships exist" is rejected and the alternative hypothesis "there exists long-run relationship" is accepted at 1 percent significance level, meaning that there exists a long-

[23] See Appendix S

run relationship between the conditional volatility of stock market return (dependent variable) and conditional volatilities of growth of six macroeconomic variables (independent variables).

Table 6.8 Log-likelihood Ratio Test Results for Trend Specification

Variables	Log-likelihood with joint hypothesis of a unit root		Test Statistics
	with a deterministic trend	with no deterministic trend	
LDSEGEN (lag)	1044.162 (1)	1043.568 (1)	1.188
LIPI (lag)	2748.232 (1)	2748.141 (1)	0.182
LINT (lag)	2800.137 (6)	2799.56 (6)	1.154
LCPI (lag)	3057.174 (1)	3056.523 (1)	1.302
LEXR (lag)	2380.233 (3)	2379.811 (3)	0.844
LM2 (lag)	3089.008 (7)	3087.156 (7)	3.704
LGDPRICE (lag)	1660.912 (4)	1660.26 (4)	1.304

Notes: This distribution follows Chi-squared distribution and the critical value for one degree of freedom is 3.841 at 5% significance level.

Table 6.9 Results of ARDL Specification and Bounds Test

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (1, 0, 0, 0, 0, 0,0)		
F Statistics	7.224021	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43
R-squared	0.148919	
Adjusted R-squared	0.128305	
F-statistic	7.224021	
Prob (F-statistic)	0.000000	
Durbin-Watson stat	2.023549	

The R^2 value indicates that only 14.89 percent of the conditional variance of the stock market return can be explained by the conditional variances of the growth of selected macroeconomic indices. The remaining 85.11 percent can be explained by the factors which have not been considered in the research. The F value is significant at 1% level, meaning that the regression coefficients are significant. The Durbin Watson statistic indicates that the residuals are uncorrelated. However, the results have indicated that a very small percentage of conditional variance of the stock market return can be explained by the macroeconomic conditional variances.

As there exists cointegration relationship, so we have examined the cointegrating form and long-run relationship (see Appendix S 3) and summary of the results is presented in Table 6.10. The results show that the conditional variances of growth of industrial production, consumer price index and exchange rate are positively related with conditional volatility of the stock market return and the conditional variances of interest rate, money supply and gold price are negatively related with the conditional volatility of stock market return. However, none of the coefficients of the independent variables is statistically significant, meaning that none of the macroeconomic volatilities can significantly explain the conditional volatility of the stock market return in the long-run.

Table 6.10 Cointegrating Form and Long-run Coefficients

Independent Variables	Coefficient	Std. Error	*t*-Statistics	Probability
Cointegrating Form				
D(VDLIPI)	16.1356	14.1312	1.1418	0.2545
D(VDLINT)	-2.4846	24.0569	-0.1033	0.9178
D(VDLCPI)	-15.0721	54.0001	-0.2791	0.7804
D(VDLEXR)	-0.5323	5.3113	-0.1002	0.9202
D(VDLM2)	-21.8343	52.8713	-0.4130	0.6799
D(VDLGDPRICE)	0.0930	0.3072	0.3029	0.7622
C	-0.0033	0.0006	-5.1986	0.0000
CointEq(-1)	-0.2911	0.0409	-7.1139	0.0000
Cointeq = VDLDSEGEN - (3.2256*VDLIPI - 27.2636*VDLINT + 55.4220 *VDLCPI + 4.8936*VDLEXR - 4.0855*VDLM2 - 0.0856*VDLGDPRICE – 0.0114)				
Long Run Coefficients				
LIPI	3.225608	18.540106	0.173980	0.8620
LINT	-27.263562	55.472937	-0.491475	0.6235
LCPI	55.421955	43.320414	1.279350	0.2018
LEXR	4.893638	14.317226	0.341801	0.7327
LM2	-4.085459	27.190930	-0.150251	0.8807
LGDPRICE	-0.085621	1.666623	-0.051374	0.9591

Similarly, the short-run relationships show that all the independent variables have zero lag, meaning that there exist no short-run relationships between the variance of stock market return and the variances of growth of macroeconomic variables. So, there is a short-run disequilibrium between stock market volatility and macroeconomic volatility. However, the results of Error Correction Model (ECM) show that the error correction coefficient is -0.2911 (*p*-value 0.0000), which specifies that the error-correction term (ECT) is highly significant. Moreover, the ECT has the correct sign which implies a moderate speed of adjustment to equilibrium after a shock. The ECT indicates that approximately 29.11 percent of the short-run disequilibria is adjusted per month to bring about long-run equilibrium.

6.3.6 Viability and Stability Check of the Model

Finally, we have checked the viability as well as the stability of the model. A model is viable if the residuals are homoscedastic, not serially correlated and normally distributed. So, the tests of residual for normality, autocorrelation, and heteroscedasticity are carried out to examine the significance of the results. The correlogram of the residuals (see Appendix R 4.1) is estimated up to 36 lags. The Ljung-Box Q statistics is used to investigate whether the residuals are serially correlated. The high *p*-value indicates that the residuals are not serially correlated. Therefore, we conclude that residuals are independent (stationary).

Furthermore, we have used Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test and Jarque-Bera statistic to examine residuals for the serial correlation, homoscedasticity and normality respectively to check the robustness of the results. The results of these tests (see Appendix S 4) have indicated that the residuals are not serially correlated, however, the residuals show heteroskedasticity and the distribution of the residuals is not normal. So, the results have indicated that the model is not a good fit model. So, the results of the cointegration test and the error correction model are not reliable.

In addition, we have applied Cumulative Sum (CUSUM) test to check the stability of the coefficients and Cumulative Sum Squares (CUSUMSQ) test to check the stability of the variances of the coefficients. The plot of CUSUM control chart (see Figure 5.1) has indicated that the slope parameters (coefficients) are unstable around 1996. Also, the CUSUMSQ chart (see Figure 5.2) shows that the variances of the residuals are unstable for most of the period. So, the results indicate that the coefficients are not stable over most of the period, meaning that the relationship is not stable over the period.

Figure 6.2 Cumulative Sum (CUSUM) Control Chart

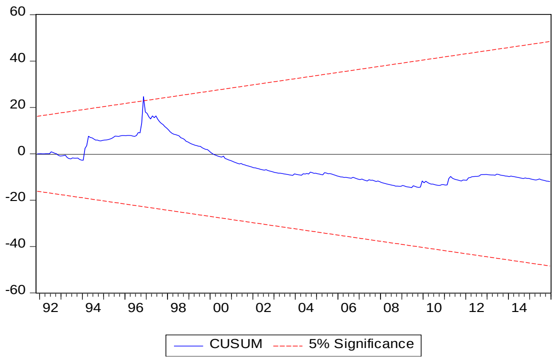
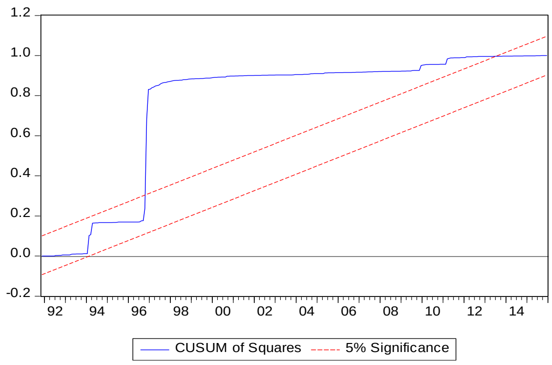


Figure 6.3 Cumulative Sum of Squares (CUSUMSQ) Control Chart



The above results have indicated that the cointegration model for total sample period (from January 1991 to December 2015) is not a good fit model and the coefficients are not stable over the period. In addition, long- and short-run coefficients of the macroeconomic volatilities are not found statistically significant to explain stock market volatility. So, the findings of the model are not reliable and significant. One of the reasons of this instability may be due to the catastrophes of 1996 and 2010. However, findings indicate that the catastrophe of 1996 is more prominent than that of 2010.

For the total sample period, we have found volatility clustering of the residuals and higher volatilities are seen around 1996 and 2010. These results have motivated us to apply the volatility estimation model over the period between the catastrophes of 1996 and 2010, which is named as the recovery period in this study.

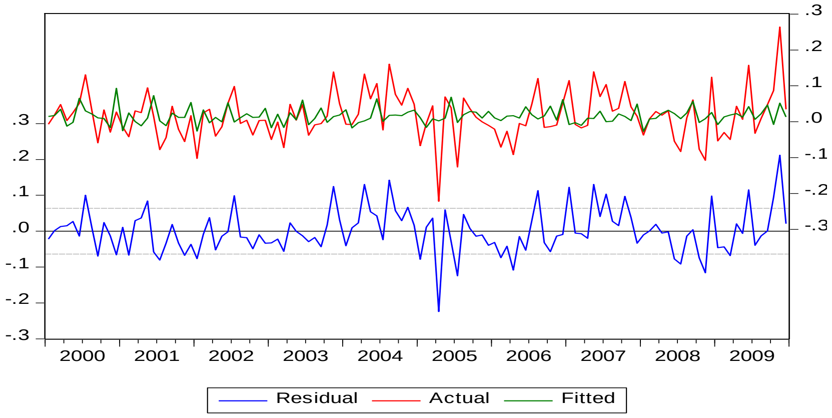
6.3.7 Volatility Modeling for the Recovery Period

In chapter 5, we have considered the period from January 2000 to December 2009 as recovery period because between the catastrophes of 1996 and 2010, this period is considered as the most stable period of our stock market. Moreover, numerous reform measures have been implemented during this period to achieve a sustainable development of the stock market and also the automation and upgradation of the trading platform have been implemented since August 1998 to build up a state-of-the-art market surveillance system to increase the transparency of the transactions as well as to strengthen the surveillance system. These steps are expected to enhance the investors' confidence and to improve the efficiency of the stock market.

To modeling volatility of the recovery period, the first pre-test of the estimation process is to check the stationarity of the variables. The first difference of the research variables in the recovery period are stationary (see section 5.4). Furthermore, the second pre-test for volatility modeling is to check the residuals for autocorrelation and heteroscedasticity. For the purpose, the research variables are fitted the into Ordinary Least Squares (OLS) with the stock market return as dependent variable and the growth of macroeconomic variables as independent variables. Then the residuals of the OLS are checked for autocorrelation and heteroskedasticity using Breusch-Godfrey Serial Correlation LM and Autoregressive Conditional Heteroscedasticity (ARCH) Tests respectively. The results of Breusch-Godfrey Serial Correlation LM and Autoregressive Conditional Heteroscedasticity (ARCH) tests (see Appendix T) show that the residuals are not serially correlated and not heteroskedastic respectively at 5 percent significance level.

So, the results reveal that the GARCH model cannot be applied for estimation for this period, because the GARCH model can only be applied when the residuals are serially correlated and heteroskedastic. The plot of residuals (see figure 6.4) also depicts that there is no volatility clustering during the period.

Figure 6.4 Residuals of Ordinary Least Squares Estimation for the Recover Period



Moreover, the OLS results shows that among the independent variables only the growth of money supply is statistically significant (see Appendix T) and has the highest sensitivity among the determinants suggesting that in the recovery period the of growth of money supply has the highest impact on the stock market return. This result is consistent with the result of cointegration test of chapter 5, where we have found that the only the growth of money supply is significant in explaining the stock market return in the recovery period.

6.4 Conclusion

The residuals of Ordinary Least Squares (OLS) estimation of research variables for the total sample period (from January 1991 to December 2015) with stock market return as dependent variable and the growth of macroeconomic variables as independent variables have showed serial correlation and heteroskedasticity, which has warranted the use of GARCH family models to estimate the relationship. Among the different GARCH models the EGARCH(1,1,1) model has been found as the best suited model for the estimation.

The mean equation of the EGARCH model has shown that both the growth of inflation and money supply are significantly positively related with the stock market return, while growth of exchange rate is significantly negative relatively with the stock market return. On the other hand, the growth of other macroeconomic variables - namely industrial production index, interest rate and gold price, are not significantly related with the stock market return at 5 percent significance level. These results indicate the importance of inflation, exchange rate and money supply for Bangladesh stock market.

The variance equation has shown the presence of asymmetric effect of good and bad news on the stock market conditional volatility, with good news imply a higher next period conditional variance compared to the bad news of the same magnitude. This result has indicated that the conditional volatility of stock market return in Bangladesh does not have any leverage effect. Also, highly significant ARCH and GARCH coefficients have indicated that the new surprise as well as the lagged values of volatilities of stock market return have significant impact on current stock market volatility. Nevertheless, the estimated GARCH coefficient is higher compared to the estimated ARCH coefficient indicating that the stock market volatility is more sensitive to its past volatilities than to new surprises. Furthermore, the summation of GARCH and ARCH coefficients is very high indicating that a shock persists over many future periods.

Although the residuals of Ordinary Least Squares (OLS) estimation for the total sample period (from January 1991 to December 2015) have shown serial correlation and heteroskedasticity, but the residuals of OLS estimation for the recovery period (from January 2000 to December 2009) are not serially correlated and homoscedastic. Moreover, the volatility clustering is observed in the total sample period, while this is not found in the recovery period. The non-linearity and volatility clustering in the stock market return might have been observed in the total sample period due to the catastrophes of 1996 and 2010.

On the other hand, the results of cointegration have shown that there exists a long-run cointegrating relationship between the stock market conditional volatility and the conditional volatilities of the growth of macroeconomic variables. But none of the coefficients in the long-run equation is found statistically significant at 5 percent level. The Bounds test results have revealed that only 14.89 percent of the conditional variance of the stock market return can be explained by the selected macroeconomic variables' volatilities, meaning that remaining 85.11 percent is explained by other factors which have not been considered in this research. This result indicates that only a small percentage of stock market volatility can be explained by the selected macroeconomic variables' volatilities. So, we can conclude that stock market volatility has been driven by factors, which have not been considered in the research.

The result of Error Correction Model (ECM) has shown that the error correction term (ECT) is highly significant and has the correct sign. The ECT also indicates that approximately 29.11 percent of the short-run disequilibria is adjusted per month to bring about long-run equilibrium. Also, all the independent variables have zero lag indicating that there exist no short-run relationships between stock market volatility and macroeconomic volatility.

The results of the viability check of the model have indicated that although the residuals are not serially correlated, but residuals are heteroskedasticity and the distribution is not normal, suggesting that the ARDL cointegration model used is not a good fit model. In addition, the results of the stability tests of the coefficients have indicated that the coefficients are unstable over most of the period indicating that the relationship between the stock market volatility and the macroeconomic volatilities are unstable during the period.

Therefore, we can conclude that the findings of this chapter have indicated nonlinear relationship between the stock market return and the growth of macroeconomic variables, and the presence of volatility clustering of the residuals over the total sample period. In addition, the stock market volatility cannot be reliably explained by the macroeconomic variables' volatilities. The stock market volatility has been found very unstable over the period. On the other hand, in the recovery period, no nonlinearity has been observed, which indicates that the catastrophes of 1996 and 2010 has created this nonlinearity and volatility clustering in the stock market.

Chapter 7

Relationship between Stock Market and Real Economy

7.1 Introduction

In the last three empirical investigation chapters, the relationships between stock market index and macroeconomic indices of Bangladesh have been investigated from different perspectives. However, out of the six macroeconomic variables selected for the study, five have been chosen from financial sector and one from real sector of economy. Stock market is also a financial sector macroeconomic variable. Therefore, it may give the impression that the research has examined relationship between one financial sector variable, the stock market index, and the macroeconomic factors which are mostly chosen from the financial sector, leaving a gap on relationship between the stock market and the real sector macroeconomic variable to understand the impact of stock market on real economy.

There is a widespread agreement that a viable stock market provides diversified channels for limited resources from surplus units to deficit units, hence it is supposed to play a significant role in economy in the sense that it mobilizes domestic resources and channels them to productive investments. This implies that an economy with well-functioning stock markets will experience a higher growth rate of productivity. For this reason, a stock market is seen as a general measure of the state of the real economy of a country where it operates. Harvey (1989) has mentioned that stock market contains valuable information about real economic activities.

Kar and Mandal (2011) have argued that stock prices can have a direct impact on economic output through the financial accelerator and wealth effect channels. The financial accelerator channel focuses on the impact that stock prices have on firms' balance sheets (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). As the ability of firms to borrow depends substantially on the collateral they can pledge, hence higher credit can be raised if stock price increases. This additional fund can be used for investment purposes, which in turn triggers an expansion in real economic activities. Alongside, the wealth effect channel suggests that with the rise in stock prices investors become wealthier and their propensity to consume more results in expansion of economy. Thus, a positive relationship exists between efficient stock markets and economic growth both in the short- and long-run primarily through the effect of stock markets on investment (Masoud, 2013).

Conversely, opponents to this view argue that stock markets are just a side show of total financing activities of a country, since firms raise relatively little cash from public markets. Therefore, stock markets play a minor role in channeling savings to investments, and stock prices passively reflect real economic conditions without affecting them. Many studies have supported this view. For example, Binswanger (2001) has argued that the relation has broken down. In a similar vein, Stock and Watson (2001) have showed that certain asset prices predict output growth in some countries in some periods.

Despite all these controversies, economic theory suggests that there should be a strong link between economic activities and security prices (Duca, 2007). Many empirical studies have confirmed the link between stock prices and real sector variables (Fama, 1981; Schwert, 1990). However, the empirical evidence, particularly in the South Asian region, regarding the direction of causality between stock prices and the real sector variables is not conclusive. Krchniva (2013) has argued that the relationship between the stock market and the real economy depends on the size and maturity of the economy and its stock market.

In this connection, it is worth mentioning that Bangladesh stock market and its economy have been passing through numerous liberalization and deregulation processes since 1991. The measures taken for economic liberalization, privatization, relaxation of foreign exchange controls, and the opening of the stock markets to international investors are supposed to have great impacts on the economy and the stock market. As a result, the indicators like stock market capitalization, trading volume and the market index have shown phenomenal growth during this period. The market capitalization of Dhaka Stock Exchange (DSE) to GDP has increased from 0.94% in June 1991 to about 30.95% in June 2009 (Wahab and Faruq, 2012). Also, the size of the economy has increased significantly. In this context, it would be very interesting to investigate the relationship of the stock market with the dynamics of real economic activities of Bangladesh.

Moreover, Bangladesh stock market has experienced two major bubbles within a decade and a half, one in 1996 and other in 2010. However, our investigations have revealed that only the catastrophe of 1996 has created a structural instability in the stock market. This has motivated us to examine the relationships between the stock market and the real economy around the catastrophe of 1996, that is during the bubble and meltdown periods of 1996. In fact, these investigations have been conducted to describe the relationships during the crisis times of the stock market.

On the other hand, following the crash of 1996, several capital market development programs have been implemented through a strong partnership between the government of Bangladesh and the Asian Development Bank to broaden the market capacity and develop a fair, transparent, and efficient domestic capital market. The main objective of these programs has been set forth to restore investors’ confidence, which has significantly damaged after the market crash of 1996, because of excessive speculations, allegedly aggravated by widespread irregular activities. In addition, the stock market has been striving for continuous upgradation of its trading platform since August 1998 to fulfill the dream of transforming Dhaka Stock Exchange (DSE) into modern world class exchange. In these perspectives, this study has also examined whether these initiatives have increased the response of stock market to real economy of Bangladesh.

This chapter is organized into six sections. In section 7.2, we have discussed the methodology to be used in the analyses. In section 7.3, the results of the investigations for different periods have been reported. To examine the significance of the results, the diagnostic tests of the residuals have been conducted. Furthermore, the stability tests have been applied to investigate the stability of the regression parameters. Finally, in section 7.4, the findings of the investigations are summarized in the conclusion.

7.2 Empirical Method

In this research, the industrial production index is the only macroeconomic variable chosen from the real sector. Furthermore, the industrial production index has been used as a proxy of GDP, because data on the former is available on monthly basis but the latter is not. Moreover, the productive capacity of an economy indeed depends directly on the accumulation of real assets, which in turn contributes to the production capacity of firms. Thus, economies of scale may generate higher profitability due to increased turnover. Tainer (1993) has argued that the industrial production index is procyclical and can be used as a proxy of the level of economic activities.

In this context, the industrial production index has been used to represent the real economy of Bangladesh. On the other hand, the Dhaka Stock Exchange General Index has been used to represent the stock market. The month end data of 25 years of the aforesaid variables have been collected, then these data are adjusted considering a base value 100 at the beginning of our sample period i.e. the end of January 1991.

The empirical investigations of this chapter have been carried out using the econometric models outlined in chapter 4. More specifically, the econometric models for unit root tests to check the presence of unit root and the order of integration of the research variables, the Johansen and Juselius cointegration test and the ARDL cointegration approach to examine the long-run relationships along with the error correction model to investigate the short-run dynamics and significance of error correction mechanism have been used in the analyses.

The empirical investigations have been carried out to examine the relationships between stock market and real economy of Bangladesh in different periods. Firstly, the relationships have been examined on total sample period. Later, the relationships have been examined around the catastrophe of 1996, that is during the bubble and meltdown periods of 1996. Finally, the study has been extended further to cover the period between the two catastrophes of Dhaka Stock Exchange to examine whether the reform measures for the development of the stock market as well as the automation initiatives to build up a state-of-the-art market surveillance system to increase the transparency of market transactions have enhanced the investors' confidence and improved the efficiency of the stock market.

7.3 Findings of the Study

The results of empirical investigations on relationships between stock market and real economy of Bangladesh in different periods are reported in this section. Firstly, we have summarized the results of unit root tests and the trend specification of the research variables. Secondly, results of the cointegration test have been reported. Thirdly, the findings of Error Correction Model (ECM) have been presented. Fourthly, we have checked the viability of the model using residuals diagnostic tests. Additionally, the stability of the parameters of the equations have been examined. Finally, the results of Granger Causality test have been portrayed.

7.3.1 Unit Root Tests Results

In section 4.4.2, we have found that DSE General Index and Industrial Production Index for the period from January 1991 to December 2015 are integrated of order 1, *I(1)*. Also, in section 5.4, we have found that DSE General Index and Industrial Production Index are *I(1)* and *I(0)* respectively in the bubble period, both the variables are *I(0)* in the meltdown period. In the recovery period, ADF test indicates that both the variables are *I(1)*. On the other hand, PP test indicates DSE General Index is *I(1),* but Industrial Production Index is *I(0)*. As PP test is robust to general forms of heteroskedasticity in the error terms, we have accepted the PP test result and concluded that DSE General Index and Industrial Production Index are *I(1)* and *I(0)* respectively.

7.3.2 Trend Specification of the Variables

After the unit root tests, the second pre-test for cointegration analysis is to identify the most appropriate trend specification. From section 4.4.3, we have found that industrial production index for the period from January 1991 to December 2015 at level has significant trend. Also, from section 5.5, we have found that industrial production index has significant trend in both the bubble and meltdown periods and DSE general index has significant trend in the recovery period. Based on the results of unit root tests and the trend specification, we have applied cointegration tests as per the procedure described in chapter 4 and the results are reported in the following sub-sections.

7.3.3 Relationships in the Total Sample Period

As DSE General Index and Industrial Production Index for the period from January 1991 to December 2015 are integrated of order 1, *I(1)*, so both the cointegration tests has been applied to examine the long- and short-run relationships between the stock market and the real economy. Furthermore, it is found that industrial production index has significant trend in this period, so the restricted trend has been included in the cointegration tests.

7.3.3.1 Johansen and Juselius Cointegration Results

The optimal lag length for the Johansen and Juselius cointegration model is determined using the automatic lag length selection criteria. The result[24] shows that out of five selection criteria three have supported 14 lags, hence lag length 14 has been used in the cointegration analysis. The results of the cointegration test[25] (see Table 7.1) show that the variables are not cointegrated, meaning that there exists no cointegration relationship between the stock market and the real economy.

Table 7.1 Results of Johansen and Juselius Cointegration Test on Total Sample Period

Hypothesized Number of CE(s)	Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
	Trace Statistic	Critical Value at 5% Significance	Probability	Max-Eigen Statistics	Critical Value at 5% Significance	Probability
None	13.13324	25.87211	0.7278	10.51561	19.38704	0.5639
At most 1	2.617633	12.51798	0.9185	2.617633	12.51798	0.9185

As the variables are not cointegrated, so the Vector Autoregression (VAR) Model has been applied instead of Vector Error Correction Model (VECM) to examine the short-run relationships between the stock market and the real economy. The VAR has been applied on 1st differences of the variables, which represent the growth of the variables.

[24] See Appendix U
[25] See Appendix V

To apply the VAR model, we need to choose the optimal lag length. Again, the lag length selection criteria have been used to estimate the optimal lag length to be used in the VAR model. The result shows (see Appendix V 2.1) that the preferred lag length is 13. Thus, lag length 13 has been used in the VAR estimation. The summary of the results (see Appendix V 2.2) is portrayed in Table 7.2. The results show that lagged values of growth of industrial production do not jointly explain the stock market return at 5% significance level, while the lagged values of stock market return can jointly explain the growth of industrial production at 5% significance level. Thus, the VAR result is consistent with the financial theory that the stock market is a leading indicator of industrial production, meaning that the stock market is a leading indicator of the real economy.

Table 7.2 Significance of the Independent Variable in VAR Model on Total Sample Period

Independent Variables	Null Hypothesis	χ^2 Statistics	*p*-value
DLIPI	C(14) = C(15) = C(16) = C(17) = C(18) = C(19) = C(20) = C(21) = C(22) = C(23) =C(24) = C(25) = C(26) = 0	6.821183	0.9111
DLDSEGEN	C(28) = C(29) = C(30) = C(31) = C(32) = C(33) = C(34) = C(35) = C(36) = C(37) = C(38) = C(39) = C(40) = 0	**36.78324***	**0.0004**

Notes: * denotes the significance of the coefficient at 5% level.

7.3.3.2 Granger Causality Test Results

The Granger Causality test is carried out for 12 lags, considering that the market is efficient and one year is quite long time to propagate the impact of one variable to the other. The results of the Granger causality (see Appendix V 2.3) have been portrayed in Table 7.3, the results indicate that there is a unidirectional causality running from stock market return to growth of industrial production index. This result is consistent with the results of Granger causality test of chapter 4 (see section 4.4.4), where VECM Granger Causality Test has been applied with stock market return as dependent variable and all the macroeconomic variables as independent variables and the results have indicated a unidirectional causality running from the stock market return to growth of industrial production index. Thus, we can conclude that the stock market is a leading indicator of economic growth represented by the industrial production.

Table 7.3 Results of Granger Causality Test on Total Sample Period

Null Hypothesis	χ^2 Statistics	Probability
D(LIPI) does not Granger Cause D(LDSEGEN)	0.97146	0.4765
D(LDSEGEN) Does not Granger Cause D(LIPI)	**2.09862***	**0.0174**

Notes: * denotes that coefficient is significant at 5% level.

7.3.3.3 ARDL Cointegration Test Results

We have used the ARDL Bounds testing procedure to check the robustness of the results of Johansen and Juselius cointegration test. For ARDL model, we need to select the optimal lag lengths for both the dependent variable, DSE General Index (LDSEGEN), and the regressor, Industrial Production Index (LIPI). From Table 4.4, we have found that at level the dependent variable (i.e., LDSEGEN) has 2 lags and regressor (i.e., LIPI) has 6 lags. So, we have used these two lag values in the ARDL test.

It is mentioned earlier that industrial production index has significant trend. So, in the ARDL test, we have included trend in the cointegration equation. The results of ARDL specification and the Pesaran Bounds Test are summarized in Table 7.4. The Bounds test result indicates that null hypothesis of "no long-run relationship exists" cannot be rejected at 5% significance level, meaning that there is no cointegration relationship between stock market index (dependent variable) and industrial production index (independent variables) in the total sample period.

Besides, the Bounds test results also have showed that R^2 is 0.0543, which indicates that about 5.43 percent of the variation in stock market return can be explained by the changes of industrial production index. The F value is significant at 10% level, meaning that the regression coefficients are weakly significant. The Durbin Watson statistic confirms the presence of non-autocorrelated residuals. The results of error correction model (see Appendix V 3.4) indicate that the lagged values of industrial production index cannot jointly explain the stock market return. These results are similar to that of Johansen and Juselius cointegration test and the VAR model, which confirm the robustness of the results.

Table 7.4 ARDL Specification and Bounds Test Results on Total Sample Period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (2,6)		
F Statistics	**1.992034**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.50	4.63
R-squared	0.054349	
Adjusted R-squared	0.020934	
F-statistic	1.626468	
Prob (F-statistic)	0.098602	
Durbin-Watson stat	2.024204	

The viability tests (see Appendix V 3.4) of the model show that the residuals are not serially correlated. However, the residuals are heteroskedastic, and the distribution of the residuals are not normal. These results reveal that the model is not a good fit model. Moreover, the CUSUM and CUSUMSQ plots of the residuals (Figure 7.1 and Figure 7.2) indicate that the regression parameters are not stable.

Figure 7.1 Cumulative Sum (CUSUM) Control Chart for Total Sample Period

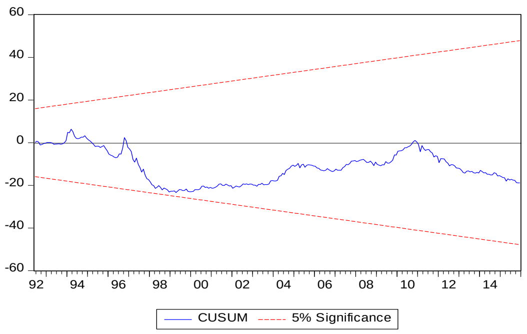
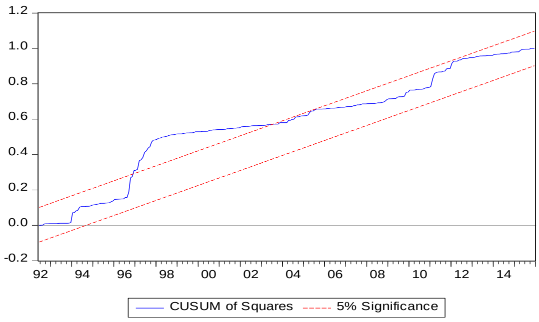


Figure 7.2 Cumulative Sum Squares (CUSUMSQ) Control Chart for Total Sample Period



7.3.4 Relationships in the Bubble Period

As the DSE General Index and Industrial Production Index are *I(1)* and *I(0)* respectively and industrial production index has significant trend in the bubble period, so we have applied the ARDL approach with restricted trend to examine the cointegration relationship between the stock market and industrial production index.

7.3.4.1 ARDL Cointegration Test Results

From Table 5.3, we have found that at level the dependent variable (i.e., LDSEGEN) has 4 lags and regressor (i.e., LIPI) has 1 lag. So, we have used these two lag values in ARDL test. The results of ARDL specification and the Pesaran Bounds Test (see Appendix W 1.1 and W 1.2) are summarized in Table 7.5. The results indicate that null hypothesis of "no long-run relationship exists" cannot be rejected at 5% significance level, meaning that there is no cointegration relationship between stock market index and industrial production index in the bubble period.

Table 7.5 ARDL Specification and Bounds Test Results on Bubble Period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (4,1)		
F Statistics	**2.269957**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.30	5.83
1%	6.10	6.73
R-squared	0.201779	
Adjusted R-squared	0.087747	
F-statistic	1.769501	
Prob (F-statistic)	0.114957	
Durbin-Watson stat	1.990436	

The Bounds test have also indicated that about 20.18 percent of the stock market return can be explained by the changes of industrial production index. The F value is not significant, meaning that the regression coefficients are not significant. The Durbin Watson statistic confirms the presence of non-autocorrelated residuals. The results of error correction model (see Appendix W 1.3) indicate that industrial production index has 1 lag and the *t*-statistic along with associated *p*-value show that industrial production index cannot explain the stock market return in the short-run.

The viability tests of the model (see Appendix W 1.4) show that the residuals are not serially correlated. However, the residuals are heteroskedastic, and the distribution of the residuals is not normal. These results indicate that though the residuals are not serially correlated, other two conditions are not fulfilled, hence the model is not a good fit model. Moreover, the CUSUM and CUSUMSQ plots of the residuals (Figure 7.3 and Figure 7.4) indicate that the regression parameters are not stable over the period.

Figure 7.3 Cumulative Sum (CUSUM) Control Chart for Bubble Period

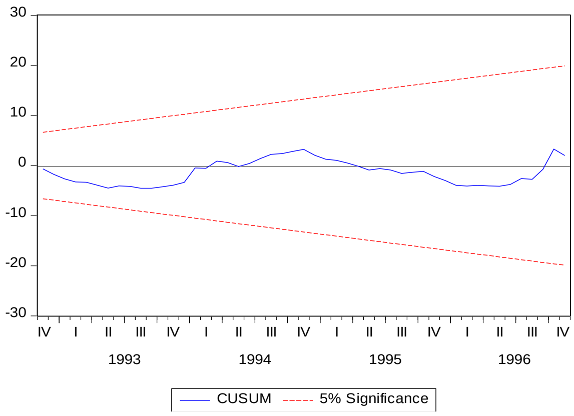
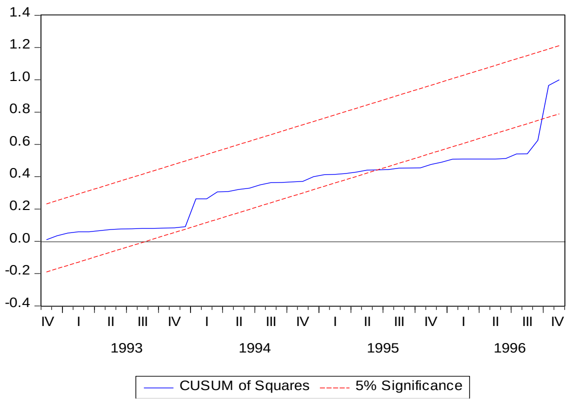


Figure 7.4 Cumulative Sum Squares (CUSUMSQ) Control Chart for Bubble Period



7.3.4.2 Granger Causality Test Results

The Granger Causality test is carried out for 12 lags, considering that the market is efficient and one year is quite long to propagate the impact of one variable to the other. The results of the granger causality (see Appendix W 1.5) are shown in Table 7.6, which indicate that there is no causal relation between stock market return and growth of industrial production index.

Table 7.6 Results of Granger Causality Test on Bubble Period

Null Hypothesis	χ^2 Statistics	Probability
D(LIPI) does not Granger Cause D(LDSEGEN)	0.48013	0.9116
D(LDSEGEN) Does not Granger Cause D(LIPI)	1.50509	0.1734

Notes: * denotes that coefficient is significant at 10% level.

7.3.5 Relationships in the Meltdown Period

In the meltdown period, both DSE General Index and Industrial Production Index are *I(0)*, and industrial production index has significant trend, so we have applied the ARDL approach with restricted trend to examine the cointegration relationship between the stock market and industrial production index.

7.3.5.1 ARDL Cointegration Test Results

From Table 5.3, we have found that at level both the dependent variable (i.e., LDSEGEN) and the regressor (i.e., LIPI) have 2 lags in the meltdown period. So, we have used these lag values in ARDL test. The results of ARDL and Bounds tests (see Appendix W 2.1 and W 2.2) are summarized in Table 7.7, which indicate that the null hypothesis of "no long-run relationship exists" cannot be rejected at 5% significance level, meaning that there is no cointegration relationship between stock market index and industrial production index.

Table 7.7 ARDL Specification and Bounds Test Results on Meltdown Period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (2,2)		
F Statistics	**4.949526**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73
R-squared	0.351140	
Adjusted R-squared	0.225554	
F-statistic	2.796016	
Prob (F-statistic)	0.027220	
Durbin-Watson stat	2.464886	

The Bounds test results also have indicated that R^2 is 0.3511, meaning that about 35.11 percent of the stock market return can be explained by the growth of industrial production index. The F value is significant at 5% level, meaning that the regression coefficients are significant. However, the Durbin Watson statistic indicates the presence of autocorrelated residuals. The results of error correction model (see Appendix W 2.4) indicate that industrial production index cannot jointly explain the stock market return.

The viability tests of the model (see Appendix W 2.5) show that the residuals are serially correlated, and the distribution of the residuals is not normal. However, the residuals do not show heteroskedasticity. These results indicate that the model is not a good fit model. Moreover, the CUSUM and CUSUMSQ plots of the residuals (Figure 7.5 and Figure 7.6) indicate that the regression parameters are not stable over the period.

Figure 7.5 Cumulative Sum (CUSUM) Control Chart for Meltdown Period

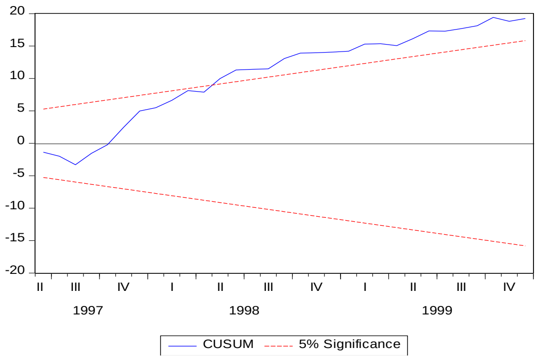
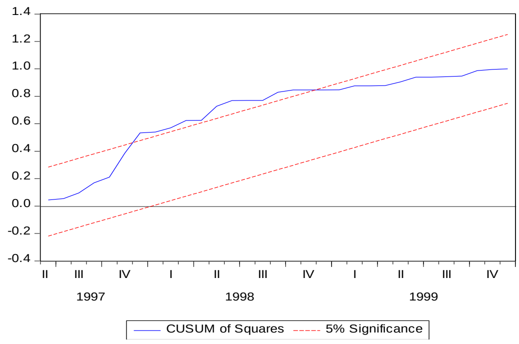


Figure 7.6 Cumulative Sum Squares (CUSUMSQ) Control Chart for Meltdown Period



7.3.5.2 Granger Causality Test Results

The Granger Causality test is carried out for 12 lags, considering that the market is efficient and one year is quite long to propagate the impact of one variable to the other. The results of the granger causality (see Appendix W 2.6) are reported in Table 7.8, the results indicate that there is a unidirectional causal relation between stock market return and growth of industrial production index running from DSE general index to industrial production index at 10% significance level.

Table 7.8 Results of Granger Causality Test on Meltdown Period

Null Hypothesis	χ^2 Statistics	Probability
D(LIPI) does not Granger Cause D(LDSEGEN)	0.53036	0.8593
D(LDSEGEN) Does not Granger Cause D(LIPI)	**2.46593***	**0.0601**

Notes: * denotes that coefficient is significant at 10% level.

7.3.6 Relationships in the Recovery Period

In the recovery period, DSE General Index and Industrial Production Index are *I(1)* and *I(0)* respectively and DSE General Index has significant trend, so we have applied the ARDL approach with restricted trend to examine the cointegration relationship between the stock market and industrial production index.

7.3.6.1 ARDL Cointegration Test Results

For ARDL model, we need to choose the optimal lag lengths for both the dependent and independent variables. From Table 5.3, we have found that the dependent variable (i.e., LDSEGEN) and the independent variable (i.e., LIPI) at level have 10 and 12 lags respectively. So, we have used these lag values in ARDL test. The results of ARDL specification and the Pesaran Bounds Test (see Appendix W 3.1 and W 3.2) are summarized in Table 7.7. The Bounds test result indicates that null hypothesis cannot be rejected at 5% significance level, meaning that there is no cointegration relationship between stock market index and industrial production index in recovery period.

The Bounds test results also have indicated that about 37.41 percent of the variation in stock market return can be explained by the changes of industrial production index. The F statistic is significant at 5% level, meaning that the regression coefficients are significant. Also, the Durbin Watson statistic indicates the presence of non-autocorrelated residuals. The results of error correction model (see Appendix W 3.4) indicate that industrial production index cannot jointly explain the stock market return.

Table 7.9 ARDL Specification and Bounds Test Results on Recovery Period

Dependent Variable: D(LDSEEGEN)		
ARDL Model Specification (10,12)		
F Statistics	**2.637625**	
Critical Value Bounds		
Significance	I_0 Bound	I_1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.30	5.83
1%	6.10	6.73
R-squared	0.374052	
Adjusted R-squared	0.215918	
F-statistic	2.365410	
Prob (F-statistic)	0.001710	
Durbin-Watson stat	2.019811	

The viability tests of the model (see Appendix W 3.5) show that the residuals are not serially correlated, do not show heteroskedasticity, and the distribution of the residuals is normal. These results indicate that the model is a good fit model. Moreover, the CUSUM and CUSUMSQ plots of the residuals (Figure 7.7 and Figure 7.8) indicate that the regression parameters are stable over the period. The viability and stability test have confirmed that the results of the model are stable and significant.

Figure 7.7 Cumulative Sum (CUSUM) Control Chhart for Recover Period

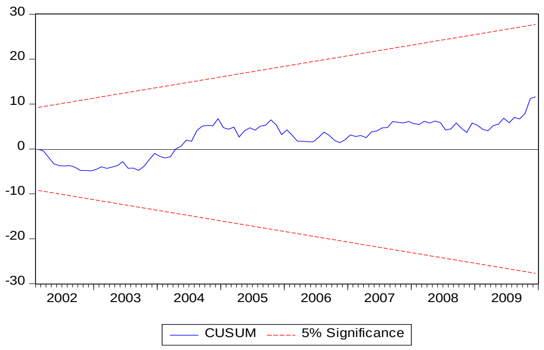
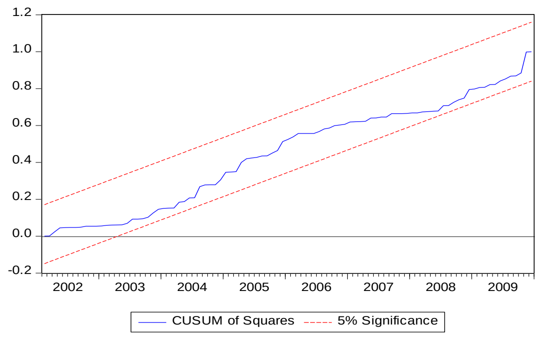


Figure 7.8 Cumulative Sum Squares (CUSUMSQ) Control Chhart for Recover Period



7.3.6.2 Granger Causality Test Results

The Granger Causality test is carried out for 12 lags, considering that the market is efficient and one year is quite long time to propagate the impact of one variable to the other. The results of the granger causality (see Appendix W 3.6) are shown in Table 7.8, the results indicate that there is a unidirectional causal relation between stock market return and growth of industrial production index with direction of causality running from growth of industrial production index to DSE general index at 10% significance level, hence indicating the inefficiency of the stock market during the recovery period.

Table 7.10 Results of Granger Causality Test on Recovery Period

Null Hypothesis	χ^2 Statistics	Probability
D(LIPI) does not Granger Cause D(LDSEGEN)	**1.66724***	**0.0865**
D(LDSEGEN) Does not Granger Cause D(LIPI)	0.66191	0.7834

Notes: * denotes that coefficient is significant at 10% level.

7.4 Conclusion

In this research, industrial production index has been considered as a proxy of GDP, hence it is used to represent the real sector of economy to examine the relationship between stock market and real economy of Bangladesh. Firstly, the empirical investigations have been conducted on total sample period i.e. on 25 years data. Later, the relationships have been examined around the catastrophe of 1996, that is during the bubble and meltdown periods of 1996, to assess the relationships during the crisis times. Moreover, following the crash of 1996, several capital market development programs as well as automation and upgradation of the trading platform are being implemented to broaden market capacity and to develop a fair, transparent, and efficient domestic capital market. In this context, the study has been extended further to cover the period from January 2000 to December 2009 to examine whether these initiatives have enhanced the investors' confidence and improved the efficiency of the stock market.

The findings of the Johansen and Juselius cointegration test on total sample period have showed that there exists no cointegration relationship between the stock market and industrial production index. The ARDL cointegration approach has also provided the same results indicating the robustness of the results. As the variables are not cointegrated, the Vector Autoregression (VAR) Model has been applied to examine the short-run relationships among the variables.

The results of VAR model have showed that lagged values of growth of industrial production do not significantly explain the stock market return, while the lagged values of stock market return can significantly explain the growth of industrial production. This result is consistent with the financial theory that the stock market is a leading indicator of industrial production. The result of Granger Causality has also provided the same results.

Alongside, the results of ARDL model have indicated that only 5.43 percent of the variation in stock market return can be explained by the growth of industrial production index. The results of the viability check of the model have indicated that the model is not a good fit model. In addition, the CUSUM and CUSUMSQ tests have showed that the regression parameters are not stable, and an instability is observed around the catastrophe of 1996. So, we can conclude that due to the structural instability in the stock market in 1996, our findings are not stable and significant for the total sample period.

The results of ARDL have indicated that no cointegration relationships exist between stock market index and industrial production in the bubble, meltdown and recovery periods. The Bounds test results have revealed that about 21.18, 35.11 and 37.41 percent of the variations in stock market return can be explained by the growth of industrial production index in the bubble, meltdown and recovery periods respectively. The results of error correction model have confirmed that in these three periods there exist no short-run relationships between industrial production index and the stock market return.

The results of the Granger Causality Tests have indicated four types of causal relationships in four periods. These are: (1) a unidirectional causal relation running from DSE general index to industrial production index at 5% significance level in the total sample period; (2) no causal relation in the bubble period; (3) a unidirectional causal relation running from DSE general index to industrial production index at 10% significance level in the meltdown period; and (4) a unidirectional causal relation running from industrial production index to DSE general index at 10% significance level in the recovery period. The causal relations in the total sample and meltdown period have indicated that the stock market is a leading indicator of the economic growth, but the causal relation in the recovery period has exposed that the stock market is inefficient.

However, the viability tests of the models have indicated that for the total sample, bubble and meltdown periods the models are not good fit models and the CUSUM and CUSUMSQ plots of the residuals have showed that the regression parameters are not stable in these three periods. These results indicate that the findings of these periods are not viable and significant.

On the other hand, the viability tests of the model for the recovery period have specified that the model is a good fit model and the CUSUM and CUSUMSQ plots of the residuals have showed that the regression parameters are stable over the period. Thus, the results of this period are viable and significant. The results of this period clearly indicate that the past (current) information about the economic activities are useful in predicting current (future) stock prices. The finding suggests that despite numerous reforms and automation initiatives the stock market is still not that developed to play its due role in influencing the real sector of economy of Bangladesh.

Chapter 8

Findings and Conclusion

8.1 Introduction

General belief is that stock markets can predict future states of economy. In order to find empirical evidence to the belief, we examined relationships between Dhaka Stock Exchange (DSE), represented by DSE General Index (DSEGEN), and macroeconomic indices representing the economy of Bangladesh. Based on the objectives, this research attempted to find answers to the following specific research questions:

1. Does any significant long-run equilibrium relationship exist between Dhaka Stock Exchange General Index (DSEGEN) and six macroeconomic variables - namely Industrial Production Index, Interest Rate, Inflation, Exchange Rate, Money Supply and Gold Price?
2. Is there any short-term relationship between DSEGEN and the macroeconomic variables?
3. Is there any causal relationship between DSEGEN and the macroeconomic variables?
4. Are the relationships same between DSEGEN and the macroeconomic variables in different periods, i.e., in bubble, meltdown and recovery periods of the stock market?
5. Is there any relationship between DSEGEN volatility and the macroeconomic volatility?
6. What is the relationship between DSEGEN and the real economy of Bangladesh?

The rest of the chapter has three main sections. The first is to present a summary of the empirical evidence and findings that we have obtained to answer the research questions. The second is to highlight the contributions of the research and the third is to indicate few potential pathways for further research. The chapter ends with an overall conclusion.

8.2 Summary of the Research and Its Findings

The literature review in chapter 2 has revealed that numerous studies have tried to investigate both theoretically and empirically the relationship between macroeconomic variables and stock market in the last three decades. The summary of the literature review has indicated that different studies have found different relationships; even a single study has found varied relationships for different countries as well as in different periods within the same country. This divergence of the findings creates rooms for further research in this area.

Though most of the studies on developed countries have documented a great deal of evidence that fundamental economic activities are strongly linked to stock market return, it is unclear if such a relationship exists in emerging stock markets of developing countries. Findings of the studies on Bangladesh are widely diverse. Because of absence of strong regulatory system and lack of information transparency, our stock market is not proficient to boost the confidence of the investors (Mondal and Imam, 2011). In addition, our economy may have been influenced to a far greater extent by global economic indicators rather than domestic economic factors, and/or foreign investment in the stock market may have weaken the link between national economic variables and the stock market return (Gunasekarage et al., 2004). Investors have also lack of knowledge (fundamental and technical) about capital market (Mondal and Imam, 2011). In this backdrop, the hypothesis that changes in macroeconomic variables have a pervasive impact on stock market has been subjected to extensive research for Bangladesh.

The literature review has also disclosed an issue whether the relationship is a contemporaneous or lead-lag one and many studies on the relationship between stock market and macroeconomic variables also have examined stock market's predictability (Tangjitprom, 2012b). The findings of the existing literature on this issue are also mixed. In addition, most of the studies on Bangladesh has hitherto concentrated primarily on contemporaneous relationship leaving a research gap in causal relationship.

Risk return behavior analysis of stock market is very important for any developing countries because these markets are very volatile. As most of the investors are risk-averse, so the volatility of stock market compels them to demand higher risk premium which creates higher cost of capital and thus slows down the economic development (Mala and Reddy, 2007). This is an important issue from Bangladesh perspective. However, a very few studies have tried to find the relationship between stock market volatility and macroeconomic volatility in Bangladesh. The findings of the studies are also mixed and not as strong as described in the standard financial theory indicating requirement of further research on this issue.

After identifying the research gap through the literature review, we have studied the issues related to the asset valuation models in chapter 3. These are valuation of shares, portfolio theory, the CAPM, the ICAPM and the APT. These theories have been discussed to determine the way in which macroeconomic variables affect the stock market return. The common asset valuation models, together with the EMH and rational expectations theory, integrate the micro and macro risk factors into the asset prices.

However, microeconomic factors are considered as the sources of unsystematic risks which can be minimized through diversification. Conversely, macroeconomic variables are considered as the likely sources of the systematic risks, which cannot be eliminated by the simple approach of diversification.

Thus, equilibrium asset pricing models, such as the CAPM and APT, deal with the valuation of stocks using macroeconomic factors. The basic CAPM relates only one factor, the market factor. Hence it omits the other factors that are important in asset pricing. Conversely, APT allows for a set of factors and is consistent with capital market equilibrium. In APT, the expected return on an asset is a function of multiple factors rather than a single market factor. It suggests that return on a security or a portfolio is dependent on impacts of a series of factors.

The APT has two different versions: the factor loading model and the macro variable model. The factor loading model uses artificial variables, while the macro variable model uses macroeconomic variables based on the economically interpretable effects. However, none of the versions of the APT provide guidelines for identification of the common macroeconomic factors which are the sources of the systematic risk. The outcome of chapter 3 reveals that the macro variable version of the APT is the most widely used valuation method in the literature. As such, the effects of macroeconomic variables on the stock market return in Bangladesh have been investigated using the macro variable version of APT within the framework of semi-strong form of EMH.

Based on this groundwork, chapter 4 of this thesis has focused on the first three research questions. Additionally, we have used multiple econometric models within the framework of multi-factor asset pricing model of APT to check the robustness of the findings. Similarly, Chapter 5, chapter 6 and chapter 7 have dealt with the fourth, fifth, and sixth question respectively.

8.2.1 Long-term Equilibrium and Causal Relationships

Our findings with Johansen and Juselius cointegration approach revealed that there existed a long-run equilibrium relationship between the stock market index and the selected macroeconomic indices. However, out of the six macroeconomic variables, viz.; industrial production index, interest rate, inflation, exchange rate, money supply and gold price, only interest rate did not enter the long-run equation significantly at 5 percent level. On the other hand, the results of short-term relationships up to 13 months (up to 13 lags) revealed that none of the macroeconomic variables was significant in explaining the stock market return indicating that there existed disequilibrium in the short-run between the stock market return and the growth of macroeconomic variables. Nevertheless, about 15.30 percent of the short-run disequilibrium was adjusted per month to bring about equilibrium in the long-run.

The empirical investigations also revealed that the DSE General Index had unidirectional causal relationships with only two macroeconomic variables, industrial production index and exchange rate, but the opposite was not true. The unidirectional causal relation running from stock market return to the growth of both industrial production index and exchange rate indicated that the performance of stock market was a leading indicator to explain the future changes of only two macroeconomic variables. Therefore, the stock market was not a leading indicator for most of the macroeconomic variables.

To check the robustness of the results, the Autoregressive Distributed Lag (ARDL) cointegration approach was applied. This test also indicated that there existed a long-run relationship between stock market index and macroeconomic indices. The cointegrating equation showed that the industrial production, consumer price index, exchange rate and gold price were significant in determining stock prices in the long-run, while money supply had insignificant long-run effect on stock market index. The investigations on short-run relationships showed that the changes in macroeconomic variables at different lags were not statistically significant in explaining the stock market return indicating that there was no short-run relationship between stock market return and the growth of macroeconomic variables. The error correction model based on ARDL approach suggested that about 12.62 percent of the short-run disequilibrium was corrected per month to bring about equilibrium in the long-run.

The results of both tests confirmed the existence of long-run equilibrium relationship and short-run disequilibrium between the stock market and the selected macroeconomic variables. However, Johansen Juselius approach showed that about 30 percent of the variations in stock prices could be explained by the changes in macroeconomic variables considered, while ARDL approach indicated that about 21 percent of the variations could be explained by the changes in macroeconomic variables. The explanatory power of the macroeconomic variables in ARDL approach might have decreased since interest rate was dropped from the list in ARDL approach as it had been found insignificant in the Johansen cointegration approach. These results revealed that substantial percentage of the stock market return was explained by the factors which had not been considered in this research.

The diagnostic tests of the residuals of ARDL cointegration approach indicated a structural instability around the catastrophe of 1996, meaning that the cointegration coefficients had changed suddenly (instable) around 1996. In contrast, the coefficients were found stable throughout the total sample period with Johansen and Juselius cointegration approach. On the other hand, the study of Caporale and Pittis (2004) suggested that stability tests perform better in the context of a dynamic model of the ARDL type because this is not affected by serial correlation or nonpredetermined regressors even if over-specified. Therefore, the result of ARDL model was accepted and concluded that there was a structural instability around 1996. Conversely, no such instability was seen around the catastrophe of 2010.

This inspired us to examine the relationships between the stock market and the macroeconomic variables around the catastrophe of 1996 - that was during the bubble and meltdown periods of 1996. The study also considered several capital market development programs as well as the automation and upgradation of the trading platform initiated in 1998, following the crash of 1996, to develop a fair, transparent, and efficient domestic capital market. To examine whether these initiatives had enhanced the investors' confidence and improved the efficiency of the stock market the study was extended further to cover the period from January 2000 to December 2009.

8.2.2 Relationships During Bubble, Meltdown and Recovery Periods

In view of the aforesaid capital market development programs, the automation and upgradation of the trading platform, and the visual inspection of the graph of Dhaka Stock Exchange (DSE) General Index, we demarcated precisely the periods of bubble creation and the bubble crash of 1996 as well as the recovery period to examine the relationships between the stock market index and the macroeconomic indices in these periods. Accordingly, we considered the period from March 1992 to November 1996 as bubble, from November 1996 to December 1999 as meltdown, and from January 2000 to December 2009 as recovery period.

The findings indicated the existence of long-run relationship between the stock market index and the macroeconomic indices and about 52.68 percent of the stock market return was explained by the changes in macroeconomic indices in the bubble period. The results showed that industrial production index, inflation, exchange rate and money supply were positively related, while interest rate and gold price were negatively related with the stock market index. However, only exchange rate was found significant at 5 percent level, and industrial production and gold price were found significant at 10 percent level.

The long-run equation of the bubble period showed that the coefficient of exchange rate had the highest sensitivity among the macroeconomic variables, which had indicated the dominance of exchange rate on stock prices. Further investigations revealed that both the exchange rate and the foreign investment in Bangladesh stock market had increased significantly during this period. Moreover, the interest rate had decreased consistently during this period. These findings revealed that the increase in exchange rate and the subsequent increase in foreign investment had significant contribution in bubble creation and at the same time the falling interest rate had further intensified it.

The analysis of the meltdown period revealed that there existed no long-run relationship between the stock market index and the selected macroeconomic indices. The result also showed that only 36.14 percent of the stock market return was explained by the growth of the macroeconomic indices indicating that the remaining 63.86 percent had explained by some other factors, which were not considered in this research.

The long-run equation of meltdown period, showed that the coefficients of interest rate and exchange rate were larger than the coefficients of other macroeconomic indices and both the variables showed negative impact on stock prices. During the period both the variables had increased significantly and most of the foreign investment, which had been invested during the bubble period, were withdrawn from Bangladesh stock market during this period. These findings indicated that the increased exchange rate had failed to attract foreign investment. Conversely, a significant amount of foreign investment had been withdrawn during this period which had created negative impact on stock market. The increased exchange rate had also increased the cost of production of the firms creating negative impact on equity prices. Thus, the exchange rate has played a key role in market crash and increased interest rate had further worsened the situation.

The results of recovery period indicated that there existed a long-run relationship between stock market index and macroeconomic indices and about 55.70 percent of the stock market return was explained by the growth of macroeconomic indices. Here the long-run equation revealed that the interest rate, exchange rate and gold price were negatively related with stock market index. On the other hand, industrial production index, inflation and money supply were positively related with the stock market index. The size of the long-run coefficients indicated that interest rate had the highest negative impact, followed by money supply and inflation with positive impact on stock market. Nevertheless, the coefficient of gold price showed a very low negative impact on stock market index.

The results of the stability check of the models for different periods revealed that in bubble period conditional variance of the residuals showed slight instability at 3rd quarter of 1996 indicating a sudden change in the coefficients at that time. But during meltdown period, the coefficients were unstable for longer period. On the other hand, during the recovery period the coefficients were found stable.

8.2.3 Stock Market Volatility and Macroeconomic Volatility

The residuals of Ordinary Least Squares (OLS) estimation, with stock market return as dependent variable and the selected macroeconomic variables as independent variables, showed serial correlation and heteroskedasticity. Also, the plot of residuals confirmed the volatility clustering of the residuals, meaning that the variances were high during certain periods and low in other periods. These results indicated that the nonlinear GARCH model should be applied for estimation of the mean and variance equations.

In this context, the mean and variance equations were estimated using best fitted GARCH model. The results showed that the EGARCH model was the best fitted model for the purpose. The results of the EGARCH model exhibited that the growth of inflation and money supply were significantly positively related with the stock market return, while change in exchange rate had significant negative relation with the stock return. Conversely, growth of other selected macroeconomic variables (industrial production index, interest rate and gold price) were not found significantly related to the stock market return. These results signified the importance of inflation, exchange rate and money supply on stock market return in Bangladesh.

On the other hand, the variance equation indicated asymmetric effect of good and bad news on stock market volatility, with a higher impact of good news on stock market volatility compared to bad news of the same magnitude. This result revealed that Bangladesh stock market did not show any leverage effect. The result also indicated that the new surprises as well as the past values of market volatility had significant impact on stock market volatility. However, the stock market volatility was more sensitive to its past values than to new surprises. The results also revealed that a shock persisted for many future periods.

The cointegration test showed that there existed a long-run relationship between the stock market volatility and the macroeconomic volatility. However, none of the coefficients of the macroeconomic volatility in the long-run equation was found statistically significant, meaning that none of the macroeconomic volatility could significantly explain the stock market volatility in the long-run. Also, there existed a short-term disequilibrium between stock market volatility and macroeconomic volatility. The error correction term showed that approximately 29.11 percent of disequilibria were corrected per month to bring about an equilibrium in the long-run.

The Bounds test revealed that only 14.89 percent of the conditional variance of the stock market return was explained by the selected macroeconomic variables' volatilities, meaning that remaining 85.11 percent was explained by other factors which were not considered in this research. This result specified that only a small percentage of stock market volatility could be explained by the macroeconomic volatility.

8.2.4 Relationship between Stock Market and the Economy

In this analysis, the industrial production index, which was used as a proxy of GDP, represented the real sector of economy of Bangladesh. The findings of the Johansen and Juselius cointegration test over the total sample period showed that there existed no cointegration relationship between the stock market and industrial production index. The ARDL cointegration approach also provided the same result indicating the robustness of the results. As the variables were not cointegrated, hence the Vector Autoregression (VAR) Model was used to examine the short-run relationships among the variables.

The results of VAR model exhibited that lagged values of growth of industrial production did not significantly explain the stock market return, while the lagged values of stock market return could significantly explain the growth of industrial production index. The result of VAR model was consistent with the financial theory that the stock market was a leading indicator of industrial production index. The result of Granger Causality Test also provided the same results.

The results indicated that only 5.43 percent of the stock market return was explained by the growth of industrial production index. The results of the viability check of the model indicated that the model was not a good fit model. In addition, the stability tests exposed that the regression parameters were not stable, and an instability was observed around the catastrophe of 1996. This structural instability as well as the nonviability of the model revealed that the results were not significant.

The structural instability of 1996 motivated us to investigate the relationships in crisis time. Moreover, the relationship was also examined in recovery period. The results indicated that there existed no cointegration relationships between the stock market index and industrial production in the bubble, meltdown and recovery periods. The Bounds test results revealed that about 21.18, 35.11 and 37.41 percent of the variations in stock market return could be explained by the changes in industrial production index in the bubble, meltdown and recovery periods respectively.

Besides, the results of the Granger Causality Test provided three diverse causal relationships between stock market return and growth of industrial production in three different periods. These were: (1) no causal relationship in the bubble period; (2) a unidirectional weakly causal relation running from stock market return to growth of industrial production index in the meltdown period; and (3) a unidirectional weakly causal relationship running from growth of industrial production index to stock market return in the recovery period. The causal relationship in the meltdown period indicated that the stock market was a leading indicator of the economic growth, but the causal relation in the recovery period exposed that the stock market was inefficient, though these two causal relationships were found weakly significant.

Alongside, the viability tests of the models of different periods indicated that for the bubble and meltdown periods the models were not good fit models. In addition, the stability tests also showed that the regression parameters were not stable in these two periods. Conversely, the viability tests of the model for recovery period specified that the model was a good fit model. Also, the stability tests confirmed that the regression parameters were stable. Thus, the results of recovery period were significant. Therefore, the above results indicated that out of the four different periods; the total sample period, bubble, meltdown and recovery periods, the relationship between the stock market and the real sector of economy was found significant only in the recovery period.

8.3 Research Contributions

Most of the studies to examine link between stock market and macroeconomic variables have used a single econometric model for investigations. This study has employed multiple cointegration techniques to check the robustness of the findings. Furthermore, a very few studies have used ARDL approach to examine the relationship between stock market and economic state variables in the emerging economy like Bangladesh. This study has attempted to fill this gap by exploring the relationship between stock market index and macroeconomic variables in Bangladesh applying ARDL approach on monthly time series data.

Another contribution of this research is the study of causal relationships between the stock market return and the growth of macroeconomic forces to investigate the stock market's predictability. The findings of the existing literature on this implication are mixed. Moreover, most of the studies, if not all, on Bangladesh have concentrated primarily on contemporaneous relationship between stock market return and growth of macroeconomic variables. This study contributes to fill the gap related to the causal relationships between stock market return and growth of macroeconomic variables in Bangladesh.

Another important contribution of this research is that it has focused on the relationships between the stock market and the macroeconomic factors in different conditions of the stock market – such as in bubble, meltdown and recovery periods. None of the studies on Bangladesh has concentrated on this implication leaving a serious gap in the literature. The relationships in different periods have been assessed separately to compare the influences of the priced factors in different periods. The outcome of these analyses is noteworthy as it brings out which macroeconomic factors are at least partially responsible for bubble creation as well as for bubble crash in 1996. The analyses also have uncovered that sometimes our stock market has partially driven by fad and fashions which are not related to the economic conditions.

The risk return behavior analysis of stock market is very important for developing countries, because the stock markets of these countries are very volatile. Specifically, this type of study has become essential for Bangladesh considering two irrational fluctuations of stock prices within one and a half decades and the size of their effects in our socio-economic life. However, the comprehensive review of literatures has indicated that no such study on Bangladesh has been made using non-linear model to estimate the mean and variance equations simultaneously as well as to identify or quantify the asymmetry in the conditional volatility of the stock market return. This study has contributed to fill up this gap. This study has been extended further to estimate the conditional variances of the research variables using the best fitted GARCH model. Later, the cointegration approach has been applied to examine the long- and short-term relationships between the stock market volatility and the macroeconomic volatility.

In addition, empirically the predictive content of stock prices for economic growth is less clear-cut and it depends on size of the economy and the stock market of a country (Krchniva, 2013). Although Bangladesh stock markets have grown significantly during the last decade, still the size is relatively small compared to other Asian Markets. Bangladesh stock market is passing through different reforms to set the foundation for sustainable market development and the automation and continuous upgradation of its trading platform is ongoing to build up a state-of-the-art market surveillance system to increase the transparency of market transactions and contribute significantly to enhance investor confidence. But a very few studies have investigated the relationship between the stock market and real economy of Bangladesh from the perspectives of these reform measures. None of the study has investigated whether these initiatives have improved the efficiency of the stock market. This study has focused on these issues to address the void in the literature on Bangladesh.

Therefore, this research may be considered as an extension to the existing relevant studies on Bangladesh. The outcomes of the study are expected to offer financial regulators and policy makers some insights into the mistakes they have made earlier in terms of formulating economic and financial policies to regulate the stock market. Also, the regulator and policy makers may find the outcomes of the research helpful in formulating different policies for ensuring and creating smooth trading and investment atmosphere, controlling market strategies and assessing the degree to which the stock market may need to be reformed. Moreover, the results can help investors and portfolio managers in extending their understanding of the risk return relationship as well as pricing of macroeconomic risk.

8.4 Recommendation for Further Research

This research has selected six macroeconomic variables to represent the economy of Bangladesh. However, only these six variables may not completely represent the macroeconomic condition of the country. Other relevant macroeconomic variables such as long-term interest rate, balance of trade, oil price, employment rate and so on might be considered to obtain more precise result. Future research may consider those macroeconomic factors to investigate the relationship between stock market and macroeconomic variables.

Since different segments of the market don't always move in tandem, the response to macroeconomic factors vary across different segments of the market. For example, banking industry stocks are heavily affected by interest rates because their business is selling money. Similarly, some industries are less sensitive to inflation risk, such as food industries, while some industries are highly sensitive to inflation risk, such as home building, hotels and motels and luxury goods. This study has focused on aggregate market-level data, ignoring sector-level data, thus creating potential loss of industry-level information. So, future research may focus on this implication.

Stock market in Bangladesh has experienced two major catastrophes since its inception, one in 1996 and other in 2010. Our investigations have revealed that the catastrophe of 1996 has created a structural instability. Thus, the relationships between the stock market and the macroeconomic variables around the catastrophe of 1996, that is during the bubble and meltdown period of 1996, have been investigated. Also, the macroeconomic factors responsible for bubble creation and bubble burst have been identified. The further study may be carried out to examine the relationships around these two crises to compare the role of different macroeconomic factors around these two catastrophes.

Another important point is that this study is based on actual past data. However, the APT is based on the expected variables. Thus, there could be another research using the expected data estimated from actual past data for estimating the relationship between the stock market and macroeconomic variables in Bangladesh. For this purpose, the current data set could be derived from past data set with appropriate lag lengths. Then, expected variables might be estimated from one-period-ahead forecasts of the current data.

8.5 The Overall Conclusion

In pursuit of the findings of this research, our intention was to draw the attention of investors, policymakers and regulators to what had happened in the stock market of Bangladesh from January 1991 to December 2015. Our analysis on twenty-five years data revealed that there existed a long-run equilibrium relationship, but a short-run disequilibrium between the stock market and the selected macroeconomic variables in Bangladesh. However, a small percentage of the stock market return could be explained by the selected macroeconomic variables, which disclosed the fact that there were other key factors which had significant explanatory power, but were not considered in the research. The empirical investigations also revealed that the stock market return Granger-caused only two macroeconomic variables, industrial production index and exchange rate, but the opposite was not true. No other causal relationship was found between stock market and macroeconomic variables, meaning that the stock market performance was not a leading indicator for most of the macroeconomic variables.

The bubble and bubble crash of 1996 had created structural instability in the stock market, but this instability was more prominent in the meltdown period. The exchange rate and the interest rate were found at least partially responsible for bubble creation as well as for the bubble burst. In addition, the explanatory power of the macroeconomic variables was the highest in the recovery period followed by the bubble period, and in the meltdown period this was the lowest. These results indicated that the stock market returns were sometimes partially driven by fad and fashions which were not related to the economic conditions. Interestingly, we did not find any structural instability around 2010, though a bubble was created at the end of 2010.

The stock market in Bangladesh did not show any leverage effect, meaning that negative news did not have higher impact on stock market volatility compared to good news. For the total sample period, there existed volatility clustering indicating that high volatility was followed by high volatility and low volatility was followed by low volatility. This volatility clustering might have occurred due to the bubble and bubble crash of 1996, which was confirmed from the results of recovery period, where we did not find any evidence of volatility clustering.

Moreover, stability test of the model showed structural instability in the total sample period as well as in the bubble and meltdown periods, which indicated that the volatility of the market was a problem in Bangladesh. This finding is justifiable in the case of emerging market mainly due to the dominance of non-institutional investors and the existence of information asymmetry problem among investors. These factors could contribute to the weak relationship between the stock market volatility and the macroeconomic volatility in Bangladesh.

The relationship between the stock market and the real sector of economy in recovery period was found stable and significant. The results of this period showed that the stock market led economic activity, which suggested that despite numerous reforms and automation initiatives Bangladesh stock market was not developed to that extent to play its due role to influence the real sector of the economy. The results indicated the inefficiency of the stock market in incorporating the information related to the economic growth in the stock prices.

The outcomes of the research are expected to offer regulators and policy makers some insights into the mistakes they have made in the past in formulating policies to regulate the stock market. Besides, they may get valuable information from this research in formulating different policies for ensuring and creating smooth trading and investment atmosphere, controlling market strategies and assessing the degree to which the stock market may need to be reformed. The investors and portfolio managers may also use the outcomes of this research in extending their understanding of the risk return relationship as well as pricing of macroeconomic risk. Moreover, considering the shortcomings of the research, we have also suggested some potential pathways for further research.

To sum up, it can be concluded that among the catastrophes of 1996 and 2010, structural instability is observed around 1996 only. The noteworthy outcome of the research is that it has brought out the macroeconomic factors which are at least partially responsible for the bubble and bubble crash of 1996. The findings have also indicated that our stock market is sometimes partially driven by fad and fashions, which are not related to the economic factors. The market volatility has showed instability throughout the period revealing that the volatility of the market is a problem in Bangladesh. Moreover, despite numerous reforms and automation initiatives the stock market is still not that developed to play its due role in influencing the real sector of economy of Bangladesh. These outcomes are expected to offer regulators and policy makers some insights into the mistakes they have made earlier in terms of formulating policies to regulate the stock market, which may help them to take future course of actions.

References

Adam, A. M. and Tweneboah, G. (2008). Macroeconomic Factors and Stock Market Movement: Evidence from Ghana. Munich Personal RePEc Archive, No. 14079.

Adeniji, S. O. (2015**).** An Empirical Investigation of the Relationship between Stock Market Prices Volatility and Macroeconomic Variables' Volatility in Nigeria. European Journal of Academic Essays, 2 (11), 1-12.

Adrangi, B., Chatrath, A. and Raffiee, K. (1999). Inflation, Output, and Stock Prices: Evidence from Two Major Emerging Markets. Journal of Economics and Finance, 23 (3), 266-278.

Ahmed, M. N. and Imam, M. O. (2007). Macroeconomic Factors and Bangladesh Stock Market: Impact Analysis Through Cointegration Approach. International Review of Business Research Papers, 3 (4), 21–35.

Akgiray, V. (1989). Conditional Heteroscedasticity in Time Series of Stock Returns: Evidence and Forecasts. The Journal of Business, 62 (1), 55-88.

Ali, Mohammad Bayezid (2011). Cointegrating Relation between Macroeconomic Variables and Stock Return: Evidence from Dhaka Stock Exchange (DSE). International Journal of Business and Commerce, 1 (2), 25-38.

Antonios, A. (2010). Stock Market and Economic Growth: An Empirical Analysis for Germany. Business and Economics Journal, 2010 (1), 1-12.

Asekome, M. O. and Agbonkhese, A. O. (2015). Macroeconomic Variables, Stock Market Bubble, Meltdown and Recovery: Evidence from Nigeria. Journal of Finance and Bank Management, 3 (2), 25-34.

Azeez, A. A and Yonezawa, Y. (2006). Macroeconomic Factors and Empirical Content of the Arbitrage Pricing Theory in the Japanese Stock Market. Japan and the World Economy, 18, 568-591.

Baillie, R. T. and DeGennaro, R. P. (1990). Stock Return and Volatility. Journal of Financial and Quantitative Analysis, 25, 203-214.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D.F. (1993). Co-integration, Error Correction and the Econometric Analysis of Non-Stationary Data. Oxford University Press, New York, NY.

Banz, R. W. (1981). The Relationship between Return and Market Value of Common Stock. Journal of Financial Economics, 9, 3-18.

Basu, S. (1977). Investment Performance of Common Stocks in Relation to Their Price Earnings Ratios: A Test of Market Efficiency. Journal of Finance, 32, 663-682.

Beenstock, M. and Chan, K. F. (1986). Testing the Arbitrage Pricing Theory in the United Kingdom. Oxford Bulletin of Economics and Statistics, 48 (2), 121-141.

Beenstock, M. and Chan, K.F. (1998). Economic Forces in the London Stock Market. Oxford Bulletin of Economics and Statistics, 50 (1), 27-39.

Beltratti, A. and Morana, C. (2006). Breaks and Persistency: Macroeconomic Causes of Stock Market Volatility. Journal of Econometrics, 131 (1-2), 151-177.

Bera, A. K. and Higgins, M. L. (1993). ARCH Models: Properties, Estimation and Testing. Journal of Economic Survey, 7, 305-362.

Bernanke, B. and Gertler, M. (1989). Agency Costs, Net Worth and Business Fluctuations. American Economic Review, 79 (1), 14-31.

Bhardwaj, R. K. and Brooks, L. D. (1993). Dual Betas from Bull and Bear Markets: Reversal of the Size Effect. Journal of Financial Research, 16, 269-283.

Binswanger, M (1999). Stock Markets, Speculative Bubbles and Economic Growth. Edward Elgar Publishing Limited.

Binswanger, M. (2001). Does the Stock Market Still Lead Real Activity? An Investigation for the G-7 countries. Financial Markets and Portfolio Management, 15(1), 15-29.

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity. Journal of Econometrics, 31, 307-327.

Box, G. E. P. and Newbold, P. (1971). Some Comments on a Paper of Coen, Gomme and Kendall. Journal of Royal Statistics Society, Series A (General), 134 (2), 229-240.

Brooks, C. (2002). Introductory Econometrics for Finance. Cambridge University Press, London.

Brooks, C. (2008). Introductory Econometrics for Finance. 8th edition. Cambridge: Cambridge University Press.

Brown R. L., Durbin J., and Evans J. M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. Journal of the Royal Statistical Society. Series B (Methodological), 37 (2), 149-192.

Bulmash, S. B. and Trivoli, G. W. (1991). Time-lagged Interactions between Stock Prices and Selected Economic Variables. Journal of Portfolio Management, 17 (4), 61-67.

Buyuksalvarci, A. (2010). The Effects of Macroeconomics Variables on Stock Returns: Evidence from Turkey. European Journal of Social Sciences, 14 (3), 404-416.

Cagan P. (1956). The Monetary Dynamics of Hyperinflation. In Studies in the Quantity Theory of Money. M. Friedman (ed.), University of Chicago Press, Chicago.

Campbell, J. Y. and Perron, P. (1991). Pitfalls and Opportunities: What Macroeconomists Should Know about Unit Roots. In O. J. Blanchard and S. Fisher (eds), NBER Macroeconomics Annual, The MIT Press, 141-201.

Caporale, G. M. and Pittis, N. (2004). Robustness of the CUSUM and CUSUM-of Square Tests to Serial Correlation, Endogeneity and Lack of Structural Invariance: Some Monte Carlo Evidence, Economic Series, 157, Institute of Advanced Studies.

Chan, K. C., Chen, N. and Hsieh, D. (1985). An Exploratory Investigation of the Firm Size Effect. Journal of Financial Economics, 14, 451-471.

Chen, N. F. (1983). Some Empirical Tests of the Theory of Arbitrage Pricing. Journal of Finance, 38 (5), 1393-1414.

Chen, N. F., Roll, R., and Ross, S. (1986). Economic Forces and the Stock Market. The Journal of Business, 59 (3), 383-403.

Chen, S. J., Hsieh, C. H. and Jordan, B. D. (1997). Real Estate and the Arbitrage Pricing Theory: Macro Variables vs. Derived Factors. Real Estate Economics, 25 (3), 505-523.

Chia, R. C. J. and Lim, S. Y. (2015). Malaysian Stock Price and Macroeconomic Variables: Autoregressive Distributed Lag (ARDL) Bounds Test. Kajian Malaysia, 33 (1), 85-103.

Chinzara, Z. (2010). Macroeconomic Uncertainty and Emerging Market Stock Market Volatility: A Case for South Africa. Rhodes University Working Paper No. 187, August 2010.

Chowdhury, S., Mollik, A. and Akhter, M. (2006). Does Predicted Macroeconomic Volatility Influence Stock Market Volatility? Evidence from the Bangladesh Capital Market. Department of Finance and Banking, University of Rajshahi, Working Paper.

Clare, Andrew D. and Thomas, Stephen H. (1994). Macroeconomic Factors, the APT and the UK Stock Market. Journal of Business Finance and Accounting, 21 (3), 309-330.

Comincioli, B. (1996). The Stock Market as a Leading Indicator: An Application of Granger Causality. The Park Place Economist, 4 (1), 31-40.

Cornell, B. (1983). The Money Supply Announcements Puzzle: Review and Interpretation. American Economic Review, 73 (4), 644-657.

Copeland, T. E. and Weston, J. F. (1988). Financial Theory and Corporate Policy, 3rd ed, Addison-Wesley Publishing Company, Wokingham.

DeFina, R. H. (1991). Does Inflation Depress the Stock Market? Business Review, Federal Reserve Bank of Philadelphia, November Issue, 3–12.

Diacogiannis, G. P. (1986). Arbitrage Pricing Model: A Critical Examination of its Empirical Applicability for the London Stock Exchange. Journal of Business Finance and Accounting, 13 (4), 489-504.

Dickey, D. A. and Fuller, W. A. (1979). Distribution of Estimators for Autoregressive Time Series with a Unit Root. Journal of American Statistical Association, 74, 427-431.

Diebold, F. X. and Yilmaz, K. (2012). Better to Give than to Receive: Predictive Directional Measurement of Volatility Spillovers. International Journal of Forecasting, 23, 57-66.

Dhrymes, P. J., Friend, I. and Gultekin, N. B. (1984). A Critical Reexamination of the Empirical Evidence on the Arbitrage Pricing Theory. Journal of Finance, 39 (2), 323-346.

Duca, G. (2007). The Relationship between the Stock Market and the Economy: Experience from International Financial Markets. Bank of Valletta Review, 36, 1-12.

Elton, E. J., Gruber, M. J. and Gultekin M. (1981). Expectations and Share Prices. Management Science, 27 (9), 975 – 987.

Elton, E. J. and Gruber, M. J. (1991). Modern Portfolio Theory and Investment Analysis, 4th edition, Wiley Series in Finance, Wiley, New York.

Enders, W. (2004). Applied Econometric Time Series, 2nd Edition, John Wiley & Sons Inc., New York.

Engle, R. (1982). Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation. Econometrica, 50 (4), 987-1008.

Engle, R. (2004). Risk and Volatility: Econometric Model and Financial Practice. American Economic Review, 94, 405–420.

Engle, R. F. and Granger, C. W. J. (1987). Co-integration and Error Correction: Representation, Estimation and Testing. Econometrica, 55 (2), 251-276.

Estrella, A. and Mishkin, F. S. (1996). The Yield Curve as a Predictor of U.S. Recessions. Current Issues in Economics and Finance, 2 (7), 1-6.

Evans, G. W. and Garey, R. (2003). Adaptive Expectations, Under Parameterization and the Lucas Critique. University of Oregon Working Paper No. 237.

Faff, W. R., Hodgson, A. and Kremmer, L. M. (2005). An Investigation of the Impact of Interest Rates and Interest Rate Volatility on Australian Financial Sector Stock Return Distributions. Journal of Business Finance & Accounting, 32, 55-78.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance, 25 (2), 383-415.

Fama, E. F. (1981). Stock Returns, Real Activity, Inflation and Money. The American Economic Review, 71 (4), 545-565.

Fama, E. F. (1991). Efficient Capital Markets: II. Journal of Finance, 46 (5), 1575-1617.

Fama, E. F. (1996). Multifactor Portfolio Efficiency and Multifactor Asset Pricing. Journal of Financial and Quantitative Analysis, 31 (4), 441–465.

Fama, E. F. (1998). Determining the Number of Priced State Variables in the ICAPM. Journal of Financial and Quantitative Analysis, 33 (2), 217-231.

Fama, E. F. and MacBeth, J. (1973). Risk, Return and Equilibrium: Empirical Tests. Journal of Political Economy, 81, 607-636.

Fama, E. F. and Schwert, W.G. (1977). Asset Returns and Inflation. Journal of Financial Economics, 5, 115-146.

Figlewski, S. and Wachtel, P. (1981). The Formation of Inflationary Expectations. The Review of Economics and Statistics, 63 (1), 1-10.

Financial Sector Reform Project (1996). An Evaluation of the Impact of Reform on the Financial Sector, Studies in Bangladesh Banking, Dhaka: FSRP, Ministry of Finance.

Fisher, I. (1930). The Theory of Interest. New York: Macmillan.

Floros, C. (2008). Modelling Volatility Using GARCH Models: Evidence from Egypt and Israel. Middle Eastern Finance and Economics, 2, 31-41.

Friedman, M. (1957). Theory of the Consumption Function. Princeton University Press, Princeton.

Friedman, M. and Schwart., A. J. (1963). Money and Business Cycles. Review of Economics and Statistics 45 (1), Part 2, 32-64.

Fuller, W. A. (1976). Introduction to Statistical Time Series. New York: Wiley.

Gertchev, N. (2007). A Critique of Adaptive and Rational Expectation. Quart J Austrian Econ 10, 313-329.

Geweke, J. and Porter-Hudak, S. (1983). The Estimation and Application of Long-Memory Time Series Models. Journal of Time Series Analysis, 4, 221- 237.

Glosten, L. R., Jagannathan, R. and Runkle, D. E. (1993). On the Relation between the Expected Value and the Volatility of the Nominal Excess Returns on Stocks. Journal of Finance, 48 (5), 1779–1801.

Goktas, O. and Hepsag, A. (2011). Do Stock Returns Lead Real Economic Activity? Evidence from Seasonal Cointegration Analysis. Economics Bulletin, 31 (3), 2117-2127.

Graham, Benjamin (1965). The Intelligent Investor. New York, Harper & Row.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica, 37 (3), 424-438.

Granger, C. W. J. (1981). Some Properties of Time Series Data and Their Use in Econometric Model Specification. Journal of Econometrics, 16, 121-130.

Granger, C.W.J. (1988). Causality, Cointegration, and Control. Journal of Economic Dynamics and Control, 12, 551-559.

Granger, C. W. J. and Newbold, P. (1974). Spurious Regressions in Econometrics. Journal of Econometrics, 2, 111-120.

Gregory, A. W. (1994). Testing for Cointegration in Linear Quadratic Models. Journal of Business and Economic Statistics, 2, 347-360.

Groenewold, N. and Fraser, P. (1997). Share Prices and Macroeconomic Factors. Journal of Business Finance and Accounting, 24 (9-10), 1367-1383.

Grossman, S. J. and Stiglitz, J. E. (1980). On the Impossibility of Informationally Efficient Markets. American Economic Review, 70 (3), 393-408.

Gunasekarage, A., Pisedtasalasai, A. and Power, D. M. (2004). Macroeconomic influences on the Stock Market: Evidence from an Emerging Market in South Asia. Journal of Emerging Market Finance, 3 (3), 285-304.

Gunasekarage, A. and Power, D. M. (2001). The Profitability of Moving Average Trading Rules in South Asian Stock Markets. Emerging Markets Review, 2, 17-33.

Hamao, Y. (1988). An Empirical Examination of the Arbitrage Pricing Theory. Japan and World Economy, 1, 45-61.

Hamburger, M., and Kochin, L. (1972). Money and Stock Prices: The Channels of Influence. Journal of Finance, 27 (2), 231-249.

Harris, R. (1995). Using Cointegration Analysis in Econometric Modelling. London: Oxford university press.

Harvey, Campbell R. (1989). Forecasts of Economic Growth from the Bond and Stock Markets. Financial Analysts Journal,45 (5), 38-45

Hassan, K. (1994). The Financial Sector Reforms in Bangladesh. K. Hassan (ed.), Banking and Finance in Bangladesh, Dhaka: Academic Publishers.

Hassan, M. K., Islam, A. M. and Basher, S. A. (1999). Market Efficiency, Time-Varying Volatility and Equity Returns in Bangladesh Stock Market. Working Papers 2002-06, York University, Department of Economics, Revised Jun 2002.

Hodrick, R. J. and Prescott, E. C. (1980). Postwar U. S. Business Cycles: An Empirical Investigation. Discussion Paper 451 (Carnegie-Mellon University).

Humpe, A. and Macmillan, P. (2007). Can Macroeconomic Variables Explain Long Term Stock Market Movements? A comparison of the US and Japan. University of St Andrews, School of Economics and Finance, Discussion Paper No. 0720.

Husain, F. (2006). Stock Prices, Real Sector and the Causal Analysis: The Case of Pakistan. Pakistan Institute of Development Economics. MPRA Paper No. 4162.

Ibrahim, M. H. and Aziz, H. (2003). Macroeconomic Variables and the Malaysian Equity Market: A View Through Rolling Subsamples. Journal of Economic Studies, 30 (1), 6-27.

Jaffe, J. and Mandelkar, G. (1976). The Fisher Effect for Risky Assets: An Empirical Investigation. Journal of Finance, 31, 447-456.

Jensen, M. C. (1978). Some Anomalous Evidence Regarding Market Efficiency. Journal of Financial Economics, 6 (2-3), 95-101.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12 (2–3), 231–254.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59, 1551-1580.

Johansen, S. (1992). Determination of Cointegration Rank in the Presence of a Linear Trend. Oxford Bulletin of Economics and Statistics, 54, 383–397.

Johansen, S. (1995). Likelihood Based Inference in Cointegrated Vector Error Correction Models, Oxford University Press, Oxford.

Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration - with Applications to the Demand for Money. Oxford Bulletin of Economics and Statistics, 52 (2), 169-210.

Joseph, M. (2002). Modelling the Impacts of Interest Rate and Exchange Rate Changes on UK Stock Returns. Derivatives Use, Trading and Regulation, 7 (4), 306-323.

Joshi, Pooja and Giri, A. K. (2013). An Empirical Analysis of the Relationship Between Stock Market Indices and Macroeconomic Variables: Evidences from India. Journal of Economics and Finance, 2 (1), 17-24.

Joshi, Pooja and Giri, A. K. (2015). Dynamic Relation between Macroeconomic variables and Indian Stock Price: An Application of ARDL Bounds Testing Approach. Asian Economic and Financial Review, 5 (10), 1119-1133

Kadir, H. B. A., Selamat, Z., Masuga, T. and Taudi, R. (2011). Predictability Power of Interest Rate and Exchange Rate Volatility on Stock Market Return and Volatility: Evidence from Bursa Malaysia. International Proceedings of Economics Development and Research, 4, 199-202.

Kar, S. and Mandal, K. (2011). Banks, Stock Markets and Output: Interactions in the Indian Economy. GDN 12th Annual Global Development Conference, Colombia, January 13-15, 2011.

Kassimatis, K. (2008). Size, Book-to-Market and Momentum Effect in the Australia Stock Market. Australian Journal of Management, 33 (1), 145-168.

Kazuo, S. (1995). Bubbles in Japan's Stock Market: A Macroeconomic Analysis. Journal of Japanese Economic Research, 30, 1–24.

Khan, M. M. and Yousuf, A. S. (2013). Macroeconomic Forces and Stock Prices: Evidence from the Bangladesh Stock Market. Munich Personal RePEc Achieve, Paper No. 46528.

Khil, J. and Lee, B. S. (2000). Are Common Stocks a Good Hedge Against Inflation? Evidence from the Pacific-Rim Countries. Pacific-Basin Finance Journal, 8 (3-4), 457-482.

Kiyotaki, N. and Moore, J. (1997). Credit Cycles. Journal of Political Economy, 105, 211-248.

Kraft, J., and Kraft, A. (1977). Determinants of Common Stock Prices: A Time Series Analysis. Journal of Finance, 32 (2), 417-425.

Krchniva, I.G. (2013). Do Stock Markets Have Any Impact on Real Economic Activity? Mendel University, Faculty of Business and Economics Working Paper.

Kwiatkowski, D., Phillips P., Schmidt, P. and Shin, Y. (1992). Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root. Journal of Econometrics, 54, 159-178.

Lee, C. M. C. (2001). Market Efficiency and Accounting Research: A discussion of Capital Market Research in Accounting by S. P. Kothari. Journal of Accounting and Economics, 31, 233-253.

Liljeblom, E. and Stenius, M. (1997). Macroeconomics Volatility and Stock Market Volatility: Empirical Evidence on Finnish Data. Applied Financial Economics, 7, 419-426.

Lintner, J. (1965a). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. Review of Economics and Statistics, 47, 13-37.

Lintner, J. (1965b). Security Prices, Risk and Maximal Gains from Diversification. Journal of Finance, 20, 587–615.

Liow, H. K., Ibrahim, F. M. and Huang, Q. (2006). Macroeconomic Risk Influences on the Property Stock Market. Journal of Property Investment and Finance, 24 (4), 295-323.

Lutkepohl, H. (2005). New Introduction to Multiple Time Series Analysis, Springer-Verlag, Berlin.

Maddala, G.S. and Kim, In-Moo (1999). Unit Roots, Cointegration, and Structural Change. Cambridge University Press.

Mala, R. and Reddy, M. (2007). Measuring Stock Market Volatility in an Emerging Economy. International Research Journal of Finance and Economics, 8, 126-133.

Malkiel, B. (1992). Efficient Market Hypothesis. P. Newman, M. Milgate and J. Eatwell (eds.), New Palgrave Dictionary of Money and Finance, Macmillan, London.

Malkiel, B. (2003). The Efficient Market Hypothesis and Its Critics. The Journal of Economic Perspectives, 17, 59-82.

Mamipour, S. and Jezeie, F. V. (2015). Non-Linear Relationships Among the Oil Price, the Gold Price and Stock Market Returns in Iran: A Multivariate Regime-Switching Approach. Iranian Journal of Economic Studies, 4 (1), 101-128.

Masoud, N. M. H. (2013). The Impact of Stock Market Performance upon Economic Growth. International Journal of Economics and Financial Issues, 3 (4), 788-798.

Maysami, R. C., Howe, L. C., and Hamzah, M. A. (2004). Relationship between Macroeconomics Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices. Journal Pengurusan, 24, 47-77.

Maysami, R. C. and Koh, T. S. (2000). A Vector Error Correction Model of the Singapore Stock Market. International Review of Economics and Finance, 9, 79-96.

McElroy, M. B. and Buremeister, E. (1985). Two Estimators for the APT Model When Factors are Measured. Economics Letters, 19, 271–275.

Men, M. and Li, R. (2006). An Empirical Study on the Relationship Between Stock Index and National Economy: Case of China. University of Business and Economics, Working Paper.

Merton, R. C. (1973). An Intertemporal Capital Asset Pricing Model. Econometrica, 41 (5), 867–887.

Merville, L.J., Hayes-Yelsken, S. and Xu, Y. (2001). Identifying the Factor Structure of Equity Returns. Journal of Portfolio Management, 27 (4), 51-61.

Mishra, Vinod and Pan, Lei (2016). Stock Market Development and Economic Growth: Empirical Evidence from China. Monash School of Business. Discussion Paper 16/16.

Mlambo, L. (2012). Adaptive and Rational Expectations Hypothesis: Reviewing the Critiques. Journal of Economic Behavior, 2, 3-15.

Mohammad, S. D., Hussain, A., Jalil, M. A., and Ali, A. (2009). Impact of Macroeconomics Variables on Stock Prices: Empirical Evidence in Case of KSE (Karachi Stock Exchange). European Journal of Scientific Research, 38 (1), 96-103.

Mondal, S. A. and Imran, M. S. (2011). Determinants of Stock Price: A Case Study on Dhaka Stock Exchange. International Islamic University Chittagong, Bangladesh. Retrieved from www.wbiconpro.com/337-Saheb.pdf

Morelli, D. (2002). The Relationship between Conditional Stock Market Volatility and Conditional Macroeconomics Volatility Empirical Evidence Based on UK data. International Review of Financial Analysis, 11, 101-110.

Mossin, J. (1966). Equilibrium in a Capital Asset Market. Econometrica, 34 (4), 768-783.

Mukherjee, T. and Naka, A. (1995). Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model. The Journal of Financial Research, 18 (2), 223-237.

Mukhuti, Somnath and Amalendu, Bhunia (2013). Is It True That Indian Gold Price Influenced by Indian Stock Market Reaction? E3 Journal of Business Management and Economics, 4 (8), 181-186.

Muth, John F. (1961). Rational Expectations and the Theory of Price Movements. Econometrica, 29 (3), 315–335.

Nelson, C. R. (1976). Inflation and Rates of Return on Common Stocks. Journal of Finance, 31 (2), 471-483.

Nelson, C. R. and Plosser, C. I. (1982). Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications. Journal of Monetary Economics, 10, 139-162.

Nelson, D. B. (1991). Conditional Heteroskedasticity in Asset Returns: A New Approach. Econometrica, 59 (2), 347-370.

Pantula, S.G. (1991). Asymptotic Distributions of the Unit-Root Tests When the Process is Nearly Stationary. Journal of Business and Economic Statistics, 9, 63-71.

Patterson, K. (2000). An Introduction to Applied Econometrics: A Time Series Approach. Macmillan, London.

Pearce, Douglas K. (1983). Stock Prices and the Economy. Federal Reserve Bank of Kansas City Economic Review, November 1983, 7-22.

Perron P. (1988). Trends and Random Walks in Macroeconomic Time Series: Further Evidence from a New Approach. Journal of Economic Dynamics and Control, 12, 297-332.

Pesaran, M.H., Shin, Y. and Smith, R.J. (2001). Bounds Testing Approaches to the Analysis of Level Relationship. Journal of Applied Economics, 16, 289-326.

Phillips, P. C. B. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression. Biometrika, 75 (2), 335-46.

Poon, S. and Taylor, S. J. (1991). Macroeconomic Factors and the UK Stock Market. The Journal of Business Finance and Accounting, 18 (5), 619-636.

Quadir, M. M. (2012). The Effect of Macroeconomic Variables on Stock Returns on Dhaka Stock Exchange. International Journal of Economics and Financial Issues, 2 (4), 480-487.

Rafique, A., Naseem, M. A. and Sultana, N. (2013). Impact of Macroeconomic Variable on Stock Market Index (A Case of Pakistan). Elixir International Journal, 57, 14099-14104.

Raquib, A. (1999). Financial Sector Reform in Bangladesh: An Evaluation. Bank Parikroma, XXIV (3 and 4), Dhaka: Bangladesh Institute of Bank Management.

Reinganum, M. R. (1981). Abnormal Returns in Small Firm Portfolios. Financial Analysts Journal, 37, 52-56.

Reinganum, M. R. (1982). A Direct Test of Roll's Conjecture on the Firm Size Effect. Journal of Finance, 37, 27-36.

Roll, R., and Ross, S. A. (1980). An Empirical Investigation of The Arbitrage Pricing Theory. Journal of Finance, 35 (5), 1073-1103.

Roll, R., and Ross, S. A. (1995). The Arbitrage Pricing Theory Approach to Strategic Portfolio Planning. Financial Analysts Journal, 51 (1), 122-131.

Ross, S. A. (1976). The Arbitrage Theory of Capital Asset Pricing. Journal of Economic Theory, 13, 341-361.

Sargent, T. J. and Wallace N. (1975). Rational Expectations, the Optimal Monetary Instrument and Optimal Money Supply Rule. Journal of Political Economy, 83, 241-254.

Schwert, G. W. (1989). Why Does Stock Market Volatility Change Over Time? The Journal of Finance, 44 (5), 1115-1153.

Schwert, W. (1990). Stock Returns and Real Activity: A Century of Evidence. Journal of Finance, 45 (4), 1237-1257.

Shanken, J. (1985). Multi-Beta CAPM or Equilibrium APT: A Reply. Journal of Finance, 40, 1189-1196.

Shanken, J. and Weinstein, M.I. (2006). Economic Forces and the Stock Market Revisited. Journal of Empirical Finance, 13 (2), 129-144.

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. Journal of Finance, 19, 425-442.

Siamwalla, A., Vajragupta, Y. and Vichyanond, P. (1999). Foreign Capital Flows to Thailand: Determinants and Impact. Thailand Development Research Institute (TDRI), November 1999.

Siddikee, M. N. and Begum N. N. (2016). Volatility of Dhaka Stock Exchange. International Journal of Economics and Finance, 8 (5), 220-229.

Sims, C.A. (1972). Money, Income and Causality. American Economic Review, 62, 540-552.

Sims, C. A., Stock, J. H. and Watson, M. W. (1990). Inference in Linear Time Series Models with Some Unit Roots. Econometrica, 58 (1), 113–44.

Sinclair, N. A. (1984). Aspects of the Factor Structure Implicit in the Australian Industrial Equity Market: February 1958 to August 1977. Australian Journal of Management, 9 (1), 23-36.

Singh, T., Mehta, S., and Varsha, M. S. (2011). Macroeconomic Factors and Stock Returns: Evidence from Taiwan. Journal of Economics and International Finance 2 (4), 217-227.

Sirucek, M. (2011). Effect of Money Supply on the Dow Jones Industrial Average Stock Index. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 399-408.

Stock, J.H. and Watson, M.W. (2001). Forecasting Output and Inflation: The Role of Asset Prices. NBER Working Paper Series, 8180.

Strong, R. (2005). Derivatives: An Introduction. Thomson/South-Western Pub. Mason Ohio, USA.

Sumner, S., Johnson, R. and Soenen, L. (2010). Spillover Effects between Gold, Stocks, and Bonds. Journal of Centrum Cathedra, 3, 106-120.

Talla, J. (2013). Impact of Macroeconomic Variables on the Stock Market Prices of the Stockholm Stock Exchange (OMXS30). JÖNKÖPING UNIVERSITY: Sweden. Master of Science Thesis.

Tainer, E. M. (1993). Using Economic Indicators to Improve Investment Analysis. New York, USA: John Wiley & Sons, Inc.

Tangjitprom, N. (2012a). Macroeconomic Factors of Emerging Stock Market: The Evidence from Thailand. International Journal of Financial Research, 3 (2), 105-114.

Tangjitprom, N. (2012b). The Review of Macroeconomic Factors and Stock Returns. International Business Research, 5 (8), 107-115.

Toda, H. Y. and Phillips, P. C. B. (1993). Vector Autoregression and Causality. Econometrica, 61 (6), 1367-1393

Tully, E., and Lucey, B. M. (2007). A Power GARCH Examination of the Gold Market. Research in International Business and Finance, 21, 316-325.

Tursoy, T., Gunsel, N. and Rjoub, H. (2008). Macroeconomic Factors, The APT and The Istanbul Stock Market. International Research Journal of Finance and Economics, 22, 50-57.

Uddin, M. and Alam, M. (2007). The Impacts of Interest Rate on Stock Market: Empirical Evidence from Dhaka Stock Exchange. South Asian Journal of Management and Sciences, 1 (2), 123-132.

Verbeek, M. (2004). A Guide to Modern Econometrics. 2nd edition (Vol. 2). West Sussex: John Wiley & Sons, Ltd.

Wahab, M. A. and Faruq M. O. (2012). A Comprehensive Study on Capital Market Developments in Bangladesh. Working Paper Series: WP 1203, March 2012, Research Department, Bangladesh Bank.

Wang, L. K. and Liow, K. H. (1999). The Behavior of Singapore Property Stocks to Market and Interest Rate Risks. SES Journal 1999, 28-34.

Wang, X. (2011). The Relationship between Stock Market Volatility and Macroeconomic Volatility: Evidence from China. Journal of Chinese Economic and Finance, 2, 67-77.

Yule, G. U. (1926). Why Do We Sometimes Get Nonsense-correlations between Time Series? -A Study in Sampling and the Nature of Time Series. Journal of the Royal Statistical Society, 89, 1-63.

Zakoian, J. M. (1994) Threshold Heteroskedastic Models. Journal of Economic Dynamics and Control, 18 (5), 931-955.

Zukarnain Z. and Sofian S. (2012). Empirical Evidence on the Relationship between Stock Market Volatility and Macroeconomics Volatility in Malaysia. Journal of Business Studies, 4 (2), 61-71.

Appendix A: Correlogram of Research Variables

A 1 Correlogram of Log DSE General Index (LDSEGEN)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.987</td><td>0.987</td><td>295.37</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>*|. |</td><td>2</td><td>0.973</td><td>-0.069</td><td>583.23</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.958</td><td>-0.016</td><td>863.45</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.943</td><td>-0.054</td><td>1135.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.926</td><td>-0.036</td><td>1398.8</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.910</td><td>0.005</td><td>1653.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>7</td><td>0.894</td><td>0.024</td><td>1900.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>8</td><td>0.878</td><td>-0.040</td><td>2139.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>9</td><td>0.861</td><td>-0.010</td><td>2370.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>10</td><td>0.844</td><td>-0.039</td><td>2593.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>11</td><td>0.827</td><td>-0.000</td><td>2807.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.809</td><td>-0.031</td><td>3013.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>13</td><td>0.791</td><td>-0.019</td><td>3210.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.774</td><td>0.006</td><td>3400.4</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>15</td><td>0.756</td><td>-0.023</td><td>3581.9</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>16</td><td>0.739</td><td>0.036</td><td>3756.0</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>17</td><td>0.723</td><td>0.021</td><td>3923.2</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|* |</td><td>18</td><td>0.709</td><td>0.075</td><td>4084.7</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>19</td><td>0.696</td><td>0.020</td><td>4241.0</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>20</td><td>0.684</td><td>-0.017</td><td>4392.2</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>21</td><td>0.670</td><td>-0.032</td><td>4538.2</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>22</td><td>0.657</td><td>-0.030</td><td>4678.8</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>23</td><td>0.644</td><td>0.026</td><td>4814.5</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>24</td><td>0.631</td><td>-0.034</td><td>4945.0</td><td>0.000</td></tr>
</table>

A 2 Correlogram of 1st Difference of Log DSE General Index (DLDSEGEN)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|* |</td><td>.|* |</td><td>1</td><td>0.159</td><td>0.159</td><td>7.6390</td><td>0.006</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>0.042</td><td>0.017</td><td>8.1615</td><td>0.017</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>3</td><td>0.077</td><td>0.070</td><td>9.9709</td><td>0.019</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>4</td><td>0.060</td><td>0.038</td><td>11.088</td><td>0.026</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>5</td><td>-0.072</td><td>-0.093</td><td>12.676</td><td>0.027</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>6</td><td>-0.100</td><td>-0.085</td><td>15.753</td><td>0.015</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>7</td><td>0.055</td><td>0.083</td><td>16.669</td><td>0.020</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>0.048</td><td>0.043</td><td>17.393</td><td>0.026</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>9</td><td>-0.006</td><td>-0.002</td><td>17.404</td><td>0.043</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>10</td><td>-0.026</td><td>-0.035</td><td>17.620</td><td>0.062</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>0.037</td><td>0.018</td><td>18.051</td><td>0.080</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>12</td><td>0.016</td><td>0.007</td><td>18.136</td><td>0.112</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>-0.048</td><td>-0.030</td><td>18.875</td><td>0.127</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>-0.038</td><td>-0.025</td><td>19.327</td><td>0.153</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>15</td><td>-0.081</td><td>-0.090</td><td>21.428</td><td>0.124</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>16</td><td>-0.038</td><td>-0.011</td><td>21.894</td><td>0.147</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>17</td><td>-0.063</td><td>-0.031</td><td>23.154</td><td>0.144</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>18</td><td>-0.152</td><td>-0.135</td><td>30.560</td><td>0.032</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>19</td><td>0.004</td><td>0.047</td><td>30.564</td><td>0.045</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>20</td><td>-0.009</td><td>-0.014</td><td>30.593</td><td>0.061</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>21</td><td>0.056</td><td>0.077</td><td>31.603</td><td>0.064</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>22</td><td>-0.102</td><td>-0.119</td><td>34.984</td><td>0.039</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>23</td><td>0.061</td><td>0.073</td><td>36.194</td><td>0.039</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>24</td><td>0.033</td><td>-0.005</td><td>36.558</td><td>0.048</td></tr>
</table>

A 3 Correlogram of Log Industrial Production Index (LIPI)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.980</td><td>0.980</td><td>290.89</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|* |</td><td>2</td><td>0.963</td><td>0.086</td><td>573.11</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|* |</td><td>3</td><td>0.951</td><td>0.101</td><td>849.05</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.941</td><td>0.063</td><td>1119.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.930</td><td>0.021</td><td>1385.6</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.919</td><td>-0.006</td><td>1646.0</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>*|. |</td><td>7</td><td>0.904</td><td>-0.099</td><td>1899.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>8</td><td>0.889</td><td>-0.034</td><td>2144.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>9</td><td>0.878</td><td>0.069</td><td>2384.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>10</td><td>0.870</td><td>0.063</td><td>2621.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|* |</td><td>11</td><td>0.864</td><td>0.105</td><td>2855.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.858</td><td>0.025</td><td>3086.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>*|. |</td><td>13</td><td>0.843</td><td>-0.183</td><td>3311.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.829</td><td>-0.027</td><td>3529.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>15</td><td>0.819</td><td>0.022</td><td>3742.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>16</td><td>0.808</td><td>-0.028</td><td>3950.6</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|* |</td><td>17</td><td>0.801</td><td>0.099</td><td>4156.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>18</td><td>0.790</td><td>-0.062</td><td>4356.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>19</td><td>0.776</td><td>-0.054</td><td>4551.1</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>20</td><td>0.762</td><td>-0.019</td><td>4738.9</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>21</td><td>0.752</td><td>0.064</td><td>4922.7</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>22</td><td>0.744</td><td>0.013</td><td>5103.1</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|* |</td><td>23</td><td>0.739</td><td>0.093</td><td>5282.0</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>24</td><td>0.731</td><td>-0.064</td><td>5457.2</td><td>0.000</td></tr>
</table>

A 4 Correlogram of 1st Difference of Log Industrial Production Index (DLIPI)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>*|. |</td><td>*|. |</td><td>1</td><td>-0.163</td><td>-0.163</td><td>8.0433</td><td>0.005</td></tr>
<tr><td>*|. |</td><td>**|. |</td><td>2</td><td>-0.178</td><td>-0.210</td><td>17.629</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>**|. |</td><td>3</td><td>-0.192</td><td>-0.280</td><td>28.781</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>**|. |</td><td>4</td><td>-0.146</td><td>-0.336</td><td>35.274</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>*|. |</td><td>5</td><td>0.103</td><td>-0.179</td><td>38.498</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>6</td><td>0.218</td><td>0.022</td><td>53.054</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>7</td><td>0.058</td><td>0.036</td><td>54.095</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>8</td><td>-0.165</td><td>-0.113</td><td>62.484</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>9</td><td>-0.118</td><td>-0.108</td><td>66.836</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>**|. |</td><td>10</td><td>-0.170</td><td>-0.285</td><td>75.875</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>**|. |</td><td>11</td><td>0.031</td><td>-0.335</td><td>76.177</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|* |</td><td>12</td><td>0.475</td><td>0.184</td><td>146.86</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>13</td><td>0.010</td><td>0.097</td><td>146.89</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>14</td><td>-0.126</td><td>0.059</td><td>151.90</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>15</td><td>-0.171</td><td>0.042</td><td>161.19</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>16</td><td>-0.135</td><td>-0.018</td><td>166.97</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>17</td><td>0.104</td><td>-0.009</td><td>170.39</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>18</td><td>0.186</td><td>-0.020</td><td>181.51</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>19</td><td>0.108</td><td>0.095</td><td>185.28</td><td>0.000</td></tr>
<tr><td>**|. |</td><td>.|. |</td><td>20</td><td>-0.205</td><td>-0.052</td><td>198.88</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>21</td><td>-0.107</td><td>-0.026</td><td>202.60</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>22</td><td>-0.179</td><td>-0.139</td><td>213.07</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>23</td><td>0.198</td><td>0.082</td><td>225.88</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>24</td><td>0.261</td><td>0.041</td><td>248.14</td><td>0.000</td></tr>
</table>

A 5 Correlogram of Log Interest Rate (LINT)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.974</td><td>0.974</td><td>287.61</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.946</td><td>-0.063</td><td>559.69</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.916</td><td>-0.042</td><td>815.77</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>*|. |</td><td>4</td><td>0.884</td><td>-0.066</td><td>1054.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>5</td><td>0.852</td><td>0.008</td><td>1277.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|* |</td><td>6</td><td>0.827</td><td>0.109</td><td>1488.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>7</td><td>0.801</td><td>-0.040</td><td>1687.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>*|. |</td><td>8</td><td>0.773</td><td>-0.070</td><td>1872.4</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>9</td><td>0.742</td><td>-0.064</td><td>2043.9</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>*|. |</td><td>10</td><td>0.707</td><td>-0.114</td><td>2199.9</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>11</td><td>0.671</td><td>0.016</td><td>2341.0</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>12</td><td>0.636</td><td>-0.012</td><td>2468.2</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>13</td><td>0.600</td><td>-0.027</td><td>2581.9</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>*|. |</td><td>14</td><td>0.563</td><td>-0.084</td><td>2682.3</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>15</td><td>0.524</td><td>-0.064</td><td>2769.6</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>*|. |</td><td>16</td><td>0.483</td><td>-0.067</td><td>2844.0</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>17</td><td>0.441</td><td>-0.023</td><td>2906.1</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>18</td><td>0.401</td><td>0.034</td><td>2957.8</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>19</td><td>0.363</td><td>-0.001</td><td>3000.2</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>20</td><td>0.324</td><td>-0.066</td><td>3034.2</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>21</td><td>0.285</td><td>-0.050</td><td>3060.5</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>22</td><td>0.247</td><td>-0.002</td><td>3080.4</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>23</td><td>0.211</td><td>0.039</td><td>3094.9</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>24</td><td>0.176</td><td>0.028</td><td>3105.1</td><td>0.000</td></tr>
</table>

A 6 Correlogram of 1st Difference of Log Interest Rate (DLINT)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|* |</td><td>.|* |</td><td>1</td><td>0.076</td><td>0.076</td><td>1.7469</td><td>0.186</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>0.049</td><td>0.044</td><td>2.4791</td><td>0.290</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>3</td><td>0.079</td><td>0.073</td><td>4.3945</td><td>0.222</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>4</td><td>-0.024</td><td>-0.037</td><td>4.5684</td><td>0.335</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>5</td><td>-0.173</td><td>-0.178</td><td>13.757</td><td>0.017</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>6</td><td>0.034</td><td>0.057</td><td>14.108</td><td>0.028</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>7</td><td>0.068</td><td>0.088</td><td>15.522</td><td>0.030</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>0.055</td><td>0.071</td><td>16.471</td><td>0.036</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>9</td><td>0.152</td><td>0.125</td><td>23.664</td><td>0.005</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>10</td><td>-0.008</td><td>-0.082</td><td>23.686</td><td>0.008</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>-0.007</td><td>-0.012</td><td>23.699</td><td>0.014</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>12</td><td>0.069</td><td>0.085</td><td>25.173</td><td>0.014</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>13</td><td>0.062</td><td>0.091</td><td>26.378</td><td>0.015</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>0.027</td><td>0.057</td><td>26.610</td><td>0.022</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>15</td><td>0.086</td><td>0.025</td><td>28.940</td><td>0.016</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>16</td><td>0.030</td><td>-0.024</td><td>29.228</td><td>0.022</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>17</td><td>0.038</td><td>0.046</td><td>29.684</td><td>0.029</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>18</td><td>0.019</td><td>0.021</td><td>29.801</td><td>0.039</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>19</td><td>0.039</td><td>0.057</td><td>30.293</td><td>0.048</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>20</td><td>0.014</td><td>0.005</td><td>30.360</td><td>0.064</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>21</td><td>-0.016</td><td>-0.070</td><td>30.439</td><td>0.084</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>22</td><td>-0.021</td><td>-0.044</td><td>30.579</td><td>0.105</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>23</td><td>-0.050</td><td>-0.053</td><td>31.380</td><td>0.114</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>24</td><td>-0.013</td><td>0.001</td><td>31.437</td><td>0.142</td></tr>
</table>

A 7 Correlogram of Log Consumer Price Index (LCPI)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.990</td><td>0.990</td><td>296.96</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.980</td><td>-0.009</td><td>588.86</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.970</td><td>-0.007</td><td>875.70</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.959</td><td>-0.008</td><td>1157.5</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.950</td><td>0.012</td><td>1434.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.940</td><td>0.020</td><td>1706.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>7</td><td>0.931</td><td>0.003</td><td>1974.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>8</td><td>0.922</td><td>-0.008</td><td>2238.5</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>9</td><td>0.912</td><td>-0.017</td><td>2497.5</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>10</td><td>0.903</td><td>-0.011</td><td>2752.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>11</td><td>0.893</td><td>-0.009</td><td>3001.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.883</td><td>-0.022</td><td>3246.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>13</td><td>0.872</td><td>-0.009</td><td>3487.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.862</td><td>-0.007</td><td>3722.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>15</td><td>0.852</td><td>-0.016</td><td>3953.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>16</td><td>0.842</td><td>0.005</td><td>4179.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>17</td><td>0.832</td><td>0.011</td><td>4400.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>18</td><td>0.822</td><td>0.015</td><td>4618.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>19</td><td>0.813</td><td>-0.006</td><td>4831.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>20</td><td>0.804</td><td>-0.008</td><td>5040.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>21</td><td>0.794</td><td>-0.012</td><td>5244.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>22</td><td>0.784</td><td>-0.023</td><td>5445.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>23</td><td>0.774</td><td>-0.016</td><td>5640.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>24</td><td>0.763</td><td>-0.022</td><td>5832.0</td><td>0.000</td></tr>
</table>

A 8 Correlogram of 1st Difference of Log CPI (DLCPI)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|** |</td><td>.|** |</td><td>1</td><td>0.240</td><td>0.240</td><td>17.348</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>2</td><td>-0.007</td><td>-0.068</td><td>17.362</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>3</td><td>-0.006</td><td>0.012</td><td>17.374</td><td>0.001</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>4</td><td>-0.162</td><td>-0.175</td><td>25.417</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>5</td><td>-0.168</td><td>-0.093</td><td>34.092</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>6</td><td>-0.117</td><td>-0.075</td><td>38.326</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>7</td><td>-0.153</td><td>-0.128</td><td>45.518</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>8</td><td>-0.138</td><td>-0.118</td><td>51.405</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>9</td><td>-0.064</td><td>-0.072</td><td>52.661</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>10</td><td>0.045</td><td>0.019</td><td>53.304</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>11</td><td>0.154</td><td>0.083</td><td>60.742</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|*** |</td><td>12</td><td>0.525</td><td>0.473</td><td>147.24</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>13</td><td>0.264</td><td>0.058</td><td>169.22</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>14</td><td>0.066</td><td>0.074</td><td>170.60</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>15</td><td>0.063</td><td>0.081</td><td>171.86</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>16</td><td>-0.152</td><td>-0.063</td><td>179.16</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|* |</td><td>17</td><td>-0.102</td><td>0.111</td><td>182.47</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>18</td><td>-0.145</td><td>-0.091</td><td>189.20</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>19</td><td>-0.203</td><td>-0.046</td><td>202.49</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>20</td><td>-0.171</td><td>-0.092</td><td>211.92</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>21</td><td>-0.018</td><td>0.090</td><td>212.03</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>22</td><td>-0.001</td><td>-0.094</td><td>212.03</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>23</td><td>0.079</td><td>-0.028</td><td>214.05</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|* |</td><td>24</td><td>0.361</td><td>0.086</td><td>256.63</td><td>0.000</td></tr>
</table>

A 9 Correlogram of Log Exchange Rate (LEXR)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.991</td><td>0.991</td><td>297.75</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.982</td><td>-0.020</td><td>591.09</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.973</td><td>0.005</td><td>880.15</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.964</td><td>-0.012</td><td>1164.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.955</td><td>-0.010</td><td>1445.2</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.946</td><td>-0.012</td><td>1721.1</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>7</td><td>0.937</td><td>0.016</td><td>1992.8</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>8</td><td>0.929</td><td>0.003</td><td>2260.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>9</td><td>0.920</td><td>0.013</td><td>2524.1</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>10</td><td>0.912</td><td>-0.014</td><td>2783.8</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>11</td><td>0.903</td><td>-0.012</td><td>3039.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.895</td><td>0.008</td><td>3291.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>13</td><td>0.886</td><td>-0.001</td><td>3539.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.878</td><td>-0.010</td><td>3783.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>15</td><td>0.869</td><td>0.005</td><td>4023.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>16</td><td>0.861</td><td>-0.010</td><td>4259.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>17</td><td>0.852</td><td>-0.007</td><td>4492.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>18</td><td>0.844</td><td>-0.012</td><td>4721.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>19</td><td>0.835</td><td>-0.012</td><td>4946.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>20</td><td>0.826</td><td>-0.004</td><td>5167.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>21</td><td>0.818</td><td>-0.004</td><td>5384.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>22</td><td>0.809</td><td>-0.008</td><td>5597.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>23</td><td>0.800</td><td>-0.022</td><td>5806.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>24</td><td>0.791</td><td>-0.005</td><td>6012.0</td><td>0.000</td></tr>
</table>

A 10 Correlogram of 1st Difference of Log Exchange Rate (DLEXR)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|. |</td><td>.|. |</td><td>1</td><td>0.061</td><td>0.061</td><td>1.1135</td><td>0.291</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>-0.049</td><td>-0.052</td><td>1.8294</td><td>0.401</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>3</td><td>0.066</td><td>0.072</td><td>3.1415</td><td>0.370</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>4</td><td>-0.002</td><td>-0.014</td><td>3.1426</td><td>0.534</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>5</td><td>0.017</td><td>0.025</td><td>3.2267</td><td>0.665</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>6</td><td>-0.028</td><td>-0.036</td><td>3.4602</td><td>0.749</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>7</td><td>0.006</td><td>0.014</td><td>3.4730</td><td>0.838</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>0.072</td><td>0.065</td><td>5.0822</td><td>0.749</td></tr>
<tr><td>.|** |</td><td>.|** |</td><td>9</td><td>0.225</td><td>0.225</td><td>20.734</td><td>0.014</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>10</td><td>0.049</td><td>0.029</td><td>21.495</td><td>0.018</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>-0.040</td><td>-0.029</td><td>21.989</td><td>0.024</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>12</td><td>-0.048</td><td>-0.079</td><td>22.710</td><td>0.030</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>0.042</td><td>0.045</td><td>23.264</td><td>0.039</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>14</td><td>-0.052</td><td>-0.066</td><td>24.123</td><td>0.044</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>-0.012</td><td>0.024</td><td>24.171</td><td>0.062</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>16</td><td>-0.044</td><td>-0.071</td><td>24.784</td><td>0.074</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>17</td><td>-0.000</td><td>-0.012</td><td>24.784</td><td>0.100</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>18</td><td>0.007</td><td>-0.069</td><td>24.798</td><td>0.131</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>19</td><td>-0.072</td><td>-0.069</td><td>26.465</td><td>0.118</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>20</td><td>-0.085</td><td>-0.076</td><td>28.816</td><td>0.091</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>21</td><td>-0.038</td><td>-0.003</td><td>29.283</td><td>0.107</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>22</td><td>0.138</td><td>0.142</td><td>35.466</td><td>0.035</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>23</td><td>-0.071</td><td>-0.059</td><td>37.128</td><td>0.032</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>24</td><td>-0.027</td><td>0.006</td><td>37.372</td><td>0.040</td></tr>
</table>

A 11 Correlogram of Log Money Supply (LM2)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.990</td><td>0.990</td><td>297.16</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.981</td><td>-0.002</td><td>589.53</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.971</td><td>-0.008</td><td>877.10</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.961</td><td>-0.008</td><td>1159.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.951</td><td>-0.003</td><td>1437.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.942</td><td>0.007</td><td>1711.3</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>7</td><td>0.932</td><td>-0.016</td><td>1979.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>8</td><td>0.922</td><td>-0.002</td><td>2244.0</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>9</td><td>0.913</td><td>-0.003</td><td>2503.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>10</td><td>0.903</td><td>-0.011</td><td>2758.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>11</td><td>0.893</td><td>-0.004</td><td>3008.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.884</td><td>0.007</td><td>3254.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>13</td><td>0.874</td><td>-0.025</td><td>3495.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.864</td><td>-0.001</td><td>3731.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>15</td><td>0.854</td><td>-0.006</td><td>3964.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>16</td><td>0.844</td><td>-0.013</td><td>4191.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>17</td><td>0.834</td><td>-0.003</td><td>4414.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>18</td><td>0.825</td><td>0.005</td><td>4632.9</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>19</td><td>0.815</td><td>-0.015</td><td>4847.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>20</td><td>0.805</td><td>-0.002</td><td>5056.7</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>21</td><td>0.795</td><td>-0.005</td><td>5262.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>22</td><td>0.785</td><td>-0.011</td><td>5463.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>23</td><td>0.775</td><td>-0.004</td><td>5659.6</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>24</td><td>0.766</td><td>0.003</td><td>5852.1</td><td>0.000</td></tr>
</table>

A 12 Correlogram of 1st Difference of Log Money Supply (DLM2)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>**|. |</td><td>**|. |</td><td>1</td><td>-0.322</td><td>-0.322</td><td>31.336</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>2</td><td>-0.037</td><td>-0.157</td><td>31.741</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>3</td><td>0.039</td><td>-0.029</td><td>32.205</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>4</td><td>-0.116</td><td>-0.134</td><td>36.343</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>**|. |</td><td>5</td><td>-0.181</td><td>-0.308</td><td>46.387</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|**** |</td><td>6</td><td>0.582</td><td>0.486</td><td>150.47</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|* |</td><td>7</td><td>-0.181</td><td>0.188</td><td>160.58</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>8</td><td>-0.154</td><td>-0.205</td><td>167.87</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>9</td><td>0.114</td><td>-0.029</td><td>171.93</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>10</td><td>-0.144</td><td>0.015</td><td>178.40</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>11</td><td>-0.182</td><td>-0.175</td><td>188.77</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|**** |</td><td>12</td><td>0.733</td><td>0.569</td><td>357.28</td><td>0.000</td></tr>
<tr><td>**|. |</td><td>.|. |</td><td>13</td><td>-0.294</td><td>0.062</td><td>384.47</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>14</td><td>-0.001</td><td>0.077</td><td>384.47</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>0.002</td><td>-0.053</td><td>384.47</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>16</td><td>-0.104</td><td>-0.031</td><td>387.93</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>17</td><td>-0.195</td><td>-0.082</td><td>400.07</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>*|. |</td><td>18</td><td>0.510</td><td>-0.166</td><td>483.38</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>19</td><td>-0.184</td><td>0.022</td><td>494.27</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>20</td><td>-0.144</td><td>-0.080</td><td>500.94</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>21</td><td>0.141</td><td>0.025</td><td>507.42</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>22</td><td>-0.200</td><td>0.010</td><td>520.39</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>23</td><td>-0.045</td><td>0.135</td><td>521.05</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|* |</td><td>24</td><td>0.528</td><td>0.116</td><td>612.30</td><td>0.000</td></tr>
</table>

A 13 Correlogram of Log Gold Price (LGDPRICE)

Sample: 1991M01 2015M12
Included observations: 300

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.994</td><td>0.994</td><td>299.27</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.988</td><td>0.022</td><td>595.99</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.982</td><td>-0.024</td><td>890.01</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.975</td><td>-0.036</td><td>1181.1</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.968</td><td>-0.030</td><td>1469.1</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>6</td><td>0.962</td><td>0.024</td><td>1754.2</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>7</td><td>0.955</td><td>-0.053</td><td>2036.0</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>8</td><td>0.947</td><td>-0.021</td><td>2314.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>9</td><td>0.940</td><td>-0.000</td><td>2589.4</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>10</td><td>0.933</td><td>-0.003</td><td>2861.2</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>11</td><td>0.925</td><td>-0.032</td><td>3129.3</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>12</td><td>0.917</td><td>-0.009</td><td>3393.9</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>13</td><td>0.909</td><td>-0.020</td><td>3654.8</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>14</td><td>0.901</td><td>-0.008</td><td>3912.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>15</td><td>0.893</td><td>-0.012</td><td>4165.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>16</td><td>0.885</td><td>0.016</td><td>4415.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>17</td><td>0.877</td><td>-0.032</td><td>4661.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>18</td><td>0.868</td><td>-0.010</td><td>4903.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>*|. |</td><td>19</td><td>0.859</td><td>-0.069</td><td>5141.4</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>20</td><td>0.850</td><td>0.005</td><td>5375.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>21</td><td>0.841</td><td>-0.028</td><td>5604.6</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>22</td><td>0.831</td><td>-0.031</td><td>5829.6</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>23</td><td>0.821</td><td>-0.020</td><td>6050.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>24</td><td>0.811</td><td>-0.011</td><td>6266.0</td><td>0.000</td></tr>
</table>

A 14 Correlogram of 1st Difference of Log Gold Price (DLGDPRICE)

Sample: 1991M01 2015M12
Included observations: 299

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>*|. |</td><td>*|. |</td><td>1</td><td>-0.125</td><td>-0.125</td><td>4.7532</td><td>0.029</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>2</td><td>-0.069</td><td>-0.086</td><td>6.1971</td><td>0.045</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>3</td><td>0.130</td><td>0.113</td><td>11.345</td><td>0.010</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>4</td><td>0.105</td><td>0.135</td><td>14.687</td><td>0.005</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>5</td><td>-0.120</td><td>-0.075</td><td>19.106</td><td>0.002</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>6</td><td>-0.010</td><td>-0.040</td><td>19.140</td><td>0.004</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>7</td><td>0.104</td><td>0.061</td><td>22.483</td><td>0.002</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>-0.029</td><td>0.002</td><td>22.751</td><td>0.004</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>9</td><td>-0.058</td><td>-0.028</td><td>23.801</td><td>0.005</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>10</td><td>0.119</td><td>0.087</td><td>28.232</td><td>0.002</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>-0.004</td><td>-0.001</td><td>28.238</td><td>0.003</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>12</td><td>0.071</td><td>0.114</td><td>29.810</td><td>0.003</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>0.005</td><td>0.014</td><td>29.817</td><td>0.005</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>0.019</td><td>-0.008</td><td>29.925</td><td>0.008</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>-0.026</td><td>-0.030</td><td>30.140</td><td>0.011</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>16</td><td>-0.010</td><td>-0.028</td><td>30.169</td><td>0.017</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>17</td><td>-0.005</td><td>-0.015</td><td>30.178</td><td>0.025</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>18</td><td>0.036</td><td>0.048</td><td>30.585</td><td>0.032</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>19</td><td>-0.079</td><td>-0.072</td><td>32.600</td><td>0.027</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>20</td><td>0.107</td><td>0.093</td><td>36.260</td><td>0.014</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>21</td><td>0.085</td><td>0.109</td><td>38.611</td><td>0.011</td></tr>
<tr><td>.|. |</td><td>.|* |</td><td>22</td><td>0.048</td><td>0.081</td><td>39.359</td><td>0.013</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>23</td><td>0.002</td><td>0.027</td><td>39.361</td><td>0.018</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>24</td><td>0.123</td><td>0.076</td><td>44.341</td><td>0.007</td></tr>
</table>

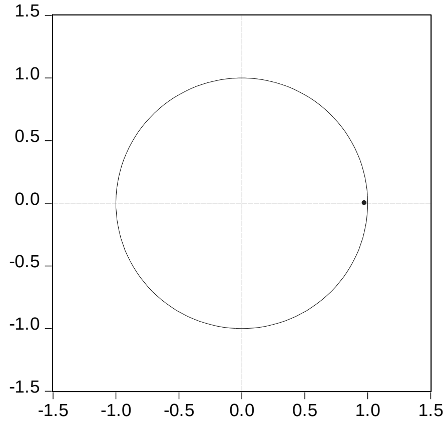
APPENDIX B: Stability of VAR and Optimal Lag Length Selection

Roots of Characteristic Polynomial
Endogenous variables: **LDSEGEN**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/26/16 Time: 23:45

Root	Modulus
0.976307	0.976307

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: **LDSEGEN**
Exogenous variables: **C @TREND**
Sample: 1991M01 2015M12
Included observations: 292

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-160.5105	NA	0.178210	1.113086	1.138269	1.123173
1	285.3831	882.6249	0.008463	-1.934131	-1.896356	-1.918999
2	289.6135	8.345038*	0.008278*	-1.956257*	-1.905891*	-1.936082*
3	289.7713	0.310242	0.008326	-1.950489	-1.887531	-1.925270
4	290.9494	2.307642	0.008316	-1.951708	-1.876158	-1.921446
5	291.5000	1.074801	0.008342	-1.948630	-1.860489	-1.913324
6	292.2623	1.482926	0.008355	-1.947002	-1.846269	-1.906653
7	292.9407	1.314926	0.008374	-1.944799	-1.831475	-1.899406
8	294.4311	2.878641	0.008346	-1.948158	-1.822242	-1.897721

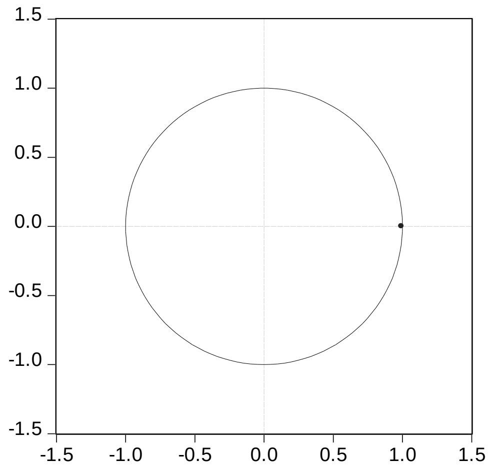
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LDSEGEN**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/26/16 Time: 23:47

Root	Modulus
0.993099	0.993099

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: **LDSEGEN**
Exogenous variables: **C**
Sample: 1991M01 2015M12
Included observations: 292

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-372.0815	NA	0.753878	2.555353	2.567945	2.560397
1	284.3725	1303.915	0.008464	-1.934058	-1.908875	-1.923971
2	288.0831	7.345111*	0.008308*	-1.952624*	-1.914849*	-1.937493*

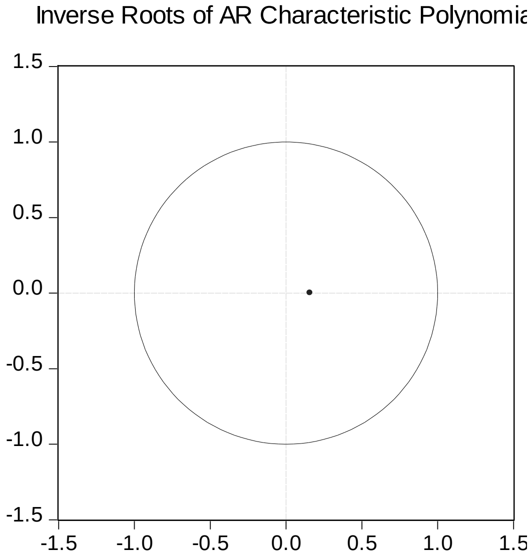
3	288.1410	0.114174	0.008362	-1.946171	-1.895805	-1.925997
4	288.9790	1.647363	0.008371	-1.945062	-1.882104	-1.919844
5	289.2778	0.585234	0.008412	-1.940259	-1.864709	-1.909997
6	290.4075	2.205251	0.008404	-1.941147	-1.853006	-1.905841
7	291.3852	1.901812	0.008406	-1.940995	-1.840262	-1.900645
8	292.4934	2.148103	0.008399	-1.941736	-1.828411	-1.896342

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables**: DLDSEGEN**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/26/16 Time: 23:49

Root	Modulus
0.158751	0.158751

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLDSEGEN**
Exogenous variables: **C @TREND**
Date: 12/26/16 Time: 23:49
Sample: 1991M01 2015M12
Included observations: 291

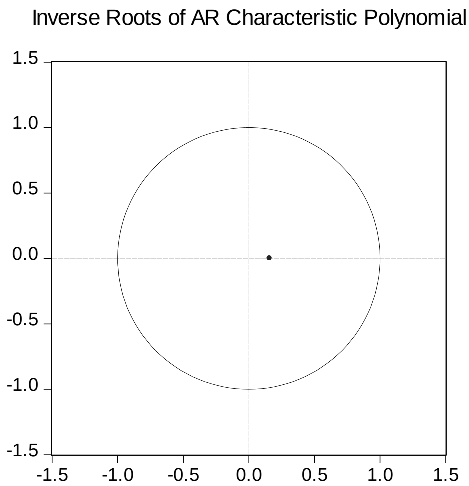
Lag	LogL	LR	FPE	AIC	SC	HQ
0	282.1163	NA	0.008539	-1.925198	-1.899952	-1.915084
1	285.6397	6.974142*	0.008392*	-1.942541*	-1.904672*	-1.927370*
2	285.6718	0.063177	0.008449	-1.935888	-1.885396	-1.915661
3	286.3826	1.397343	0.008465	-1.933901	-1.870786	-1.908617
4	286.6039	0.433393	0.008511	-1.928549	-1.852811	-1.898208
5	287.8817	2.494212	0.008495	-1.930459	-1.842097	-1.895061
6	288.9652	2.107259	0.008490	-1.931032	-1.830047	-1.890577
7	289.9565	1.921421	0.008490	-1.930973	-1.817365	-1.885461
8	290.2256	0.519630	0.008533	-1.925949	-1.799718	-1.875380

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLDSEGEN**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/26/16 Time: 23:50

Root	Modulus
0.159041	0.159041

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C
Date: 12/26/16 Time: 23:50
Sample: 1991M01 2015M12
Included observations: 291

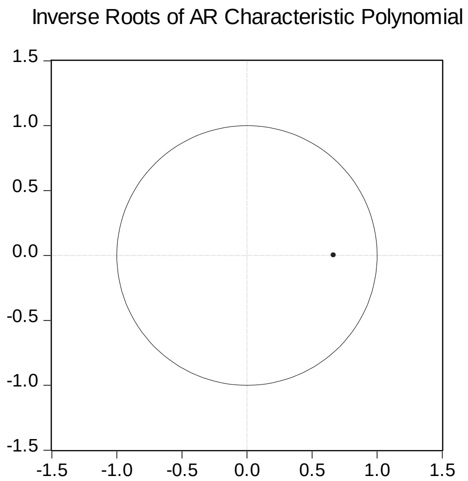
Lag	LogL	LR	FPE	AIC	SC	HQ
0	281.9567	NA	0.008490	-1.930974	-1.918350	-1.925917
1	285.5211	7.079894*	0.008342*	-1.948599*	-1.923352*	-1.938485*
2	285.5563	0.069595	0.008397	-1.941967	-1.904098	-1.926797
3	286.2755	1.418763	0.008414	-1.940038	-1.889546	-1.919811
4	286.5000	0.441233	0.008459	-1.934708	-1.871592	-1.909424
5	287.7717	2.490912	0.008443	-1.936575	-1.860837	-1.906234
6	288.8454	2.095790	0.008439	-1.937082	-1.848720	-1.901684
7	289.8469	1.947843	0.008438	-1.937092	-1.836107	-1.896637
8	290.1230	0.535161	0.008481	-1.932117	-1.818509	-1.886605

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LIPI**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/26/16 Time: 23:51

Root	Modulus
0.666293	0.666293

No root lies outside the unit circle.
VAR satisfies the stability condition.



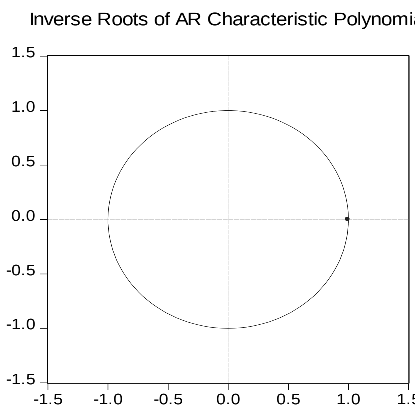
VAR Lag Order Selection Criteria
Endogenous variables**: LIPI**
Exogenous variables: **C @TREND**
Sample: 1991M01 2015M12
Included observations: 292

Lag	LogL	LR	FPE	AIC	SC	HQ
0	302.2767	NA	0.007487	-2.056689	-2.031506	-2.046602
1	386.0914	165.9073	0.004246	-2.623914	-2.586139	-2.608783
2	386.1133	0.043248	0.004274	-2.617215	-2.566848	-2.597040
3	387.1843	2.105220	0.004272	-2.617701	-2.554743	-2.592482
4	393.2624	11.90635	0.004126	-2.652482	-2.576932	-2.622220
5	407.4171	27.63082	0.003771	-2.742583	-2.654442	-2.707277
6	411.4938	7.929948*	0.003692*	-2.763656*	-2.662923*	-2.723306*
7	411.7889	0.572004	0.003710	-2.758828	-2.645503	-2.713435
8	412.5763	1.520994	0.003716	-2.757372	-2.631456	-2.706935

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LIPI**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/26/16 Time: 23:57

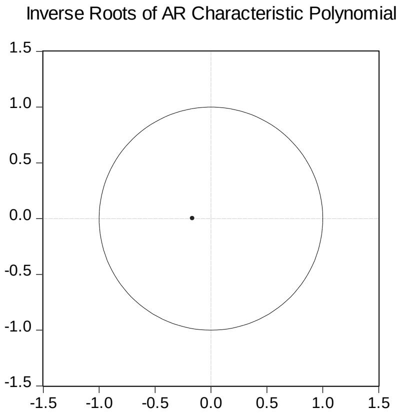
Root	Modulus
0.994251	0.994251



VAR Lag Order Selection Criteria
Endogenous variables: **LIPI**
Exogenous variables: **C**
Date: 12/26/16 Time: 23:57
Sample: 1991M01 2015M12
Included observations: 292

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-227.2386	NA	0.279543	1.563278	1.575869	1.568321
1	360.6889	1167.801	0.005018	-2.456773	-2.431590	-2.446686
2	365.1560	8.842333	0.004901	-2.480520	-2.442745	-2.465389
3	371.7345	12.97684	0.004717	-2.518730	-2.468363	-2.498555
4	383.9461	24.00488	0.004368	-2.595521	-2.532563	-2.570302
5	402.9478	37.22259	0.003862	-2.718820	-2.643271	-2.688558
6	408.5302	10.89725*	0.003742*	-2.750207*	-2.662066*	-2.714901*
7	408.5821	0.100888	0.003767	-2.743713	-2.642980	-2.703363
8	408.8622	0.542836	0.003785	-2.738782	-2.625457	-2.693389

* indicates lag order selected by the criterion



Roots of Characteristic Polynomial
Endogenous variables: **DLIPI**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/26/16 Time: 23:58

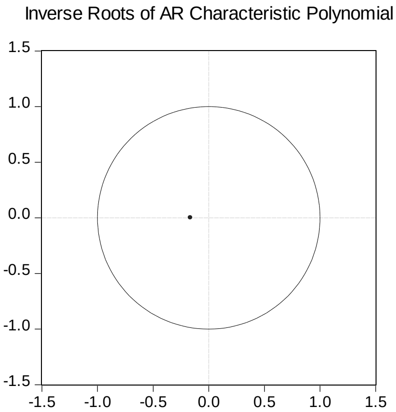
Root	Modulus
-0.164850	0.164850

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	358.7145	NA	0.005044	-2.451646	-2.426400	-2.441532
1	363.3316	9.139003	0.004920	-2.476506	-2.438636	-2.461335
2	369.9552	13.06523	0.004734	-2.515156	-2.464664	-2.494929
3	382.3178	24.30039	0.004378	-2.593250	-2.530134	-2.567965
4	401.2204	37.02562	0.003871	-2.716291	-2.640553	-2.685950
5	406.7292	10.75258*	0.003753*	-2.747280*	-2.658918*	-2.711882*
6	406.7781	0.095030	0.003778	-2.740743	-2.639758	-2.700288
7	407.0639	0.554028	0.003796	-2.735834	-2.622226	-2.690323
8	408.8481	3.445772	0.003776	-2.741224	-2.614993	-2.690655

* indicates lag order selected by the criterion



Roots of Characteristic Polynomial
Endogenous variables: **DLIPI**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/26/16 Time: 23:59

Root	Modulus
-0.164650	0.164650

No root lies outside the unit circle.

VAR Lag Order Selection Criteria
Endogenous variables: **DLIPI**
Exogenous variables: **C**
Date: 12/26/16 Time: 23:59
Sample: 1991M01 2015M12
Included observations: 291

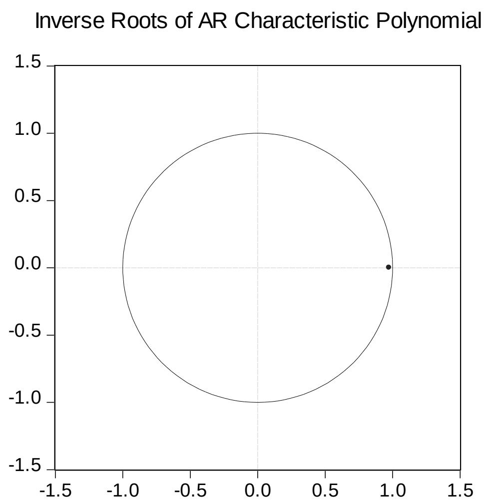
Lag	LogL	LR	FPE	AIC	SC	HQ
0	358.6714	NA	0.005011	-2.458223	-2.445599	-2.453166
1	363.2785	9.150814	0.004888	-2.483013	-2.457767	-2.472900
2	369.8927	13.09221	0.004703	-2.521600	-2.483730	-2.506429
3	382.2575	24.38967	0.004350	-2.599708	-2.549216	-2.579481
4	401.1528	37.14127	0.003847	-2.722700	-2.659584	-2.697416
5	406.6541	10.77572*	0.003729*	-2.753637*	-2.677898*	-2.723295*
6	406.7061	0.101371	0.003754	-2.747121	-2.658759	-2.711723
7	406.9991	0.570019	0.003772	-2.742262	-2.641277	-2.701807
8	408.7621	3.416815	0.003752	-2.747506	-2.633898	-2.701994

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LINT**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/26/16 Time: 23:59

Root	Modulus
0.975198	0.975198

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LINT**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:00
Sample: 1991M01 2015M12
Included observations: 292

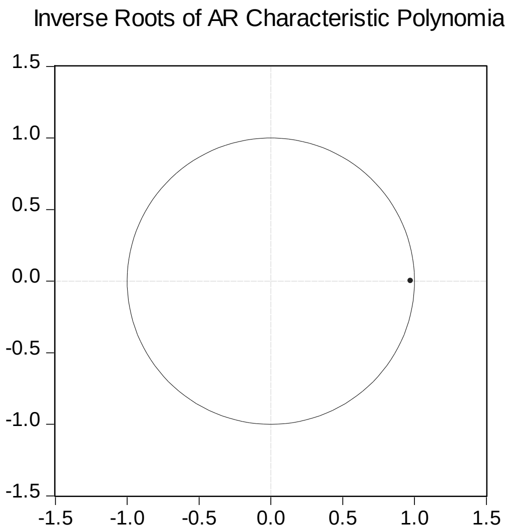
Lag	LogL	LR	FPE	AIC	SC	HQ
0	798.2474	NA	0.000251	-5.453749	-5.428566	-5.443662
1	1268.385	930.6153	1.01e-05	-8.667022	-8.629247*	-8.651891*
2	1269.381	1.964896	1.01e-05	-8.666995	-8.616629	-8.646820
3	1269.767	0.758311	1.01e-05	-8.662788	-8.599830	-8.637569
4	1270.771	1.967296	1.01e-05	-8.662817	-8.587268	-8.632555
5	1270.878	0.207993	1.02e-05	-8.656698	-8.568556	-8.621392
6	1275.282	8.566876*	9.95e-06*	-8.680014*	-8.579281	-8.639664
7	1275.821	1.045174	9.98e-06	-8.676857	-8.563533	-8.631464
8	1277.111	2.491504	9.96e-06	-8.678843	-8.552927	-8.628406

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LINT**
Exogenous variables**: C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:00

Root	Modulus
0.975248	0.975248

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LINT**
Exogenous variables: **C**
Date: 12/27/16 Time: 00:01
Sample: 1991M01 2015M12
Included observations: 288

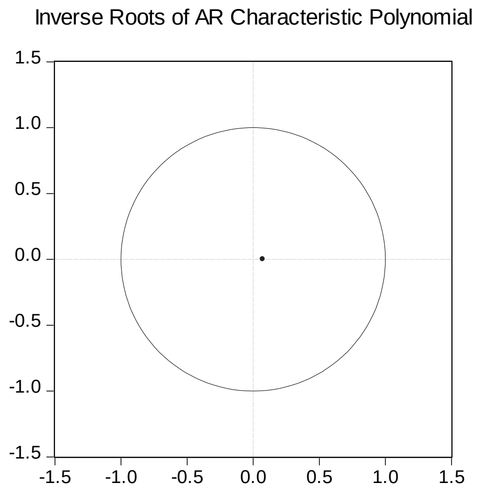
Lag	LogL	LR	FPE	AIC	SC	HQ
0	793.9402	NA	0.000238	-5.506529	-5.493811	-5.501432
1	1248.683	903.1699	1.02e-05	-8.657521	-8.632084*	-8.647328*
2	1249.750	2.112181	1.02e-05	-8.657988	-8.619832	-8.642698
3	1250.191	0.869149	1.02e-05	-8.654104	-8.603230	-8.633717
4	1251.277	2.133719	1.02e-05	-8.654699	-8.591106	-8.629215
5	1251.353	0.149634	1.03e-05	-8.648285	-8.571974	-8.617704
6	1255.473	8.039204	1.01e-05	-8.669950	-8.580920	-8.634272
7	1256.091	1.201485	1.01e-05	-8.667297	-8.565548	-8.626522
8	1257.489	2.708352	1.01e-05	-8.670060	-8.555592	-8.624188
9	1258.524	1.998970	1.00e-05	-8.670306	-8.543120	-8.619337
10	1261.506	5.735153*	9.91e-06*	-8.684066*	-8.544161	-8.628001
11	1262.087	1.114840	9.94e-06	-8.681161	-8.528537	-8.619999
12	1262.090	0.006146	1.00e-05	-8.674239	-8.508897	-8.607980

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 12/27/16 Time: 00:02

Root	Modulus
0.073820	0.073820

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLINT**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:02
Sample: 1991M01 2015M12
Included observations: 291

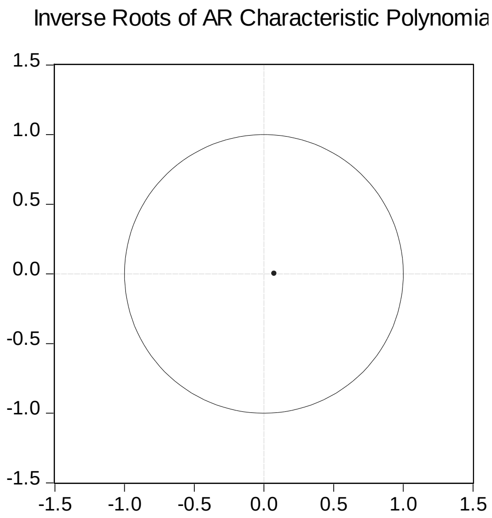
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1260.438	NA	1.03e-05	-8.649059	-8.623813*	-8.638946*
1	1261.227	1.561963	1.03e-05	-8.647610	-8.609741	-8.632439
2	1261.476	0.491252	1.03e-05	-8.642449	-8.591956	-8.622221
3	1262.212	1.446038	1.04e-05	-8.640632	-8.577517	-8.615348
4	1262.438	0.442488	1.04e-05	-8.635312	-8.559573	-8.604971
5	1267.314	9.517109*	1.01e-05*	-8.661950*	-8.573588	-8.626552
6	1267.723	0.796131	1.02e-05	-8.657890	-8.556905	-8.617435
7	1268.760	2.010652	1.02e-05	-8.658147	-8.544539	-8.612635
8	1269.446	1.324494	1.02e-05	-8.655988	-8.529757	-8.605419

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLINT**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:02

Root	Modulus
0.076177	0.076177

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLINT**
Exogenous variables: **C**
Date: 12/27/16 Time: 00:02
Sample: 1991M01 2015M12
Included observations: 291

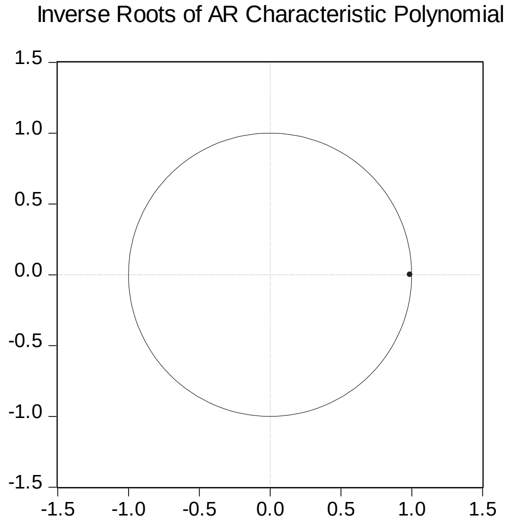
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1260.057	NA	1.02e-05	-8.653316	-8.640693*	-8.648259*
1	1260.904	1.680616	1.02e-05	-8.652258	-8.627012	-8.642144
2	1261.184	0.554623	1.03e-05	-8.647311	-8.609442	-8.632140
3	1261.970	1.551101	1.03e-05	-8.645843	-8.595350	-8.625615
4	1262.169	0.390950	1.04e-05	-8.640337	-8.577221	-8.615053
5	1266.875	9.218223*	1.01e-05*	-8.665809*	-8.590070	-8.635467
6	1267.345	0.917099	1.01e-05	-8.662165	-8.573803	-8.626767
7	1268.467	2.181530	1.01e-05	-8.663001	-8.562016	-8.622546
8	1269.210	1.441092	1.01e-05	-8.661238	-8.547630	-8.615726

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LCPI**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:03

Root	Modulus
0.988866	0.988866

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LCPI**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:03
Sample: 1991M01 2015M12
Included observations: 288

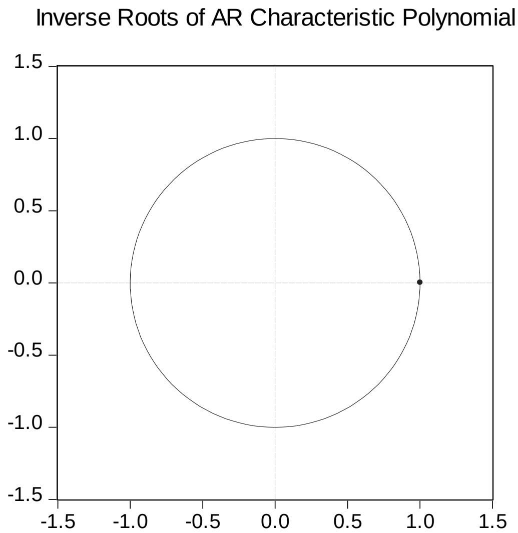
Lag	LogL	LR	FPE	AIC	SC	HQ
0	392.6966	NA	0.003883	-2.713171	-2.687734	-2.702977
1	941.7659	1086.700	8.64e-05	-6.519207	-6.481051	-6.503917
2	949.9592	16.15917	8.21e-05	-6.569161	-6.518287*	-6.548774
3	950.6764	1.409436	8.23e-05	-6.567197	-6.503604	-6.541713
4	950.6839	0.014676	8.29e-05	-6.560305	-6.483993	-6.529724
5	955.9640	10.30356	8.04e-05	-6.590028	-6.500998	-6.554350
6	957.9681	3.896732	7.99e-05	-6.597000	-6.495251	-6.556226
7	958.8017	1.615283	8.00e-05	-6.595845	-6.481378	-6.549974
8	962.4690	7.079779	7.85e-05	-6.614368	-6.487182	-6.563399
9	966.6461	8.035096	7.68e-05	-6.636431	-6.496526	-6.580366
10	968.8960	4.312358*	7.61e-05*	-6.645111*	-6.492488	-6.583949*
11	969.1025	0.394467	7.66e-05	-6.639601	-6.474259	-6.573342
12	969.2591	0.297803	7.70e-05	-6.633743	-6.455683	-6.562387

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LCPI**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:04

Root	Modulus
1.002527	1.002527

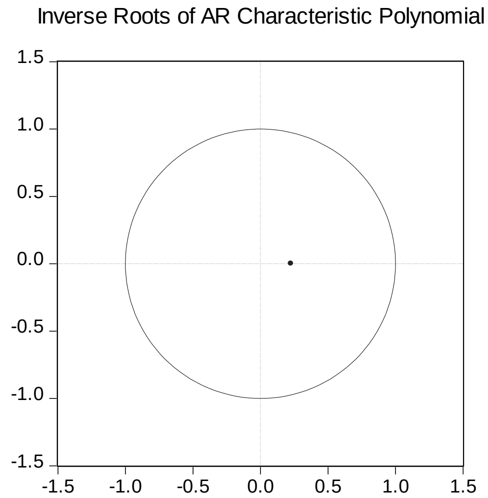
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: **DLCPI**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:05

Root	Modulus
0.226810	0.226810

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLCPI**
Exogenous variables**: C @TREND**
Date: 12/27/16 Time: 00:05
Sample: 1991M01 2015M12
Included observations: 284

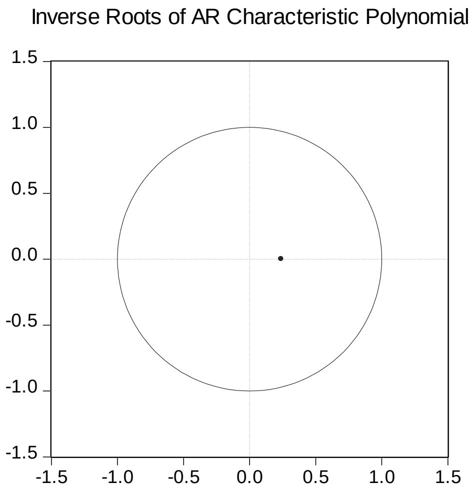
Lag	LogL	LR	FPE	AIC	SC	HQ
0	929.3128	NA	8.54e-05	-6.530372	-6.504675	-6.520070
1	936.5521	14.32556	8.17e-05	-6.574311	-6.535765	-6.558857
2	937.3796	1.631654	8.18e-05	-6.573096	-6.521702	-6.552491
3	937.3834	0.007591	8.24e-05	-6.566081	-6.501838	-6.540324
4	942.0682	9.171553	8.03e-05	-6.592029	-6.514938	-6.561122
5	944.1843	4.127913	7.97e-05	-6.599889	-6.509950	-6.563831
6	944.8736	1.339664	7.98e-05	-6.597701	-6.494913	-6.556491
7	948.5420	7.104346	7.83e-05	-6.616493	-6.500856	-6.570132
8	953.0874	8.770680	7.64e-05	-6.641460	-6.512975	-6.589948
9	955.4739	4.588170	7.57e-05	-6.651225	-6.509891	-6.594561
10	955.9352	0.883732	7.60e-05	-6.647431	-6.493249	-6.585617
11	956.0608	0.239659	7.64e-05	-6.641273	-6.474243	-6.574307
12	993.6266	71.42798*	5.91e-05*	-6.898779*	-6.718900*	-6.826662*
13	994.0297	0.763499	5.93e-05	-6.894575	-6.701848	-6.817307
14	994.3605	0.624338	5.96e-05	-6.889863	-6.684287	-6.807443
15	995.0123	1.225488	5.98e-05	-6.887410	-6.668986	-6.799839

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLCPI**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:06

Root	Modulus
0.239669	0.239669

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables**: DLCPI**
Exogenous variables: **C**
Date: 12/27/16 Time: 00:06
Sample: 1991M01 2015M12
Included observations: 284

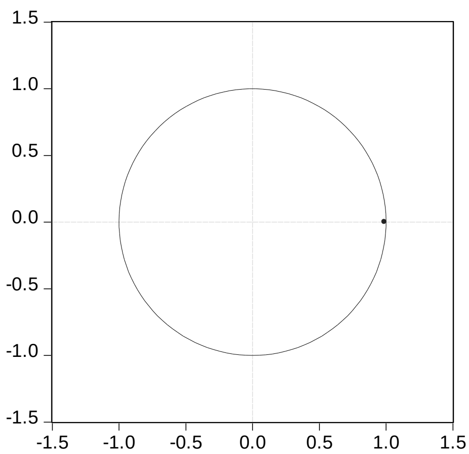
Lag	LogL	LR	FPE	AIC	SC	HQ
0	926.1513	NA	8.67e-05	-6.515150	-6.502301	-6.509999
1	934.4688	16.51796	8.23e-05	-6.566682	-6.540985	-6.556380
2	935.0225	1.095570	8.26e-05	-6.563539	-6.524993	-6.548085
3	935.0327	0.020149	8.32e-05	-6.556568	-6.505174	-6.535963
4	938.9063	7.610895	8.15e-05	-6.576805	-6.512563	-6.551049
5	940.2901	2.708955	8.13e-05	-6.579507	-6.502416	-6.548600
6	940.5599	0.526406	8.17e-05	-6.574366	-6.484426	-6.538307
7	942.8449	4.441229	8.10e-05	-6.583415	-6.480627	-6.542205
8	945.2722	4.700867	8.02e-05	-6.593466	-6.477830	-6.547105
9	945.8965	1.204525	8.04e-05	-6.590820	-6.462335	-6.539308
10	945.9306	0.065651	8.09e-05	-6.584019	-6.442685	-6.527355
11	947.1931	2.418323	8.08e-05	-6.585867	-6.431685	-6.524052
12	990.1757	82.03012*	6.01e-05*	-6.881519*	-6.714489*	-6.814553*
13	990.9596	1.490454	6.02e-05	-6.879997	-6.700118	-6.807880
14	991.6319	1.273639	6.03e-05	-6.877690	-6.684962	-6.800421
15	992.6795	1.977155	6.03e-05	-6.878025	-6.672449	-6.795605

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LEXR**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:07

Root	Modulus
0.988645	0.988645

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:08
Included observations: 292

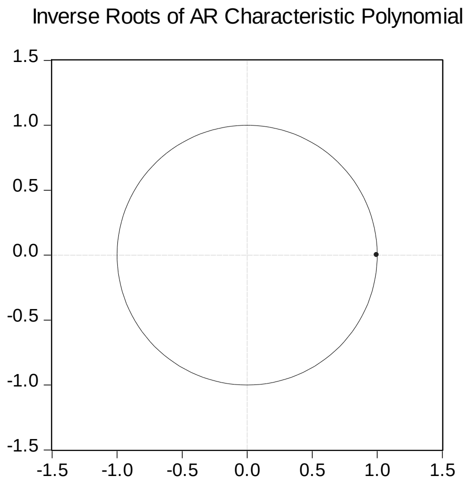
Lag	LogL	LR	FPE	AIC	SC	HQ
0	471.3179	NA	0.002352	-3.214506	-3.189323	-3.204419
1	946.1773	939.9613*	9.16e-05*	-6.460118*	-6.422344*	-6.444987*
2	946.7096	1.050096	9.19e-05	-6.456915	-6.406549	-6.436740
3	947.0593	0.687413	9.23e-05	-6.452461	-6.389503	-6.427243
4	947.9263	1.698263	9.24e-05	-6.451550	-6.376000	-6.421288
5	947.9350	0.017000	9.30e-05	-6.444760	-6.356619	-6.409454
6	948.0897	0.301069	9.36e-05	-6.438971	-6.338238	-6.398621
7	948.2326	0.276858	9.41e-05	-6.433100	-6.319775	-6.387707
8	948.2876	0.106216	9.47e-05	-6.426627	-6.300711	-6.376190

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LEXR**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:08

Root	Modulus
0.996735	0.996735

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LEXR**
Exogenous variables: **C**
Date: 12/27/16 Time: 00:08
Sample: 1991M01 2015M12
Included observations: 292

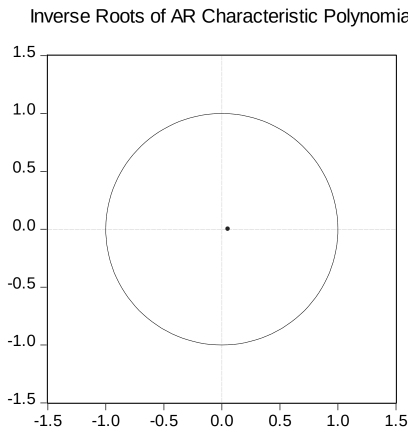
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9.127801	NA	0.062756	0.069369	0.081960	0.074412
1	945.9314	1897.035*	9.11e-05*	-6.465283*	-6.440100*	-6.455196*
2	946.3509	0.830320	9.15e-05	-6.461307	-6.423532	-6.446176
3	946.8123	0.910203	9.18e-05	-6.457618	-6.407252	-6.437444
4	947.5157	1.382759	9.20e-05	-6.455587	-6.392629	-6.430369
5	947.5546	0.076199	9.26e-05	-6.449004	-6.373454	-6.418742
6	947.6369	0.160611	9.32e-05	-6.442718	-6.354577	-6.407412
7	947.8706	0.454709	9.37e-05	-6.437470	-6.336737	-6.397121
8	947.8883	0.034224	9.43e-05	-6.430742	-6.317417	-6.385348

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLEXR**
Exogenous variables: **C @TREND**
Lag specification: 1 1

Root	Modulus
0.055041	0.055041

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLEXR**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:09
Included observations: 291

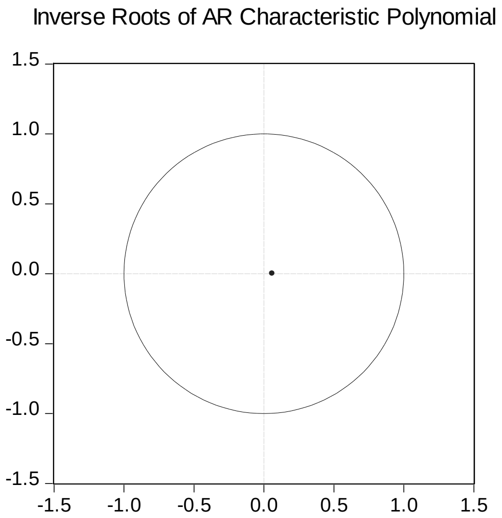
Lag	LogL	LR	FPE	AIC	SC	HQ
0	943.7307	NA*	9.05e-05*	-6.472376*	-6.447130*	-6.462262*
1	944.0600	0.651834	9.09e-05	-6.467766	-6.429897	-6.452596
2	944.7212	1.304155	9.11e-05	-6.465437	-6.414945	-6.445210
3	945.4656	1.463238	9.13e-05	-6.463681	-6.400565	-6.438396
4	945.5006	0.068698	9.19e-05	-6.457049	-6.381310	-6.426708
5	945.5904	0.175159	9.25e-05	-6.450793	-6.362431	-6.415395
6	945.8144	0.435701	9.30e-05	-6.445460	-6.344475	-6.405005
7	945.8356	0.041148	9.36e-05	-6.438733	-6.325125	-6.393221
8	946.3883	1.067414	9.39e-05	-6.435659	-6.309427	-6.385090

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLEXR**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:09

Root	Modulus
0.060868	0.060868

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLEXR**
Exogenous variables: **C**
Date: 12/27/16 Time: 00:10
Sample: 1991M01 2015M12
Included observations: 291

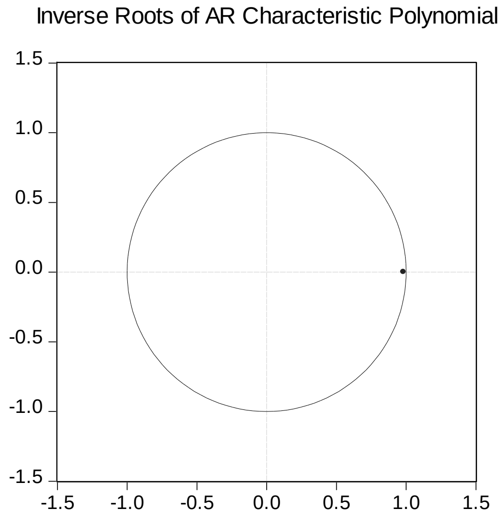
Lag	LogL	LR	FPE	AIC	SC	HQ
0	943.1206	NA*	9.02e-05*	-6.475056*	-6.462433*	-6.469999*
1	943.5135	0.780349	9.06e-05	-6.470883	-6.445637	-6.460770
2	944.0774	1.116191	9.09e-05	-6.467886	-6.430017	-6.452715
3	944.9421	1.705629	9.10e-05	-6.466956	-6.416464	-6.446729
4	944.9582	0.031636	9.16e-05	-6.460194	-6.397078	-6.434910
5	945.0856	0.249561	9.22e-05	-6.454197	-6.378458	-6.423855
6	945.2599	0.340104	9.27e-05	-6.448521	-6.360160	-6.413123
7	945.3002	0.078453	9.33e-05	-6.441926	-6.340941	-6.401471
8	945.9283	1.217405	9.35e-05	-6.439370	-6.325762	-6.393858

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LM2**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:10

Root	Modulus
0.980840	0.980840

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LM2**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:11
Included observations: 285

Lag	LogL	LR	FPE	AIC	SC	HQ
0	313.9334	NA	0.006559	-2.189007	-2.163375	-2.178732
1	800.2704	962.4353	0.000218	-5.594880	-5.556433	-5.579467
2	815.6065	30.24167	0.000197	-5.695484	-5.644221	-5.674934
3	819.0250	6.717089	0.000193	-5.712456	-5.648377	-5.686769
4	819.1794	0.302369	0.000195	-5.706522	-5.629628	-5.675697
5	822.0993	5.696296	0.000192	-5.719995	-5.630285	-5.684032
6	839.3318	33.49763	0.000171	-5.833908	-5.731382	-5.792807
7	873.9516	67.05307	0.000135	-6.069836	-5.954494	-6.023598
8	878.4454	8.672237	0.000132	-6.094354	-5.966196	-6.042979
9	886.5333	15.55150	0.000126	-6.144094	-6.003120	-6.087581
10	886.8053	0.521049	0.000126	-6.138985	-5.985196	-6.077334
11	886.8326	0.052178	0.000127	-6.132159	-5.965554	-6.065371
12	894.1293	13.87653	0.000122	-6.176346	-5.996926	-6.104421
13	969.2503	142.3345*	7.23e-05*	-6.696494*	-6.504257*	-6.619431*
14	969.4430	0.363796	7.27e-05	-6.690828	-6.485776	-6.608628
15	969.6098	0.313566	7.32e-05	-6.684981	-6.467113	-6.597643

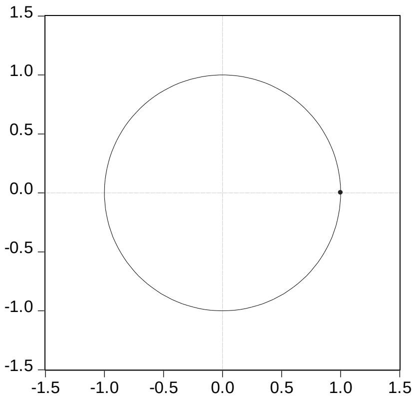
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LM2**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:11

Root	Modulus
1.000976	1.000976

Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.

Inverse Roots of AR Characteristic Polynomial

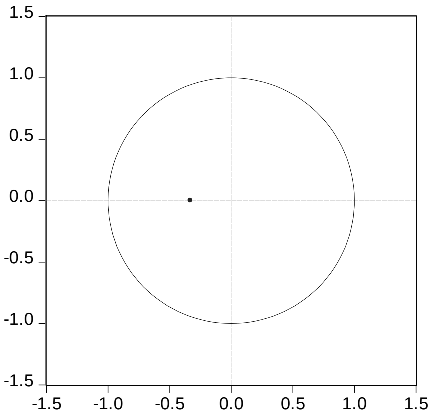


Roots of Characteristic Polynomial
Endogenous variables**: DLM2**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:12

Root	Modulus
-0.329872	0.329872

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: **DLM2**
Exogenous variables: **C @TREND**
Included observations: 284

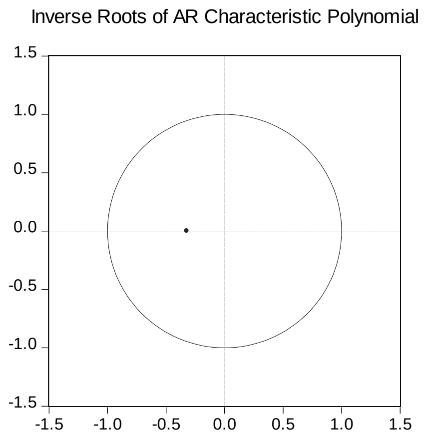
Lag	LogL	LR	FPE	AIC	SC	HQ
0	795.3110	NA	0.000219	-5.586697	-5.561000	-5.576395
1	811.0332	31.11226	0.000198	-5.690375	-5.651829	-5.674921
2	814.5757	6.985114	0.000194	-5.708279	-5.656885	-5.687674
3	814.7982	0.437251	0.000195	-5.702804	-5.638562	-5.677048
4	817.5243	5.336950	0.000193	-5.714960	-5.637869	-5.684052
5	834.5079	33.12995	0.000172	-5.827520	-5.737581	-5.791462
6	868.9785	66.99920	0.000136	-6.063229	-5.960441	-6.022019
7	873.3138	8.395832	0.000133	-6.086717	-5.971080	-6.040356
8	881.5186	15.83179	0.000126	-6.137455	-6.008970	-6.085942
9	881.7923	0.526190	0.000127	-6.132340	-5.991006	-6.075676
10	881.8257	0.063984	0.000128	-6.125533	-5.971351	-6.063718
11	889.0994	13.88151	0.000122	-6.169714	-6.002683	-6.102748
12	963.7227	141.8894*	7.29e-05*	-6.688188*	-6.508309*	-6.616071*
13	963.7953	0.137591	7.34e-05	-6.681657	-6.488930	-6.604389
14	963.8695	0.139949	7.39e-05	-6.675137	-6.469561	-6.592717
15	963.9854	0.217969	7.44e-05	-6.668911	-6.450487	-6.581340

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **DLM2**
Exogenous variables: **C**
Lag specification: 1 1

Root	Modulus
-0.322169	0.322169

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **DLM2**
Exogenous variables: **C**
Included observations: 284

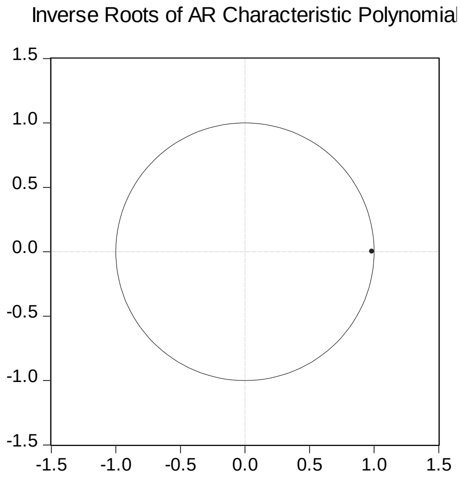
Lag	LogL	LR	FPE	AIC	SC	HQ
0	794.4824	NA	0.000219	-5.587904	-5.575056	-5.582753
1	809.3835	29.59232	0.000199	-5.685800	-5.660103	-5.675497
2	812.3136	5.798276	0.000196	-5.699392	-5.660846	-5.683938
3	812.3769	0.124877	0.000197	-5.692795	-5.641401	-5.672191
4	814.2548	3.689626	0.000196	-5.698978	-5.634735	-5.673222
5	827.7595	26.43865	0.000180	-5.787038	-5.709947	-5.756131
6	866.7538	76.06635	0.000137	-6.054604	-5.964664	-6.018545
7	871.8228	9.852500	0.000134	-6.083259	-5.980471	-6.042049
8	879.0408	13.97849	0.000128	-6.127048	-6.011411	-6.080687
9	879.1255	0.163526	0.000129	-6.120602	-5.992117	-6.069090
10	879.1319	0.012214	0.000130	-6.113605	-5.972271	-6.056941
11	884.8341	10.92249	0.000125	-6.146719	-5.992537	-6.084904
12	963.2524	149.6574*	7.27e-05*	-6.691918*	-6.524888*	-6.624952*
13	963.3688	0.221425	7.31e-05	-6.685696	-6.505817	-6.613579
14	963.4860	0.222037	7.36e-05	-6.679479	-6.486752	-6.602211
15	963.5549	0.130030	7.41e-05	-6.672922	-6.467346	-6.590502

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LGDPRICE**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:13

Root	Modulus
0.984872	0.984872

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: **LGDPRICE**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:14
Sample: 1991M01 2015M12
Included observations: 292

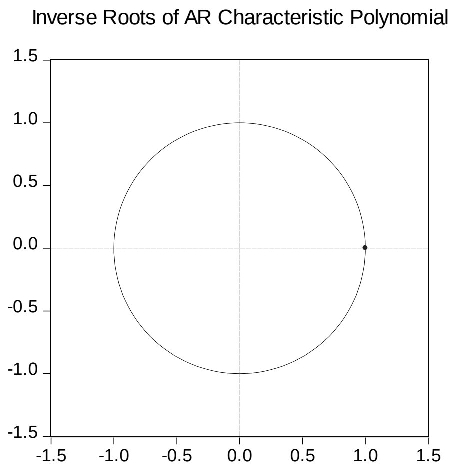
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-81.61673	NA	0.103813	0.572717	0.597901	0.582805
1	490.4677	1132.414	0.002077	-3.338820	-3.301045*	-3.323689
2	492.6417	4.288265	0.002061	-3.346861	-3.296494	-3.326686
3	493.7281	2.135732	0.002059	-3.347453	-3.284495	-3.322234
4	495.2901	3.059712	0.002052	-3.351302	-3.275752	-3.321040
5	497.9886	5.267576*	0.002028*	-3.362935*	-3.274794	-3.327629*
6	498.9231	1.817871	0.002029	-3.362487	-3.261754	-3.322137
7	499.1989	0.534540	0.002039	-3.357526	-3.244202	-3.312133
8	499.7057	0.978941	0.002046	-3.354149	-3.228232	-3.303712

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: **LGDPRICE**
Exogenous variables: **C**
Lag specification: 1 1
Date: 12/27/16 Time: 00:14

Root	Modulus
1.000867	1.000867

Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.

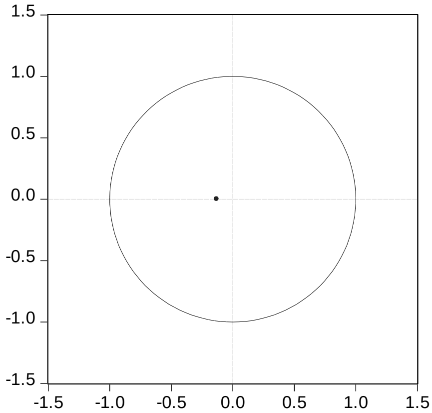


Roots of Characteristic Polynomial
Endogenous variables: **DLGDPRICE**
Exogenous variables: **C @TREND**
Lag specification: 1 1
Date: 12/27/16 Time: 00:15

Root	Modulus
-0.130070	0.130070

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomia



VAR Lag Order Selection Criteria
Endogenous variables: **DLGDPRICE**
Exogenous variables: **C @TREND**
Date: 12/27/16 Time: 00:15
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	486.5939	NA	0.002095	-3.330542	-3.305296*	-3.320428
1	488.9020	4.568742	0.002076	-3.339533	-3.301664	-3.324362
2	490.0105	2.186522	0.002074	-3.340279	-3.289786	-3.320051
3	491.5476	3.021305	0.002067	-3.343970	-3.280854	-3.318685
4	494.1442	5.086026*	0.002044*	-3.354943*	-3.279204	-3.324601*
5	495.1265	1.917419	0.002044	-3.354821	-3.266460	-3.319423
6	495.4200	0.570791	0.002054	-3.349965	-3.248980	-3.309510
7	495.9036	0.937437	0.002062	-3.346417	-3.232809	-3.300905
8	495.9043	0.001320	0.002076	-3.339549	-3.213318	-3.288980

* indicates lag order selected by the criterion

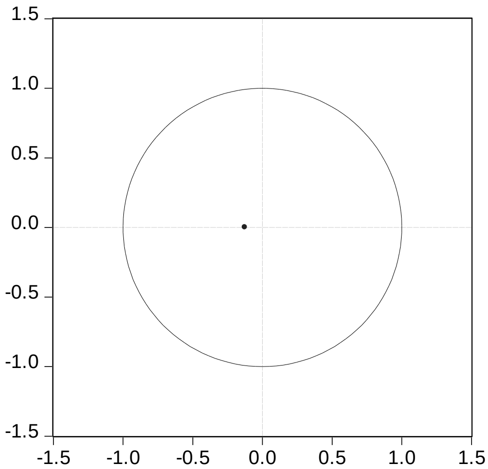
Roots of Characteristic Polynomial

Endogenous variables: DLGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 12/27/16 Time: 00:15

Root	Modulus
-0.125456	0.125456

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C
Date: 12/27/16 Time: 00:15
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	486.1454	NA	0.002087	-3.334333	-3.321710*	-3.329276
1	488.3240	4.327202	0.002070	-3.342433	-3.317187	-3.332319
2	489.3192	1.969943	0.002070	-3.342400	-3.304531	-3.327230
3	491.0094	3.333913	0.002060	-3.347144	-3.296651	-3.326916
4	493.7805	5.446872*	0.002035*	-3.359316*	-3.296200	-3.334032*
5	494.6741	1.750348	0.002037	-3.358585	-3.282846	-3.328243
6	494.9040	0.448703	0.002047	-3.353292	-3.264930	-3.317894
7	495.4806	1.121617	0.002053	-3.350382	-3.249397	-3.309927
8	495.4819	0.002501	0.002068	-3.343518	-3.229910	-3.298006

* indicates lag order selected by the criterion

APPENDIX C: Unit Root Tests

C 1 ADF Unit Root Tests

C 1.1 ADF Unit Root Tests on Log DSE General Index

Null Hypothesis: LDSEGEN has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.263817	0.4520
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 12/27/16 Time: 21:24
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.028777	0.012712	-2.263817	0.0243
D(LDSEGEN(-1))	0.167887	0.058237	2.882824	0.0042
D(LDSEGEN(-2))	0.033661	0.058499	0.575413	0.5655
C	0.144521	0.060621	2.384005	0.0178
@TREND("1991M01")	0.000247	0.000131	1.890588	0.0597

R-squared	0.042533	Mean dependent var	0.008705
Adjusted R-squared	0.029417	S.D. dependent var	0.091286
S.E. of regression	0.089933	Akaike info criterion	-1.962805
Sum squared resid	2.361697	Schwarz criterion	-1.900621
Log likelihood	296.4765	Hannan-Quinn criter.	-1.937910
F-statistic	3.242869	Durbin-Watson stat	2.005650
Prob(F-statistic)	0.012647		

Null Hypothesis: LDSEGEN has a unit root
Exogenous: **Constant**
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.262698	0.6475
Test critical values:	1% level	-3.452215	
	5% level	-2.871061	
	10% level	-2.571915	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 12/27/16 Time: 21:25
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.007516	0.005952	-1.262698	0.2077
D(LDSEGEN(-1))	0.158364	0.058273	2.717623	0.0070
D(LDSEGEN(-2))	0.020113	0.058312	0.344915	0.7304
C	0.052810	0.036516	1.446234	0.1492

R-squared	0.030813	Mean dependent var	0.008705
Adjusted R-squared	0.020890	S.D. dependent var	0.091286
S.E. of regression	0.090328	Akaike info criterion	-1.957372
Sum squared resid	2.390606	Schwarz criterion	-1.907625
Log likelihood	294.6698	Hannan-Quinn criter.	-1.937457
F-statistic	3.105103	Durbin-Watson stat	2.002547
Prob(F-statistic)	0.026919		

C 1.2 ADF Unit Root Tests on 1st Difference of Log DSE General Index

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.92199	0.0000
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Date: 12/27/16 Time: 21:25
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.827481	0.075763	-10.92199	0.0000
D(LDSEGEN(-1),2)	-0.016441	0.058409	-0.281475	0.7785
C	0.009403	0.010681	0.880353	0.3794
@TREND("1991M01")	-1.46E-05	6.13E-05	-0.238888	0.8114

R-squared	0.420844	Mean dependent var	-6.43E-05
Adjusted R-squared	0.414914	S.D. dependent var	0.118399
S.E. of regression	0.090564	Akaike info criterion	-1.952140
Sum squared resid	2.403147	Schwarz criterion	-1.902393
Log likelihood	293.8928	Hannan-Quinn criter.	-1.932225
F-statistic	70.96963	Durbin-Watson stat	2.002002
Prob(F-statistic)	0.000000		

C 1.3 ADF Unit Root Tests on Log Industrial Production Index

Null Hypothesis: LIPI has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 6 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.488473	0.3337
Test critical values:	1% level	-3.989689	
	5% level	-3.425237	
	10% level	-3.135737	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 12/27/16 Time: 21:26
Sample (adjusted): 1991M08 2015M12
Included observations: 293 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.137859	0.055399	-2.488473	0.0134
D(LIPI(-1))	-0.323201	0.074711	-4.326010	0.0000
D(LIPI(-2))	-0.332597	0.074935	-4.438478	0.0000
D(LIPI(-3))	-0.361375	0.071291	-5.069039	0.0000
D(LIPI(-4))	-0.351285	0.068063	-5.161162	0.0000
D(LIPI(-5))	-0.145127	0.064895	-2.236327	0.0261
D(LIPI(-6))	0.045478	0.059867	0.759657	0.4481
C	0.644164	0.251969	2.556526	0.0111
@TREND("1991M01")	0.000862	0.000343	2.512206	0.0126

R-squared	0.296858	Mean dependent var	0.006809
Adjusted R-squared	0.277051	S.D. dependent var	0.070434
S.E. of regression	0.059888	Akaike info criterion	-2.762457
Sum squared resid	1.018576	Schwarz criterion	-2.649414
Log likelihood	413.6999	Hannan-Quinn criter.	-2.717182
F-statistic	14.98764	Durbin-Watson stat	1.998230
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous**: Constant**
Lag Length: 6 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.044380	0.9608
Test critical values:	1% level	-3.452519	
	5% level	-2.871195	
	10% level	-2.571986	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Sample (adjusted): 1991M08 2015M12
Included observations: 293 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	0.000299	0.006742	0.044380	0.9646
D(LIPI(-1))	-0.438503	0.059498	-7.370027	0.0000
D(LIPI(-2))	-0.433035	0.063966	-6.769751	0.0000
D(LIPI(-3))	-0.442110	0.064226	-6.883618	0.0000
D(LIPI(-4))	-0.412246	0.064180	-6.423267	0.0000
D(LIPI(-5))	-0.185297	0.063478	-2.919076	0.0038
D(LIPI(-6))	0.018711	0.059458	0.314691	0.7532
C	0.017965	0.037170	0.483326	0.6292

R-squared	0.281232	Mean dependent var	0.006809
Adjusted R-squared	0.263578	S.D. dependent var	0.070434
S.E. of regression	0.060443	Akaike info criterion	-2.747304
Sum squared resid	1.041211	Schwarz criterion	-2.646821
Log likelihood	410.4800	Hannan-Quinn criter.	-2.707059
F-statistic	15.93027	Durbin-Watson stat	1.996629
Prob(F-statistic)	0.000000		

C 1.4 ADF Unit Roots Tests on 1st Difference of Log Industrial Production Index

Null Hypothesis: D(LIPI) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 5 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.73396	0.0000
Test critical values:	1% level	-3.989689	
	5% level	-3.425237	
	10% level	-3.135737	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Sample (adjusted): 1991M08 2015M12
Included observations: 293 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-2.893357	0.269552	-10.73396	0.0000
D(LIPI(-1),2)	1.455012	0.235547	6.177167	0.0000
D(LIPI(-2),2)	1.022104	0.191735	5.330818	0.0000
D(LIPI(-3),2)	0.579949	0.147212	3.939562	0.0001
D(LIPI(-4),2)	0.167385	0.102909	1.626539	0.1049
D(LIPI(-5),2)	-0.018215	0.059390	-0.306703	0.7593
C	0.017419	0.007490	2.325557	0.0207
@TREND("1991M01")	1.44E-05	4.18E-05	0.344279	0.7309

R-squared	0.695310	Mean dependent var	-0.000106
Adjusted R-squared	0.687826	S.D. dependent var	0.108158
S.E. of regression	0.060431	Akaike info criterion	-2.747713
Sum squared resid	1.040785	Schwarz criterion	-2.647230
Log likelihood	410.5399	Hannan-Quinn criter.	-2.707468
F-statistic	92.91092	Durbin-Watson stat	1.997108
Prob(F-statistic)	0.000000		

C 1.5 ADF Unit Root Tests on Log Interest Rate

Null Hypothesis: LINT has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 6 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.483544	0.3361
Test critical values:	1% level	-3.989689	
	5% level	-3.425237	
	10% level	-3.135737	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample (adjusted): 1991M08 2015M12
Included observations: 293 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.028564	0.011501	-2.483544	0.0136
D(LINT(-1))	0.080439	0.058759	1.368974	0.1721
D(LINT(-2))	0.060013	0.057943	1.035711	0.3012
D(LINT(-3))	0.084268	0.058037	1.451971	0.1476
D(LINT(-4))	-0.019460	0.058130	-0.334760	0.7381
D(LINT(-5))	-0.174630	0.058103	-3.005518	0.0029
D(LINT(-6))	0.060406	0.058937	1.024927	0.3063
C	0.001769	0.000961	1.841267	0.0666
@TREND("1991M01")	2.18E-06	2.17E-06	1.001153	0.3176

R-squared	0.071361	Mean dependent var	-0.000149
Adjusted R-squared	0.045202	S.D. dependent var	0.003180
S.E. of regression	0.003108	Akaike info criterion	-8.679624
Sum squared resid	0.002743	Schwarz criterion	-8.566581
Log likelihood	1280.565	Hannan-Quinn criter.	-8.634349
F-statistic	2.727969	Durbin-Watson stat	2.009238
Prob(F-statistic)	0.006522		

Null Hypothesis: LINT has a unit root
Exogenous: **Constant**
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.827551	0.0557
Test critical values:	1% level	-3.452831	
	5% level	-2.871332	
	10% level	-2.572060	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample (adjusted): 1991M12 2015M12
Included observations: 289 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.033863	0.011976	-2.827551	0.0050

D(LINT(-1))	0.070461	0.059102	1.192185	0.2342
D(LINT(-2))	0.070514	0.058825	1.198719	0.2317
D(LINT(-3))	0.105787	0.058876	1.796756	0.0735
D(LINT(-4))	0.010601	0.059066	0.179481	0.8577
D(LINT(-5))	-0.188459	0.059044	-3.191831	0.0016
D(LINT(-6))	0.039838	0.058838	0.677080	0.4989
D(LINT(-7))	0.089215	0.058893	1.514864	0.1309
D(LINT(-8))	0.079361	0.058915	1.347030	0.1791
D(LINT(-9))	0.144551	0.059030	2.448780	0.0150
D(LINT(-10))	-0.063463	0.059585	-1.065087	0.2878
C	0.002528	0.000954	2.649672	0.0085

R-squared	0.107844	Mean dependent var	-0.000151
Adjusted R-squared	0.072415	S.D. dependent var	0.003202
S.E. of regression	0.003084	Akaike info criterion	-8.684376
Sum squared resid	0.002635	Schwarz criterion	-8.532137
Log likelihood	1266.892	Hannan-Quinn criter.	-8.623375
F-statistic	3.043969	Durbin-Watson stat	1.998385
Prob(F-statistic)	0.000731		

C 1.6 ADF Unit Root Tests on 1st Difference of Log Interest Rate

Null Hypothesis: D(LINT) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 5 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.228364	0.0000
Test critical values:	1% level	-3.989689	
	5% level	-3.425237	
	10% level	-3.135737	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Sample (adjusted): 1991M08 2015M12
Included observations: 293 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-0.960419	0.132868	-7.228364	0.0000
D(LINT(-1),2)	0.033387	0.118268	0.282296	0.7779
D(LINT(-2),2)	0.085903	0.107286	0.800696	0.4240
D(LINT(-3),2)	0.161787	0.096030	1.684754	0.0931
D(LINT(-4),2)	0.131688	0.080926	1.627276	0.1048
D(LINT(-5),2)	-0.053367	0.059400	-0.898442	0.3697
C	-0.000422	0.000384	-1.097829	0.2732
@TREND("1991M01")	1.84E-06	2.19E-06	0.839892	0.4017

R-squared	0.486122	Mean dependent var	-5.51E-06
Adjusted R-squared	0.473501	S.D. dependent var	0.004322
S.E. of regression	0.003136	Akaike info criterion	-8.664964
Sum squared resid	0.002802	Schwarz criterion	-8.564482
Log likelihood	1277.417	Hannan-Quinn criter.	-8.624720
F-statistic	38.51527	Durbin-Watson stat	2.006919
Prob(F-statistic)	0.000000		

C 1.7 ADF Unit Root Tests on Log Consumer Price Index

Null Hypothesis: LCPI has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.427023	0.8512
Test critical values:	1% level	-3.990131	
	5% level	-3.425451	
	10% level	-3.135864	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 12/27/16 Time: 21:33
Sample (adjusted): 1991M12 2015M12
Included observations: 289 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.011684	0.008188	-1.427023	0.1547
D(LCPI(-1))	0.144236	0.060012	2.403451	0.0169
D(LCPI(-2))	-0.137345	0.060306	-2.277455	0.0235
D(LCPI(-3))	-0.032476	0.060223	-0.539269	0.5901
D(LCPI(-4))	-0.203684	0.059558	-3.419909	0.0007
D(LCPI(-5))	-0.137315	0.060429	-2.272347	0.0238
D(LCPI(-6))	-0.089942	0.059418	-1.513714	0.1312
D(LCPI(-7))	-0.142765	0.058449	-2.442539	0.0152
D(LCPI(-8))	-0.147687	0.059439	-2.484691	0.0136
D(LCPI(-9))	-0.120223	0.059387	-2.024394	0.0439
D(LCPI(-10))	-0.041777	0.059298	-0.704533	0.4817
C	0.056735	0.036593	1.550428	0.1222
@TREND("1991M01")	8.78E-05	4.07E-05	2.156109	0.0319

R-squared	0.196132	Mean dependent var	0.004819
Adjusted R-squared	0.161181	S.D. dependent var	0.009385
S.E. of regression	0.008595	Akaike info criterion	-6.631229
Sum squared resid	0.020391	Schwarz criterion	-6.466303
Log likelihood	971.2126	Hannan-Quinn criter.	-6.565144
F-statistic	5.611652	Durbin-Watson stat	1.978654
Prob(F-statistic)	0.000000		

C 1.8 ADF Unit Root Tests on 1st Difference of Log Consumer Price Index

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.659916	0.0267
Test critical values:	1% level	-3.990470	
	5% level	-3.425616	
	10% level	-3.135961	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 12/27/16 Time: 21:33
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.921887	0.251888	-3.659916	0.0003
D(LCPI(-1),2)	0.025188	0.244903	0.102847	0.9182
D(LCPI(-2),2)	-0.085795	0.228569	-0.375358	0.7077
D(LCPI(-3),2)	-0.065954	0.211649	-0.311619	0.7556
D(LCPI(-4),2)	-0.192302	0.192744	-0.997707	0.3193
D(LCPI(-5),2)	-0.264489	0.174862	-1.512563	0.1316
D(LCPI(-6),2)	-0.276818	0.157067	-1.762426	0.0791
D(LCPI(-7),2)	-0.340669	0.139342	-2.444841	0.0151
D(LCPI(-8),2)	-0.413279	0.121563	-3.399718	0.0008
D(LCPI(-9),2)	-0.512610	0.105035	-4.880386	0.0000
D(LCPI(-10),2)	-0.484056	0.091906	-5.266883	0.0000
D(LCPI(-11),2)	-0.510268	0.074289	-6.868675	0.0000
D(LCPI(-12),2)	-0.051662	0.059724	-0.865024	0.3878
C	0.002276	0.001118	2.035398	0.0428
@TREND("1991M01")	1.42E-05	6.77E-06	2.093974	0.0372

R-squared	0.586530	Mean dependent var	-3.00E-05
Adjusted R-squared	0.565170	S.D. dependent var	0.011494
S.E. of regression	0.007579	Akaike info criterion	-6.875732
Sum squared resid	0.015568	Schwarz criterion	-6.683984
Log likelihood	998.2296	Hannan-Quinn criter.	-6.798873
F-statistic	27.45914	Durbin-Watson stat	2.009198
Prob(F-statistic)	0.000000		

C 1.9 ADF Unit Root Tests on Log Exchange Rate

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.133125	0.9206
Test critical values:	1% level	-3.989153	
	5% level	-3.424977	
	10% level	-3.135584	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 12/27/16 Time: 21:34
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.013229	0.011674	-1.133125	0.2581
D(LEXR(-1))	0.064124	0.058690	1.092592	0.2755
C	0.064904	0.053956	1.202916	0.2300
@TREND("1991M01")	3.03E-05	3.48E-05	0.868657	0.3857

R-squared	0.013975	Mean dependent var	0.002640
Adjusted R-squared	0.003913	S.D. dependent var	0.009494
S.E. of regression	0.009475	Akaike info criterion	-6.466977
Sum squared resid	0.026394	Schwarz criterion	-6.417351
Log likelihood	967.5796	Hannan-Quinn criter.	-6.447112
F-statistic	1.388938	Durbin-Watson stat	1.991407
Prob(F-statistic)	0.246269		

Null Hypothesis: LEXR has a unit root
Exogenous: **Constant**
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.520495	0.5220
Test critical values:	1% level	-3.452141	
	5% level	-2.871029	
	10% level	-2.571897	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.003260	0.002144	-1.520495	0.1295
D(LEXR(-1))	0.056583	0.058020	0.975224	0.3302
C	0.018999	0.010880	1.746215	0.0818

R-squared	0.011444	Mean dependent var	0.002640
Adjusted R-squared	0.004742	S.D. dependent var	0.009494
S.E. of regression	0.009471	Akaike info criterion	-6.471125
Sum squared resid	0.026462	Schwarz criterion	-6.433906
Log likelihood	967.1976	Hannan-Quinn criter.	-6.456227
F-statistic	1.707544	Durbin-Watson stat	1.991994
Prob(F-statistic)	0.183098		

C 1.10 ADF Unit Root Tests on 1st Difference of Log Exchange Rate

Null Hypothesis: D(LEXR) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.24530	0.0000
Test critical values:	1% level	-3.989153	
	5% level	-3.424977	
	10% level	-3.135584	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 12/27/16 Time: 21:34
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-0.944959	0.058168	-16.24530	0.0000
C	0.003779	0.001130	3.345341	0.0009
@TREND("1991M01")	-8.54E-06	6.40E-06	-1.333740	0.1833

R-squared	0.472199	Mean dependent var	-1.83E-05
Adjusted R-squared	0.468621	S.D. dependent var	0.013004
S.E. of regression	0.009480	Akaike info criterion	-6.469331
Sum squared resid	0.026510	Schwarz criterion	-6.432112
Log likelihood	966.9303	Hannan-Quinn criter.	-6.454432
F-statistic	131.9613	Durbin-Watson stat	1.992037
Prob(F-statistic)	0.000000		

C 1.11 ADF Unit Root Tests on Log Money Supply

Null Hypothesis: LM2 has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 13 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.095373	0.5457
Test critical values:	1% level	-3.990470	
	5% level	-3.425616	
	10% level	-3.135961	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 12/27/16 Time: 21:35
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.012786	0.006102	-2.095373	0.0371
D(LM2(-1))	-0.204973	0.060408	-3.393149	0.0008
D(LM2(-2))	0.098560	0.048257	2.042403	0.0421
D(LM2(-3))	-0.075414	0.048578	-1.552446	0.1217
D(LM2(-4))	0.014752	0.048179	0.306198	0.7597
D(LM2(-5))	-0.042963	0.048203	-0.891288	0.3736
D(LM2(-6))	0.140582	0.047246	2.975519	0.0032
D(LM2(-7))	0.057959	0.047954	1.208638	0.2279
D(LM2(-8))	-0.153255	0.046737	-3.279105	0.0012
D(LM2(-9))	0.042589	0.047405	0.898393	0.3698
D(LM2(-10))	-0.093550	0.047626	-1.964257	0.0505
D(LM2(-11))	0.003224	0.047503	0.067879	0.9459
D(LM2(-12))	0.635103	0.047690	13.31722	0.0000
D(LM2(-13))	0.036156	0.059749	0.605131	0.5456

C	0.062249	0.027036	2.302424	0.0221
@TREND("1991M01")	0.000165	7.58E-05	2.173177	0.0306

R-squared	0.699610	Mean dependent var	0.012124
Adjusted R-squared	0.682922	S.D. dependent var	0.014749
S.E. of regression	0.008305	Akaike info criterion	-6.689554
Sum squared resid	0.018624	Schwarz criterion	-6.485023
Log likelihood	972.6062	Hannan-Quinn criter.	-6.607572
F-statistic	41.92217	Durbin-Watson stat	1.996839
Prob(F-statistic)	0.000000		

C 1.12 ADF Unit Root Tests on 1st Difference of Log Money Supply

Null Hypothesis: D(LM2) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.557102	0.3006
Test critical values:	1% level	-3.990470	
	5% level	-3.425616	
	10% level	-3.135961	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 12/27/16 Time: 21:35
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-0.567360	0.221876	-2.557102	0.0111
D(LM2(-1),2)	-0.634752	0.220178	-2.882903	0.0043
D(LM2(-2),2)	-0.537067	0.208462	-2.576328	0.0105
D(LM2(-3),2)	-0.615751	0.195495	-3.149695	0.0018
D(LM2(-4),2)	-0.602256	0.185613	-3.244690	0.0013
D(LM2(-5),2)	-0.646714	0.174240	-3.711628	0.0002
D(LM2(-6),2)	-0.504647	0.167081	-3.020367	0.0028
D(LM2(-7),2)	-0.447676	0.156506	-2.860441	0.0046
D(LM2(-8),2)	-0.604736	0.138642	-4.361859	0.0000
D(LM2(-9),2)	-0.563960	0.122670	-4.597363	0.0000
D(LM2(-10),2)	-0.660426	0.102916	-6.417157	0.0000
D(LM2(-11),2)	-0.658364	0.086212	-7.636596	0.0000
D(LM2(-12),2)	-0.025745	0.059913	-0.429703	0.6678
C	0.005816	0.002386	2.437724	0.0154
@TREND("1991M01")	6.56E-06	6.93E-06	0.945817	0.3451

R-squared	0.884067	Mean dependent var	3.84E-05
Adjusted R-squared	0.878077	S.D. dependent var	0.023934
S.E. of regression	0.008357	Akaike info criterion	-6.680416
Sum squared resid	0.018926	Schwarz criterion	-6.488668
Log likelihood	970.2995	Hannan-Quinn criter.	-6.603558
F-statistic	147.6107	Durbin-Watson stat	1.995172
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) has a unit root
Exogenous: **Constant**
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.409351	0.1400
Test critical values:	1% level	-3.453072	
	5% level	-2.871438	
	10% level	-2.572116	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 12/28/16 Time: 21:11
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-0.461524	0.191555	-2.409351	0.0166
D(LM2(-1),2)	-0.736727	0.191937	-3.838382	0.0002
D(LM2(-2),2)	-0.629520	0.184088	-3.419675	0.0007
D(LM2(-3),2)	-0.699102	0.174471	-4.006973	0.0001
D(LM2(-4),2)	-0.677200	0.167818	-4.035328	0.0001
D(LM2(-5),2)	-0.712584	0.159685	-4.462426	0.0000
D(LM2(-6),2)	-0.562576	0.155420	-3.619711	0.0004
D(LM2(-7),2)	-0.498016	0.147150	-3.384419	0.0008
D(LM2(-8),2)	-0.646597	0.131362	-4.922252	0.0000
D(LM2(-9),2)	-0.597317	0.117468	-5.084919	0.0000
D(LM2(-10),2)	-0.684936	0.099580	-6.878223	0.0000
D(LM2(-11),2)	-0.674426	0.084506	-7.980793	0.0000
D(LM2(-12),2)	-0.032109	0.059523	-0.539440	0.5900
C	0.005562	0.002370	2.346500	0.0197

R-squared	0.883684	Mean dependent var	3.84E-05
Adjusted R-squared	0.878125	S.D. dependent var	0.023934
S.E. of regression	0.008355	Akaike info criterion	-6.684114
Sum squared resid	0.018989	Schwarz criterion	-6.505149
Log likelihood	969.8282	Hannan-Quinn criter.	-6.612379
F-statistic	158.9581	Durbin-Watson stat	1.996571
Prob(F-statistic)	0.000000		

C 1.13 ADF Unit Root Tests on 2nd Difference of Log Money Supply

Null Hypothesis: D(LM2,2) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 7 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.670536	0.0000
Test critical values:	1% level	-3.990019	
	5% level	-3.425397	
	10% level	-3.135832	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,3)
Method: Least Squares
Sample (adjusted): 1991M11 2015M12
Included observations: 290 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1),2)	-6.228437	0.644063	-9.670536	0.0000
D(LM2(-1),3)	4.015661	0.614021	6.539936	0.0000
D(LM2(-2),3)	2.973149	0.544629	5.459033	0.0000
D(LM2(-3),3)	2.004868	0.444498	4.510404	0.0000
D(LM2(-4),3)	1.057387	0.341703	3.094466	0.0022
D(LM2(-5),3)	0.190187	0.240064	0.792237	0.4289
D(LM2(-6),3)	0.021294	0.143196	0.148707	0.8819
D(LM2(-7),3)	0.069719	0.058501	1.191755	0.2344
C	0.000325	0.001436	0.226369	0.8211
@TREND("1991M01")	-2.00E-06	8.17E-06	-0.245216	0.8065

R-squared	0.930794	Mean dependent var	6.03E-05
Adjusted R-squared	0.928569	S.D. dependent var	0.043578
S.E. of regression	0.011647	Akaike info criterion	-6.033667
Sum squared resid	0.037983	Schwarz criterion	-5.907119
Log likelihood	884.8817	Hannan-Quinn criter.	-5.982966
F-statistic	418.4312	Durbin-Watson stat	2.011004
Prob(F-statistic)	0.000000		

C 1.14 ADF Unit Root Tests on Gold Price

Null Hypothesis: LGDPRICE has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 5 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.794687	0.7051
Test critical values:	1% level	-3.989580	
	5% level	-3.425184	
	10% level	-3.135706	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Sample (adjusted): 1991M07 2015M12
Included observations: 294 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.014424	0.008037	-1.794687	0.0738
D(LGDPRICE(-1))	-0.129917	0.058584	-2.217604	0.0274
D(LGDPRICE(-2))	-0.057456	0.059012	-0.973635	0.3311
D(LGDPRICE(-3))	0.119874	0.058626	2.044708	0.0418
D(LGDPRICE(-4))	0.120554	0.058978	2.044049	0.0419
D(LGDPRICE(-5))	-0.077756	0.058902	-1.320089	0.1879
C	0.059075	0.032043	1.843616	0.0663
@TREND("1991M01")	0.000166	8.14E-05	2.039815	0.0423

R-squared	0.072113	Mean dependent var	0.006899
Adjusted R-squared	0.049403	S.D. dependent var	0.045730
S.E. of regression	0.044586	Akaike info criterion	-3.355941
Sum squared resid	0.568553	Schwarz criterion	-3.255708
Log likelihood	501.3234	Hannan-Quinn criter.	-3.315801
F-statistic	3.175330	Durbin-Watson stat	2.004690
Prob(F-statistic)	0.002987		

C 1.15 ADF Unit Root Tests on 1st Difference of Log Gold Price

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: **Constant, Linear Trend**
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.275343	0.0000
Test critical values:	1% level	-3.989580	
	5% level	-3.425184	
	10% level	-3.135706	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Sample (adjusted): 1991M07 2015M12
Included observations: 294 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.033426	0.142045	-7.275343	0.0000
D(LGDPRICE(-1),2)	-0.099058	0.130419	-0.759535	0.4482
D(LGDPRICE(-2),2)	-0.157893	0.113872	-1.386586	0.1666
D(LGDPRICE(-3),2)	-0.038499	0.089535	-0.429995	0.6675
D(LGDPRICE(-4),2)	0.080461	0.059110	1.361198	0.1745
C	0.002375	0.005371	0.442230	0.6587
@TREND("1991M01")	3.10E-05	3.12E-05	0.993943	0.3211

R-squared	0.582792	Mean dependent var	0.000136
Adjusted R-squared	0.574070	S.D. dependent var	0.068582
S.E. of regression	0.044759	Akaike info criterion	-3.351545
Sum squared resid	0.574956	Schwarz criterion	-3.263841
Log likelihood	499.6771	Hannan-Quinn criter.	-3.316422
F-statistic	66.81779	Durbin-Watson stat	2.006282
Prob(F-statistic)	0.000000		

C 2 Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Unit Root Tests

C 2.1 KPSS Unit Root Tests on Log DSE General Index

Null Hypothesis: LDSEGEN is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.716817
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.172007
HAC corrected variance (Bartlett kernel)	0.503978

KPSS Test Equation
Dependent Variable: LDSEGEN
Method: Least Squares
Date: 12/27/16 Time: 21:40
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.714832	0.047930	98.36862	0.0000
@TREND("1991M01")	0.009070	0.000277	32.69581	0.0000

R-squared	0.782007	Mean dependent var	6.070862
Adjusted R-squared	0.781275	S.D. dependent var	0.889767
S.E. of regression	0.416126	Akaike info criterion	1.090988
Sum squared resid	51.60199	Schwarz criterion	1.115680
Log likelihood	-161.6482	Hannan-Quinn criter.	1.100870
F-statistic	1069.016	Durbin-Watson stat	0.047812
Prob(F-statistic)	0.000000		

C 2.2 KPSS Unit Root Tests on 1st Difference of Log DSE General Index

Null Hypothesis: D(LDSEGEN) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 1 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.065762
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.008249
HAC corrected variance (Bartlett kernel)	0.009558

KPSS Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011799	0.010566	1.116686	0.2650
@TREND("1991M01")	-1.99E-05	6.11E-05	-0.325741	0.7448

R-squared	0.000357	Mean dependent var	0.008816
Adjusted R-squared	-0.003009	S.D. dependent var	0.090990

S.E. of regression	0.091127	Akaike info criterion	-1.946463
Sum squared resid	2.466316	Schwarz criterion	-1.921711
Log likelihood	292.9963	Hannan-Quinn criter.	-1.936556
F-statistic	0.106107	Durbin-Watson stat	1.682457
Prob(F-statistic)	0.744850		

Null Hypothesis: D(LDSEGEN) is stationary
Exogenous: **Constant**
Bandwidth: 1 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.068174
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.008251
HAC corrected variance (Bartlett kernel)	0.009564

KPSS Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 12/27/16 Time: 21:41
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008816	0.005262	1.675410	0.0949

R-squared	0.000000	Mean dependent var	0.008816
Adjusted R-squared	0.000000	S.D. dependent var	0.090990
S.E. of regression	0.090990	Akaike info criterion	-1.952795
Sum squared resid	2.467197	Schwarz criterion	-1.940419
Log likelihood	292.9429	Hannan-Quinn criter.	-1.947842
Durbin-Watson stat	1.681857		

C 2.3 KPSS Unit Root Tests on Log Industrial Production Index

Null Hypothesis: LIPI is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 6 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.704326
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.007393
HAC corrected variance (Bartlett kernel)	0.028376

KPSS Test Equation
Dependent Variable: LIPI
Method: Least Squares
Date: 12/27/16 Time: 21:41
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.567026	0.009937	459.6162	0.0000
@TREND("1991M01")	0.006190	5.75E-05	107.6219	0.0000

R-squared	0.974917	Mean dependent var	5.492377
Adjusted R-squared	0.974833	S.D. dependent var	0.543795
S.E. of regression	0.086269	Akaike info criterion	-2.056054
Sum squared resid	2.217805	Schwarz criterion	-2.031362
Log likelihood	310.4081	Hannan-Quinn criter.	-2.046172
F-statistic	11582.47	Durbin-Watson stat	0.673429
Prob(F-statistic)	0.000000		

C 2.4 KPSS Unit Root Tests on 1st Difference of Log Industrial Production Index

Null Hypothesis: D(LIPI) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 5 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.023075
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.004993
HAC corrected variance (Bartlett kernel)	0.001177

KPSS Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 12/27/16 Time: 21:41
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004294	0.008221	0.522292	0.6019
@TREND("1991M01")	1.64E-05	4.75E-05	0.344274	0.7309

R-squared	0.000399	Mean dependent var	0.006747
Adjusted R-squared	-0.002967	S.D. dependent var	0.070792
S.E. of regression	0.070897	Akaike info criterion	-2.448505
Sum squared resid	1.492845	Schwarz criterion	-2.423753
Log likelihood	368.0515	Hannan-Quinn criter.	-2.438598
F-statistic	0.118525	Durbin-Watson stat	2.317505
Prob(F-statistic)	0.730884		

Null Hypothesis: D(LIPI) is stationary
Exogenous: **Constant**
Bandwidth: 5 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.069558
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.004995
HAC corrected variance (Bartlett kernel)	0.001180

KPSS Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006747	0.004094	1.647947	0.1004

R-squared	0.000000	Mean dependent var	0.006747
Adjusted R-squared	0.000000	S.D. dependent var	0.070792
S.E. of regression	0.070792	Akaike info criterion	-2.454795
Sum squared resid	1.493441	Schwarz criterion	-2.442419
Log likelihood	367.9918	Hannan-Quinn criter.	-2.449841
Durbin-Watson stat	2.316584		

C 2.5 KPSS Unit Root Tests on Log of Interest Rate

Null Hypothesis: LINT is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 6 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.412625
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000277
HAC corrected variance (Bartlett kernel)	0.001815

KPSS Test Equation
Dependent Variable: LINT
Method: Least Squares
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.078918	0.001924	41.02426	0.0000
@TREND("1991M01")	4.35E-07	1.11E-05	0.039060	0.9689

R-squared	0.000005	Mean dependent var	0.078983
Adjusted R-squared	-0.003351	S.D. dependent var	0.016673
S.E. of regression	0.016701	Akaike info criterion	-5.340013
Sum squared resid	0.083122	Schwarz criterion	-5.315322
Log likelihood	803.0020	Hannan-Quinn criter.	-5.330132
F-statistic	0.001526	Durbin-Watson stat	0.035618
Prob(F-statistic)	0.968869		

C 2.6 KPSS Unit Root Tests on 1st Difference of Log of Interest Rate

Null Hypothesis: D(LINT) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 5 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.106635
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	9.86E-06
HAC corrected variance (Bartlett kernel)	1.17E-05

KPSS Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 12/27/16 Time: 21:42
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000411	0.000365	-1.125789	0.2612
@TREND("1991M01")	1.76E-06	2.11E-06	0.831592	0.4063

R-squared	0.002323	Mean dependent var	-0.000148
Adjusted R-squared	-0.001036	S.D. dependent var	0.003148
S.E. of regression	0.003150	Akaike info criterion	-8.676096
Sum squared resid	0.002947	Schwarz criterion	-8.651344
Log likelihood	1299.076	Hannan-Quinn criter.	-8.666189
F-statistic	0.691546	Durbin-Watson stat	1.850579
Prob(F-statistic)	0.406307		

Null Hypothesis: D(LINT) is stationary
Exogenous: **Constant**
Bandwidth: 5 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.173518
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	9.88E-06
HAC corrected variance (Bartlett kernel)	1.18E-05

KPSS Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000148	0.000182	-0.812473	0.4172

R-squared	0.000000	Mean dependent var	-0.000148
Adjusted R-squared	0.000000	S.D. dependent var	0.003148
S.E. of regression	0.003148	Akaike info criterion	-8.680459
Sum squared resid	0.002954	Schwarz criterion	-8.668083
Log likelihood	1298.729	Hannan-Quinn criter.	-8.675506
Durbin-Watson stat	1.846277		

C 2.7 KPSS Unit Root Tests on Log of Consumer Price Index

Null Hypothesis: LCPI is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 10 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.644902
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.004339
HAC corrected variance (Bartlett kernel)	0.044151

KPSS Test Equation
Dependent Variable: LCPI
Method: Least Squares
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.495615	0.007613	590.5478	0.0000
@TREND("1991M01")	0.004863	4.41E-05	110.3763	0.0000

R-squared	0.976124	Mean dependent var	5.222687
Adjusted R-squared	0.976043	S.D. dependent var	0.427009
S.E. of regression	0.066092	Akaike info criterion	-2.588891
Sum squared resid	1.301713	Schwarz criterion	-2.564199
Log likelihood	390.3337	Hannan-Quinn criter.	-2.579009
F-statistic	12182.93	Durbin-Watson stat	0.020403
Prob(F-statistic)	0.000000		

C 2.8 KPSS Unit Root Tests on 1st Difference of Log of Consumer Price Index

Null Hypothesis: D(LCPI) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 12 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.065971
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	8.74E-05
HAC corrected variance (Bartlett kernel)	4.44E-05

KPSS Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002736	0.001088	2.515411	0.0124
@TREND("1991M01")	1.39E-05	6.28E-06	2.212271	0.0277

R-squared	0.016211	Mean dependent var	0.004821
Adjusted R-squared	0.012899	S.D. dependent var	0.009440
S.E. of regression	0.009379	Akaike info criterion	-6.493963
Sum squared resid	0.026127	Schwarz criterion	-6.469211
Log likelihood	972.8475	Hannan-Quinn criter.	-6.484056
F-statistic	4.894143	Durbin-Watson stat	1.545481
Prob(F-statistic)	0.027709		

Null Hypothesis: D(LCPI) is stationary
Exogenous: **Constant**
Bandwidth: 12 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.781329
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	8.88E-05
HAC corrected variance (Bartlett kernel)	6.45E-05

KPSS Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004821	0.000546	8.830560	0.0000

R-squared	0.000000	Mean dependent var	0.004821
Adjusted R-squared	0.000000	S.D. dependent var	0.009440
S.E. of regression	0.009440	Akaike info criterion	-6.484308
Sum squared resid	0.026558	Schwarz criterion	-6.471932
Log likelihood	970.4040	Hannan-Quinn criter.	-6.479354
Durbin-Watson stat	1.520421		

C 2.9 KPSS Unit Root Tests on Log of Exchange Rate

Null Hypothesis: LEXR is stationary
Exogenous**: Constant, Linear Trend**
Bandwidth: 1 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		1.967746
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002278
HAC corrected variance (Bartlett kernel)	0.004492

KPSS Test Equation
Dependent Variable: LEXR
Method: Least Squares
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.626748	0.005516	838.7504	0.0000
@TREND("1991M01")	0.002921	3.19E-05	91.47545	0.0000

R-squared	0.965612	Mean dependent var	5.063380
Adjusted R-squared	0.965496	S.D. dependent var	0.257826
S.E. of regression	0.047892	Akaike info criterion	-3.233113
Sum squared resid	0.683492	Schwarz criterion	-3.208421
Log likelihood	486.9669	Hannan-Quinn criter.	-3.223231
F-statistic	8367.758	Durbin-Watson stat	0.039211
Prob(F-statistic)	0.000000		

C 2.10 KPSS Unit Root Tests on 1st Difference of Log of Exchange Rate

Null Hypothesis: D(LEXR) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 0 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.079713
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	8.90E-05
HAC corrected variance (Bartlett kernel)	8.90E-05

KPSS Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003941	0.001097	3.590523	0.0004
@TREND("1991M01")	-8.73E-06	6.34E-06	-1.376079	0.1698

R-squared	0.006335	Mean dependent var	0.002632
Adjusted R-squared	0.002990	S.D. dependent var	0.009479
S.E. of regression	0.009465	Akaike info criterion	-6.475817
Sum squared resid	0.026606	Schwarz criterion	-6.451065
Log likelihood	970.1347	Hannan-Quinn criter.	-6.465910
F-statistic	1.893593	Durbin-Watson stat	1.887809
Prob(F-statistic)	0.169834		

Null Hypothesis: D(LEXR) is stationary
Exogenous: **Constant**
Bandwidth: 0 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.266188
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	8.95E-05
HAC corrected variance (Bartlett kernel)	8.95E-05

KPSS Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002632	0.000548	4.800481	0.0000

R-squared	0.000000	Mean dependent var	0.002632
Adjusted R-squared	0.000000	S.D. dependent var	0.009479
S.E. of regression	0.009479	Akaike info criterion	-6.476151
Sum squared resid	0.026775	Schwarz criterion	-6.463775
Log likelihood	969.1845	Hannan-Quinn criter.	-6.471197
Durbin-Watson stat	1.875851		

C 2.11 KPSS Unit Root Tests on Log of Money Supply

Null Hypothesis: LM2 is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 13 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.533282
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.007150
HAC corrected variance (Bartlett kernel)	0.094368

KPSS Test Equation
Dependent Variable: LM2
Method: Least Squares
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.470957	0.009772	457.5202	0.0000
@TREND("1991M01")	0.012287	5.66E-05	217.2387	0.0000

R-squared	0.993725	Mean dependent var	6.307898
Adjusted R-squared	0.993704	S.D. dependent var	1.069237
S.E. of regression	0.084841	Akaike info criterion	-2.089432
Sum squared resid	2.145002	Schwarz criterion	-2.064740
Log likelihood	315.4148	Hannan-Quinn criter.	-2.079550
F-statistic	47192.65	Durbin-Watson stat	0.032059
Prob(F-statistic)	0.000000		

C 2.12 KPSS Unit Root Tests on 1st Difference of Log of Money Supply

Null Hypothesis: D(LM2) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 12 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.109546
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000229
HAC corrected variance (Bartlett kernel)	7.82E-05

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010029	0.001759	5.701565	0.0000
@TREND("1991M01")	1.36E-05	1.02E-05	1.334492	0.1831

R-squared	0.005960	Mean dependent var	0.012063
Adjusted R-squared	0.002614	S.D. dependent var	0.015189
S.E. of regression	0.015169	Akaike info criterion	-5.532432
Sum squared resid	0.068341	Schwarz criterion	-5.507679
Log likelihood	829.0985	Hannan-Quinn criter.	-5.522525
F-statistic	1.780868	Durbin-Watson stat	2.659596
Prob(F-statistic)	0.183065		

Null Hypothesis: D(LM2) is stationary
Exogenous**: Constant**
Bandwidth: 12 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.109546
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000230
HAC corrected variance (Bartlett kernel)	9.69E-05

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 12/27/16 Time: 21:46
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012063	0.000878	13.73296	0.0000

R-squared	0.000000	Mean dependent var	0.012063
Adjusted R-squared	0.000000	S.D. dependent var	0.015189
S.E. of regression	0.015189	Akaike info criterion	-5.533142
Sum squared resid	0.068751	Schwarz criterion	-5.520766
Log likelihood	828.2048	Hannan-Quinn criter.	-5.528189
Durbin-Watson stat	2.643746		

C 2.13 KPSS Unit Root Tests on Log of Gold Price

Null Hypothesis: LGDPRICE is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		1.104973
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.109176
HAC corrected variance (Bartlett kernel)	0.637348

KPSS Test Equation
Dependent Variable: LGDPRICE
Method: Least Squares
Date: 12/27/16 Time: 21:47
Sample: 1991M01 2015M12
Included observations: 300

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.983895	0.038186	104.3296	0.0000
@TREND("1991M01")	0.009159	0.000221	41.44143	0.0000

R-squared	0.852138	Mean dependent var	5.353208
Adjusted R-squared	0.851642	S.D. dependent var	0.860716
S.E. of regression	0.331525	Akaike info criterion	0.636414
Sum squared resid	32.75273	Schwarz criterion	0.661106
Log likelihood	-93.46216	Hannan-Quinn criter.	0.646296
F-statistic	1717.392	Durbin-Watson stat	0.018895
Prob(F-statistic)	0.000000		

C 2.14 KPSS Unit Root Tests on 1st Difference of Log of Gold Price

Null Hypothesis: D(LGDPRICE) is stationary
Exogenous: **Constant, Linear Trend**
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.209403
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002055
HAC corrected variance (Bartlett kernel)	0.001735

KPSS Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 12/27/16 Time: 21:47
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001633	0.005274	0.309612	0.7571
@TREND("1991M01")	3.36E-05	3.05E-05	1.102273	0.2712

R-squared	0.004074	Mean dependent var	0.006672
Adjusted R-squared	0.000721	S.D. dependent var	0.045503
S.E. of regression	0.045487	Akaike info criterion	-3.336124
Sum squared resid	0.614507	Schwarz criterion	-3.311372
Log likelihood	500.7505	Hannan-Quinn criter.	-3.326217
F-statistic	1.215006	Durbin-Watson stat	2.260001
Prob(F-statistic)	0.271235		

Null Hypothesis: D(LGDPRICE) is stationary
Exogenous: **Constant**
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.410658
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002064
HAC corrected variance (Bartlett kernel)	0.001780

KPSS Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006672	0.002632	2.535455	0.0117

R-squared	0.000000	Mean dependent var	0.006672
Adjusted R-squared	0.000000	S.D. dependent var	0.045503
S.E. of regression	0.045503	Akaike info criterion	-3.338730
Sum squared resid	0.617021	Schwarz criterion	-3.326354
Log likelihood	500.1402	Hannan-Quinn criter.	-3.333777
Durbin-Watson stat	2.250793		

C 3 Phillips-Perron (PP) Unit Root Tests

C 3.1 PP Unit Root Tests on Log Money Supply

Null Hypothesis: LM2 has a unit root
Exogenous: **Constant, Linear Trend**
Bandwidth: 46 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.645240	0.7727
Test critical values:	1% level	-3.989048	
	5% level	-3.424926	
	10% level	-3.135554	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000226
HAC corrected variance (Bartlett kernel)	0.000151

Phillips-Perron Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.019160	0.010326	-1.855458	0.0645
C	0.095463	0.046078	2.071759	0.0392
@TREND("1991M01")	0.000249	0.000127	1.956177	0.0514

R-squared	0.017389	Mean dependent var	0.012063
Adjusted R-squared	0.010750	S.D. dependent var	0.015189
S.E. of regression	0.015107	Akaike info criterion	-5.537306
Sum squared resid	0.067555	Schwarz criterion	-5.500178
Log likelihood	830.8273	Hannan-Quinn criter.	-5.522446
F-statistic	2.619119	Durbin-Watson stat	2.639351
Prob(F-statistic)	0.074555		

C 3.2 PP Unit Root Tests on 1st Difference of Log Money Supply

Null Hypothesis: D(LM2) has a unit root
Exogenous: **Constant, Linear Trend**
Bandwidth: 12 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-26.95416	0.0000
Test critical values:	1% level	-3.989153	
	5% level	-3.424977	
	10% level	-3.135584	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000204
HAC corrected variance (Bartlett kernel)	0.000124

Phillips-Perron Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.329872	0.054961	-24.19650	0.0000
C	0.013370	0.001765	7.573418	0.0000
@TREND("1991M01")	1.78E-05	9.70E-06	1.837751	0.0671

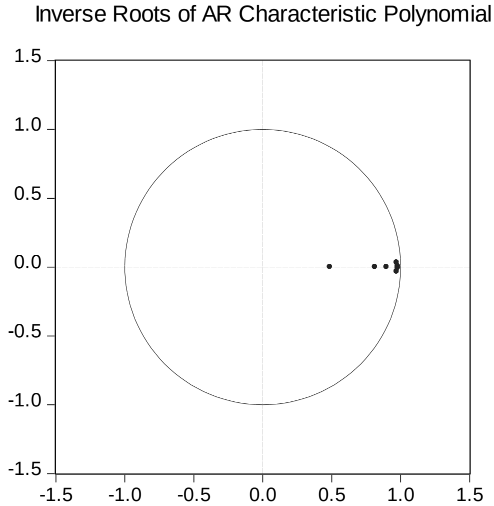
R-squared	0.664952	Mean dependent var	2.70E-05
Adjusted R-squared	0.662680	S.D. dependent var	0.024738
S.E. of regression	0.014368	Akaike info criterion	-5.637632
Sum squared resid	0.060898	Schwarz criterion	-5.600413
Log likelihood	843.0072	Hannan-Quinn criter.	-5.622734
F-statistic	292.7352	Durbin-Watson stat	2.111798
Prob(F-statistic)	0.000000		

Appendix D: Optimal Lag Selection for Johansen Cointegration Test

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN LIPI LINT LCPI LEXR LM2 LGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 12/30/16 Time: 20:40

Root	Modulus
0.978839 - 0.006330i	0.978860
0.978839 + 0.006330i	0.978860
0.971419 - 0.032836i	0.971974
0.971419 + 0.032836i	0.971974
0.898232	0.898232
0.814878	0.814878
0.487584	0.487584

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN LIPI LINT LCPI LEXR LM2 LGDPRICE
Exogenous variables: C @TREND
Date: 12/30/16 Time: 20:42
Sample: 1991M01 2015M12
Included observations: 285

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2789.854	NA	8.18e-18	-19.47968	-19.30026	-19.40775
1	5116.974	4507.264	9.33e-25	-35.46649	-34.65910*	-35.14282*
2	5182.551	123.7894	8.31e-25	-35.58281	-34.14745	-35.00741
3	5217.730	64.68097	9.17e-25	-35.48583	-33.42249	-34.65869
4	5254.681	66.12281	1.00e-24	-35.40127	-32.70996	-34.32239
5	5304.781	87.19128	9.98e-25	-35.40899	-32.08971	-34.07837
6	5375.311	119.2823	8.64e-25	-35.56008	-31.61283	-33.97772
7	5446.861	117.4934	7.45e-25	-35.71833	-31.14310	-33.88423
8	5508.984	98.95996	6.89e-25	-35.81041	-30.60722	-33.72458
9	5565.642	87.47203	6.64e-25	-35.86415	-30.03299	-33.52658
10	5621.991	84.22661	6.44e-25	-35.91572	-29.45659	-33.32642
11	5661.549	57.18603	7.06e-25	-35.84947	-28.76236	-33.00842
12	5731.854	98.18015	6.27e-25	-35.99897	-28.28389	-32.90619
13	5821.345	120.5777*	4.90e-25*	-36.28312*	-27.94007	-32.93860
14	5854.701	43.30389	5.72e-25	-36.17334	-27.20231	-32.57708
15	5906.733	64.99490	5.90e-25	-36.19462	-26.59562	-32.34662

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX E: Johansen and Juselius Cointegration Test

E 1 Results of Cointegration Test

Date: 11/19/16 Time: 23:21
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LDSEGEN LIPI LINT LCPI LEXR LM2 LGDPRICE
Lags interval (in first differences): 1 to 13

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.172629	193.8972	150.5585	0.0000
At most 1 *	0.125622	139.6995	117.7082	0.0010
At most 2 *	0.114921	101.3062	88.80380	0.0047
At most 3 *	0.080579	66.39163	63.87610	0.0303
At most 4	0.062269	42.36451	42.91525	0.0567
At most 5	0.055568	23.97688	25.87211	0.0845
At most 6	0.026311	7.625683	12.51798	0.2838

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.172629	54.19770	50.59985	0.0203
At most 1	0.125622	38.39335	44.49720	0.1981
At most 2	0.114921	34.91457	38.33101	0.1173
At most 3	0.080579	24.02712	32.11832	0.3468
At most 4	0.062269	18.38763	25.82321	0.3482
At most 5	0.055568	16.35119	19.38704	0.1308
At most 6	0.026311	7.625683	12.51798	0.2838

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
-7.581621	30.64901	45.45799	-39.72145	-53.02027	-40.40418	13.18155	0.604510
-3.433767	-35.86782	-83.93967	8.973479	-6.705237	51.99195	-5.390724	-0.368061
0.741193	-39.18253	-116.7189	40.82729	-26.90669	27.78016	-7.761090	-0.160494
-0.146534	3.419716	76.10134	13.27273	-6.804594	-2.401722	-4.490540	-0.002755
-1.177534	24.64543	-1.553338	-10.31279	1.476349	17.65437	-3.357353	-0.289925
-1.681899	7.852500	71.42847	-54.61317	-24.89404	25.80689	-2.179902	0.004121
-0.853207	12.40363	-48.70106	17.69608	11.47171	-19.86029	0.218906	0.049111

Unrestricted Adjustment Coefficients (alpha):

D(LDSEGEN)	0.020182	0.011538	-0.000265	-0.010156	-0.000171	-0.000727	0.006691
D(LIPI)	-0.000573	0.002797	0.006518	-0.002611	-0.000708	-0.005971	-0.002819
D(LINT)	-0.000240	-0.000564	7.47E-05	-0.000351	0.000192	-1.51E-05	0.000125
D(LCPI)	3.80E-05	-0.000320	-0.000203	-0.001082	-0.000789	0.000488	-0.000541
D(LEXR)	0.000181	-0.000366	0.002215	0.000200	-0.000366	0.000844	9.90E-05
D(LM2)	0.000500	-0.000510	4.47E-05	0.000236	-0.001230	-0.000837	0.000214
D(LGDPRICE)	-0.010963	0.006031	0.001066	-0.001030	-0.002693	0.000700	0.002649

1 Cointegrating Equation(s): Log likelihood 5805.098

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	-4.042541	-5.995813	5.239176	6.993263	5.329227	-1.738619	-0.079734
	(1.33278)	(3.99603)	(1.54830)	(0.90389)	(1.66524)	(0.32970)	(0.01499)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.153014
	(0.04229)
D(LIPI)	0.004341
	(0.02092)
D(LINT)	0.001823
	(0.00129)
D(LCPI)	-0.000288
	(0.00350)
D(LEXR)	-0.001370
	(0.00422)
D(LM2)	-0.003792
	(0.00356)
D(LGDPRICE)	0.083118
	(0.01953)

2 Cointegrating Equation(s): Log likelihood 5824.294

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	0.000000	2.497997	3.048147	5.586836	-0.382557	-0.815459	-0.027578
		(3.00799)	(1.36557)	(0.89935)	(1.25306)	(0.28237)	(0.01347)
0.000000	1.000000	2.101107	-0.541993	-0.347907	-1.412919	0.228361	0.012902
		(0.57026)	(0.25889)	(0.17050)	(0.23756)	(0.05353)	(0.00255)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.192632	0.204732
	(0.04590)	(0.26021)
D(LIPI)	-0.005263	-0.117863
	(0.02291)	(0.12985)
D(LINT)	0.003761	0.012867
	(0.00137)	(0.00779)
D(LCPI)	0.000812	0.012660
	(0.00384)	(0.02175)
D(LEXR)	-0.000112	0.018671
	(0.00463)	(0.02623)
D(LM2)	-0.002039	0.033639
	(0.00390)	(0.02210)
D(LGDPRICE)	0.062408	-0.552337
	(0.02113)	(0.11980)

3 Cointegrating Equation(s): Log likelihood 5841.752

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	0.000000	0.000000	4.242662	2.507429	-2.263998	-0.692013	-0.002389
			(1.46303)	(1.18252)	(1.76419)	(0.39331)	(0.01810)
0.000000	1.000000	0.000000	0.462733	-2.938047	-2.995431	0.332194	0.034089
			(0.83919)	(0.67829)	(1.01193)	(0.22560)	(0.01038)
0.000000	0.000000	1.000000	-0.478189	1.232750	0.753180	-0.049418	-0.010084
			(0.33555)	(0.27122)	(0.40463)	(0.09021)	(0.00415)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.192829	0.215128	-0.020063
	(0.04609)	(0.33825)	(0.83163)
D(LIPI)	-0.000432	-0.373245	-1.021536
	(0.02266)	(0.16632)	(0.40891)
D(LINT)	0.003816	0.009942	0.027716
	(0.00138)	(0.01012)	(0.02488)
D(LCPI)	0.000662	0.020596	0.052270
	(0.00385)	(0.02826)	(0.06948)
D(LEXR)	0.001530	-0.068127	-0.219609
	(0.00445)	(0.03266)	(0.08029)
D(LM2)	-0.002006	0.031889	0.060373
	(0.00391)	(0.02873)	(0.07064)
D(LGDPRICE)	0.063198	-0.594100	-1.129030
	(0.02121)	(0.15566)	(0.38270)

4 Cointegrating Equation(s): Log likelihood 5853.765

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	0.000000	0.000000	0.000000	10.36538	2.074933	-0.520646	-0.058812
				(1.38644)	(1.90888)	(0.45680)	(0.02123)
0.000000	1.000000	0.000000	0.000000	-2.081006	-2.522198	0.350884	0.027935
				(0.51323)	(0.70662)	(0.16910)	(0.00786)
0.000000	0.000000	1.000000	0.000000	0.347084	0.264140	-0.068733	-0.003724
				(0.12875)	(0.17727)	(0.04242)	(0.00197)
0.000000	0.000000	0.000000	1.000000	-1.852126	-1.022691	-0.040391	0.013299
				(0.42467)	(0.58470)	(0.13992)	(0.00650)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.191341	0.180398	-0.792935	-0.843762
	(0.04569)	(0.33579)	(0.92333)	(0.32348)
D(LIPI)	-4.94E-05	-0.382174	-1.220240	0.279286
	(0.02261)	(0.16617)	(0.45694)	(0.16008)
D(LINT)	0.003867	0.008742	0.001014	0.002880
	(0.00136)	(0.01002)	(0.02754)	(0.00965)
D(LCPI)	0.000821	0.016896	-0.030063	-0.027015
	(0.00380)	(0.02790)	(0.07671)	(0.02688)
D(LEXR)	0.001500	-0.067442	-0.204356	0.082641
	(0.00445)	(0.03270)	(0.08991)	(0.03150)
D(LM2)	-0.002041	0.032697	0.078339	-0.019492
	(0.00391)	(0.02876)	(0.07908)	(0.02770)
D(LGDPRICE)	0.063349	-0.597624	-1.207445	0.519433
	(0.02120)	(0.15583)	(0.42850)	(0.15012)

5 Cointegrating Equation(s): Log likelihood 5862.959

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	0.000000	0.000000	0.000000	0.000000	-14.03379	2.414552	0.145841
					(4.50394)	(1.10609)	(0.04637)
0.000000	1.000000	0.000000	0.000000	0.000000	0.711872	-0.238401	-0.013153
					(0.66724)	(0.16386)	(0.00687)
0.000000	0.000000	1.000000	0.000000	0.000000	-0.275259	0.029552	0.003129
					(0.14613)	(0.03589)	(0.00150)
0.000000	0.000000	0.000000	1.000000	0.000000	1.855680	-0.564864	-0.023269
					(0.74865)	(0.18385)	(0.00771)
0.000000	0.000000	0.000000	0.000000	1.000000	1.554090	-0.283173	-0.019744
					(0.43046)	(0.10571)	(0.00443)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.191139	0.176180	-0.792669	-0.841997	-1.071440
	(0.04614)	(0.36181)	(0.92337)	(0.32835)	(0.32930)
D(LIPI)	0.000785	-0.399630	-1.219140	0.286590	-0.147048
	(0.02283)	(0.17902)	(0.45688)	(0.16247)	(0.16294)
D(LINT)	0.003642	0.013466	0.000716	0.000904	0.017196
	(0.00137)	(0.01075)	(0.02744)	(0.00976)	(0.00979)
D(LCPI)	0.001750	-0.002548	-0.028837	-0.018878	0.011781
	(0.00380)	(0.02982)	(0.07611)	(0.02707)	(0.02714)
D(LEXR)	0.001931	-0.076453	-0.203788	0.086411	-0.068631
	(0.00449)	(0.03519)	(0.08980)	(0.03193)	(0.03203)
D(LM2)	-0.000593	0.002385	0.080249	-0.006808	-0.027721
	(0.00388)	(0.03043)	(0.07765)	(0.02761)	(0.02769)
D(LGDPRICE)	0.066521	-0.664005	-1.203262	0.547210	0.515183
	(0.02135)	(0.16742)	(0.42726)	(0.15194)	(0.15238)

6 Cointegrating Equation(s): Log likelihood 5871.135

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	LINT	LCPI	LEXR	LM2	LGDPRICE	@TREND(91M02)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.840643	-0.000784
						(0.17136)	(0.00180)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-0.073279	-0.005715
						(0.03425)	(0.00036)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-0.034295	0.000253
						(0.00899)	(9.4E-05)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-0.134432	-0.003881
						(0.02358)	(0.00025)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.077304	-0.003507
						(0.02059)	(0.00022)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-0.231954	-0.010448
						(0.01923)	(0.00020)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.189916	0.170469	-0.844615	-0.802280	-1.053335	-0.220345
	(0.04704)	(0.36433)	(1.00249)	(0.44377)	(0.35630)	(0.42663)
D(LIPI)	0.010827	-0.446518	-1.645647	0.612691	0.001597	0.189280
	(0.02298)	(0.17798)	(0.48975)	(0.21680)	(0.17406)	(0.20842)
D(LINT)	0.003667	0.013348	-0.000364	0.001729	0.017572	-0.013708
	(0.00140)	(0.01083)	(0.02980)	(0.01319)	(0.01059)	(0.01268)
D(LCPI)	0.000928	0.001287	0.006051	-0.045553	-0.000378	-0.022550
	(0.00387)	(0.02994)	(0.08239)	(0.03647)	(0.02928)	(0.03506)
D(LEXR)	0.000511	-0.069823	-0.143488	0.040306	-0.089647	0.050051
	(0.00455)	(0.03520)	(0.09686)	(0.04288)	(0.03443)	(0.04122)
D(LM2)	0.000815	-0.004189	0.020453	0.038911	-0.006881	-0.089393
	(0.00392)	(0.03038)	(0.08358)	(0.03700)	(0.02971)	(0.03557)
D(LGDPRICE)	0.065343	-0.658507	-1.153247	0.508969	0.497752	0.759136
	(0.02176)	(0.16856)	(0.46381)	(0.20531)	(0.16484)	(0.19738)

E 2 Significance of Cointegrating Coefficients

Vector Error Correction Estimates
Date: 11/19/16 Time: 23:42
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,2)=0
Convergence achieved after 22 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	4.110282
Probability	0.042623

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-6.724837
LIPI(-1)	**0.000000**
LINT(-1)	-22.37299
LCPI(-1)	-16.54463
LEXR(-1)	-50.97953
LM2(-1)	-9.567182
LGDPRICE(-1)	7.064930
@TREND(91M01)	0.341329
C	358.3950

Cointegration Restrictions:
B(1,3)=0
Convergence achieved after 16 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	1.291469
Probability	0.255777

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-7.480883
LIPI(-1)	16.72375
LINT(-1)	**0.000000**
LCPI(-1)	-26.57209
LEXR(-1)	-53.45237
LM2(-1)	-27.06694
LGDPRICE(-1)	10.62129
@TREND(91M01)	0.485280
C	403.8973

Cointegration Restrictions:
B(1,4)=0
Convergence achieved after 33 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	6.333333
Probability	0.011849

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-5.659277
LIPI(-1)	3.372788
LINT(-1)	-32.05533
LCPI(-1)	**0.000000**
LEXR(-1)	-46.49195
LM2(-1)	-21.46395
LGDPRICE(-1)	6.643737
@TREND(91M01)	0.368226
C	298.2615

Cointegration Restrictions:
B(1,5)=0
Convergence achieved after 124 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	14.22177
Probability	0.000162

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-1.363152
LIPI(-1)	37.71552
LINT(-1)	81.39192
LCPI(-1)	-27.75298
LEXR(-1)	**0.000000**
LM2(-1)	-43.95058
LGDPRICE(-1)	9.376323
@TREND(91M01)	0.374267
C	110.2704

Cointegration Restrictions:
B(1,6)=0
Convergence achieved after 24 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	4.918124
Probability	0.026576

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-7.077413
LIPI(-1)	2.317124
LINT(-1)	-15.74543
LCPI(-1)	-23.42521
LEXR(-1)	-48.59002
LM2(-1)	**0.000000**
LGDPRICE(-1)	5.854340
@TREND(91M01)	0.248862
C	331.1816

Cointegration Restrictions:
B(1,7)=0
Convergence achieved after 59 iterations.
Not all cointegrating vectors are identified
LR test for binding restrictions (rank = 1):

Chi-square(1)	11.17695
Probability	0.000828

Cointegrating Eq:	CointEq1
LDSEGEN(-1)	-4.707281
LIPI(-1)	-13.50882
LINT(-1)	-49.52918
LCPI(-1)	0.460482
LEXR(-1)	-36.79700
LM2(-1)	15.69979
LGDPRICE(-1)	**0.000000**
@TREND(91M01)	0.033325
C	186.6802

E 3 Vector Error Correction Estimates

E 3.1 Long and Short-Term Equation Estimation

Dependent Variable: D(LDSEGEN)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 11/20/16 Time: 23:48
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
D(LDSEGEN) = C(1)*(LDSEGEN(-1) - 4.04254061888*LIPI(-1) - 5.99581318154*LINT(-1) + 5.23917593595*LCPI(-1) + 6.99326292363 *LEXR(-1) + 5.32922712656*LM2(-1) - 1.73861861672*LGDPRICE(-1) - 0.0797336257223*@TREND(91M01) - 58.4801737269) + C(2) *D(LDSEGEN(-1)) + C(3)*D(LDSEGEN(-2)) + C(4)*D(LDSEGEN(-3)) + C(5)*D(LDSEGEN(-4)) + C(6)*D(LDSEGEN(-5)) + C(7)*D(LDSEGEN(-6)) + C(8)*D(LDSEGEN(-7)) + C(9)*D(LDSEGEN(-8)) + C(10) *D(LDSEGEN(-9)) + C(11)*D(LDSEGEN(-10)) + C(12)*D(LDSEGEN(-11)) + C(13)*D(LDSEGEN(-12)) + C(14)*D(LDSEGEN(-13)) + C(15) *D(LIPI(-1)) + C(16)*D(LIPI(-2)) + C(17)*D(LIPI(-3)) + C(18)*D(LIPI(-4)) + C(19)*D(LIPI(-5)) + C(20)*D(LIPI(-6)) + C(21)*D(LIPI(-7)) + C(22) *D(LIPI(-8)) + C(23)*D(LIPI(-9)) + C(24)*D(LIPI(-10)) + C(25)*D(LIPI(-11)) + C(26)*D(LIPI(-12)) + C(27)*D(LIPI(-13)) + C(28)*D(LINT(-1)) + C(29)*D(LINT(-2)) + C(30)*D(LINT(-3)) + C(31)*D(LINT(-4)) + C(32) *D(LINT(-5)) + C(33)*D(LINT(-6)) + C(34)*D(LINT(-7)) + C(35)*D(LINT(-8)) + C(36)*D(LINT(-9)) + C(37)*D(LINT(-10)) + C(38)*D(LINT(-11)) + C(39)*D(LINT(-12)) + C(40)*D(LINT(-13)) + C(41)*D(LCPI(-1)) + C(42) *D(LCPI(-2)) + C(43)*D(LCPI(-3)) + C(44)*D(LCPI(-4)) + C(45)*D(LCPI(-5)) + C(46)*D(LCPI(-6)) + C(47)*D(LCPI(-7)) + C(48)*D(LCPI(-8)) + C(49)*D(LCPI(-9)) + C(50)*D(LCPI(-10)) + C(51)*D(LCPI(-11)) + C(52) *D(LCPI(-12)) + C(53)*D(LCPI(-13)) + C(54)*D(LEXR(-1)) + C(55) *D(LEXR(-2)) + C(56)*D(LEXR(-3)) + C(57)*D(LEXR(-4)) + C(58) *D(LEXR(-5)) + C(59)*D(LEXR(-6)) + C(60)*D(LEXR(-7)) + C(61) *D(LEXR(-8)) + C(62)*D(LEXR(-9)) + C(63)*D(LEXR(-10)) + C(64) *D(LEXR(-11)) + C(65)*D(LEXR(-12)) + C(66)*D(LEXR(-13)) + C(67) *D(LM2(-1)) + C(68)*D(LM2(-2)) + C(69)*D(LM2(-3)) + C(70)*D(LM2(-4)) + C(71)*D(LM2(-5)) + C(72)*D(LM2(-6)) + C(73)*D(LM2(-7)) + C(74) *D(LM2(-8)) + C(75)*D(LM2(-9)) + C(76)*D(LM2(-10)) + C(77)*D(LM2(-11)) + C(78)*D(LM2(-12)) + C(79)*D(LM2(-13)) + C(80)*D(LGDPRICE(-1)) + C(81)*D(LGDPRICE(-2)) + C(82)*D(LGDPRICE(-3)) + C(83) *D(LGDPRICE(-4)) + C(84)*D(LGDPRICE(-5)) + C(85)*D(LGDPRICE(-6)) + C(86)*D(LGDPRICE(-7)) + C(87)*D(LGDPRICE(-8)) + C(88) *D(LGDPRICE(-9)) + C(89)*D(LGDPRICE(-10)) + C(90)*D(LGDPRICE(-11)) + C(91)*D(LGDPRICE(-12)) + C(92)*D(LGDPRICE(-13)) + C(93)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.153014	0.042287	-3.618433	0.0004
C(2)	0.285498	0.074495	3.832463	0.0002
C(3)	0.113708	0.075497	1.506133	0.1337
C(4)	0.141234	0.075097	1.880689	0.0615
C(5)	0.138316	0.076083	1.817975	0.0706
C(6)	-0.003500	0.077912	-0.044927	0.9642
C(7)	0.050123	0.078621	0.637524	0.5245
C(8)	0.158877	0.081547	1.948281	0.0528
C(9)	0.125206	0.081453	1.537161	0.1259
C(10)	0.107908	0.082024	1.315573	0.1899
C(11)	0.051383	0.082350	0.623968	0.5334
C(12)	0.124530	0.082779	1.504361	0.1341
C(13)	-0.047642	0.083160	-0.572890	0.5674
C(14)	0.106322	0.082575	1.287583	0.1994
C(15)	-0.385618	0.213262	-1.808190	0.0721
C(16)	-0.310449	0.220710	-1.406592	0.1612
C(17)	-0.441680	0.216050	-2.044347	0.0423
C(18)	-0.320997	0.214397	-1.497206	0.1360
C(19)	-0.147266	0.205719	-0.715858	0.4749
C(20)	-0.127200	0.191947	-0.662686	0.5083

C(21)	-0.167148	0.181865	-0.919079	0.3592
C(22)	-0.119031	0.177353	-0.671156	0.5029
C(23)	0.022047	0.176133	0.125171	0.9005
C(24)	-0.055218	0.172509	-0.320085	0.7493
C(25)	-0.181407	0.169458	-1.070513	0.2857
C(26)	-0.045812	0.163829	-0.279632	0.7801
C(27)	-0.126332	0.138154	-0.914430	0.3616
C(28)	-0.805363	2.334482	-0.344986	0.7305
C(29)	-1.068199	2.336299	-0.457219	0.6480
C(30)	0.383471	2.392984	0.160248	0.8729
C(31)	2.023181	2.452752	0.824862	0.4105
C(32)	-2.037132	2.440327	-0.834778	0.4049
C(33)	-1.283556	2.501217	-0.513172	0.6084
C(34)	0.553551	2.383116	0.232280	0.8166
C(35)	0.749692	2.304521	0.325314	0.7453
C(36)	2.485131	2.199022	1.130108	0.2598
C(37)	0.211163	2.227595	0.094794	0.9246
C(38)	-1.707270	2.248001	-0.759461	0.4485
C(39)	0.190278	2.204025	0.086332	0.9313
C(40)	2.039849	2.262464	0.901605	0.3684
C(41)	0.375057	0.891129	0.420879	0.6743
C(42)	0.643432	0.827450	0.777609	0.4378
C(43)	1.021022	0.833130	1.225524	0.2219
C(44)	1.183791	0.841168	1.407318	0.1609
C(45)	0.164286	0.830425	0.197834	0.8434
C(46)	-1.200006	0.823621	-1.456988	0.1467
C(47)	1.138312	0.820342	1.387608	0.1669
C(48)	-0.980380	0.804616	-1.218445	0.2245
C(49)	-0.582751	0.774117	-0.752794	0.4525
C(50)	0.021361	0.777292	0.027481	0.9781
C(51)	-1.210071	0.786552	-1.538451	0.1256
C(52)	-0.082130	0.785086	-0.104612	0.9168
C(53)	-1.294502	0.830123	-1.559410	0.1205
C(54)	0.249729	0.774035	0.322633	0.7473
C(55)	0.697492	0.764450	0.912410	0.3627
C(56)	1.107770	0.743752	1.489435	0.1380
C(57)	-0.408681	0.757728	-0.539350	0.5903
C(58)	1.133311	0.765071	1.481315	0.1402
C(59)	0.868300	0.745976	1.163979	0.2459
C(60)	0.118317	0.761705	0.155332	0.8767
C(61)	0.976079	0.758204	1.287357	0.1995
C(62)	0.978881	0.784966	1.247036	0.2139
C(63)	0.534838	0.811423	0.659136	0.5106
C(64)	0.742764	0.803705	0.924174	0.3565
C(65)	0.293044	0.789510	0.371171	0.7109
C(66)	0.896365	0.787057	1.138881	0.2562
C(67)	-0.372962	0.896785	-0.415888	0.6780
C(68)	0.268729	0.833403	0.322447	0.7475
C(69)	1.073163	0.785501	1.366214	0.1735
C(70)	-0.447650	0.768850	-0.582233	0.5611
C(71)	0.928031	0.761130	1.219281	0.2242
C(72)	0.054333	0.750442	0.072401	0.9424
C(73)	0.545633	0.769047	0.709493	0.4789
C(74)	0.193427	0.751632	0.257342	0.7972
C(75)	0.289555	0.719648	0.402356	0.6879
C(76)	1.547959	0.722399	2.142804	0.0334
C(77)	0.501883	0.708504	0.708370	0.4796
C(78)	1.223067	0.733965	1.666383	0.0973
C(79)	0.564354	0.804112	0.701834	0.4836
C(80)	0.000927	0.152299	0.006087	0.9951
C(81)	-0.264987	0.155645	-1.702513	0.0903
C(82)	-0.072190	0.156379	-0.461634	0.6449
C(83)	0.009420	0.157850	0.059679	0.9525
C(84)	0.017787	0.162055	0.109761	0.9127
C(85)	0.001997	0.160145	0.012468	0.9901

C(86)	-0.006671	0.159545	-0.041810	0.9667
C(87)	-0.152190	0.158811	-0.958312	0.3391
C(88)	0.107464	0.156747	0.685588	0.4938
C(89)	-0.114136	0.158114	-0.721856	0.4713
C(90)	-0.051608	0.153142	-0.336997	0.7365
C(91)	-0.147539	0.153245	-0.962765	0.3369
C(92)	-0.120166	0.150314	-0.799436	0.4250
C(93)	-0.076770	0.044932	-1.708572	0.0891

R-squared	0.299886	Mean dependent var	0.009678
Adjusted R-squared	-0.033847	S.D. dependent var	0.092769
S.E. of regression	0.094326	Akaike info criterion	-1.627068
Sum squared resid	1.717203	Schwarz criterion	-0.438232
Log likelihood	325.6708	Hannan-Quinn criter.	-1.150547
F-statistic	0.898582	Durbin-Watson stat	2.017233
Prob(F-statistic)	0.715895		

E 3.2 Significance of Short-run Coefficients

E 3.2.1 Industrial Production Index

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**0.722837**	**(13, 193)**	**0.7394**
Chi-square	**9.396882**	**13**	**0.7424**

**Null Hypothesis: C(15)=C(16)=C(17)=C(18)=C(19)=C(20)=
C(21)=C(22)=C(23)=C(24)=C(25)=C(26)=C(27)=0**
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(15)	-0.385618	0.213262
C(16)	-0.310449	0.220710
C(17)	-0.441680	0.216050
C(18)	-0.320997	0.214397
C(19)	-0.147266	0.205719
C(20)	-0.127200	0.191947
C(21)	-0.167148	0.181865
C(22)	-0.119031	0.177353
C(23)	0.022047	0.176133
C(24)	-0.055218	0.172509
C(25)	-0.181407	0.169458
C(26)	-0.045812	0.163829
C(27)	-0.126332	0.138154

Restrictions are linear in coefficients.

E 3.2.2 Interest Rate

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**0.340302**	**(13, 193)**	**0.9847**
Chi-square	**4.423925**	**13**	**0.9858**

**Null Hypothesis: C(28)=C(29)=C(30)=C(31)=C(32)=C(33)=
C(34)=C(35)=C(36)=C(37)=C(38)=C(39)=C(40)=0**
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(28)	-0.805363	2.334482

C(29)	-1.068199	2.336299
C(30)	0.383471	2.392984
C(31)	2.023181	2.452752
C(32)	-2.037132	2.440327
C(33)	-1.283556	2.501217
C(34)	0.553551	2.383116
C(35)	0.749692	2.304521
C(36)	2.485131	2.199022
C(37)	0.211163	2.227595
C(38)	-1.707270	2.248001
C(39)	0.190278	2.204025
C(40)	2.039849	2.262464

Restrictions are linear in coefficients.

E 3.2.3 Consumer Price Index

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**1.374907**	**(13, 193)**	**0.1744**
Chi-square	**17.87379**	**13**	**0.1624**

**Null Hypothesis: C(41)=C(42)=C(43)=C(44)=C(45)=C(46)=
C(47)=C(48)=C(49)=C(50)=C(51)=C(52)=C(53)=0**
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(41)	0.375057	0.891129
C(42)	0.643432	0.827450
C(43)	1.021022	0.833130
C(44)	1.183791	0.841168
C(45)	0.164286	0.830425
C(46)	-1.200006	0.823621
C(47)	1.138312	0.820342
C(48)	-0.980380	0.804616
C(49)	-0.582751	0.774117
C(50)	0.021361	0.777292
C(51)	-1.210071	0.786552
C(52)	-0.082130	0.785086
C(53)	-1.294502	0.830123

Restrictions are linear in coefficients.

E 3.2.4 Exchange Rate

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**0.683405**	**(13, 193)**	**0.7781**
Chi-square	**8.884263**	**13**	**0.7816**

**Null Hypothesis: C(54)=C(55)=C(56)=C(57)=C(58)=C(59)=
C(60)=C(61)=C(62)=C(63)=C(64)=C(65)=C(66)=0**
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(54)	0.249729	0.774035

C(55)	0.697492	0.764450
C(56)	1.107770	0.743752
C(57)	-0.408681	0.757728
C(58)	1.133311	0.765071
C(59)	0.868300	0.745976
C(60)	0.118317	0.761705
C(61)	0.976079	0.758204
C(62)	0.978881	0.784966
C(63)	0.534838	0.811423
C(64)	0.742764	0.803705
C(65)	0.293044	0.789510
C(66)	0.896365	0.787057

Restrictions are linear in coefficients.

E 3.2.5 Money Supply

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**1.063979**	**(13, 193)**	**0.3928**
Chi-square	**13.83173**	**13**	**0.3858**

Null Hypothesis: C(67)=C(68)=C(69)=C(70)=C(71)=C(72)=
C(73)=C(74)=C(75)=C(76)=C(77)=C(78)=C(79)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(67)	-0.372962	0.896785
C(68)	0.268729	0.833403
C(69)	1.073163	0.785501
C(70)	-0.447650	0.768850
C(71)	0.928031	0.761130
C(72)	0.054333	0.750442
C(73)	0.545633	0.769047
C(74)	0.193427	0.751632
C(75)	0.289555	0.719648
C(76)	1.547959	0.722399
C(77)	0.501883	0.708504
C(78)	1.223067	0.733965
C(79)	0.564354	0.804112

Restrictions are linear in coefficients.

E 3.2.6 Gold Price

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	**0.510100**	**(13, 193)**	**0.9168**
Chi-square	**6.631300**	**13**	**0.9201**

Null Hypothesis: C(80)=C(81)=C(82)=C(83)=C(84)=C(85)=
C(86)=C(87)=C(88)=C(89)=C(90)=C(91)=C(92)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(80)	0.000927	0.152299

C(81)	-0.264987	0.155645
C(82)	-0.072190	0.156379
C(83)	0.009420	0.157850
C(84)	0.017787	0.162055
C(85)	0.001997	0.160145
C(86)	-0.006671	0.159545
C(87)	-0.152190	0.158811
C(88)	0.107464	0.156747
C(89)	-0.114136	0.158114
C(90)	-0.051608	0.153142
C(91)	-0.147539	0.153245
C(92)	-0.120166	0.150314

Restrictions are linear in coefficients.

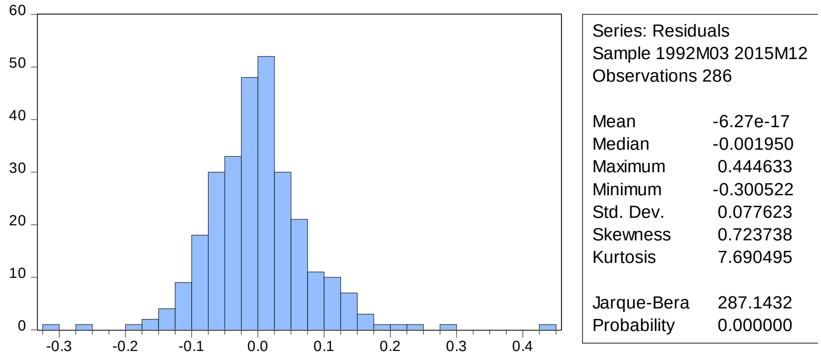
APPENDIX F: Viability Check of the Model

F 1 Correlogram of the Residuals

Date: 11/21/16 Time: 00:01
Sample: 1991M01 2015M12
Included observations: 286

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|.	.|.	1	-0.010	-0.010	0.0290	0.865
.|.	.|.	2	-0.014	-0.014	0.0849	0.958
.|.	.|.	3	-0.011	-0.011	0.1195	0.989
.|.	.|.	4	-0.011	-0.012	0.1576	0.997
.|.	.|.	5	0.004	0.003	0.1620	0.999
.|.	.|.	6	-0.025	-0.025	0.3423	0.999
.|.	.|.	7	-0.033	-0.033	0.6551	0.999
.|.	.|.	8	0.005	0.003	0.6619	1.000
.|.	.|.	9	0.001	0.000	0.6624	1.000
.|.	.|.	10	-0.043	-0.044	1.2124	1.000
.|.	.|.	11	0.031	0.029	1.4943	1.000
.|.	.|.	12	-0.025	-0.027	1.6894	1.000
.|.	.|.	13	-0.008	-0.010	1.7073	1.000
.|.	.|.	14	0.004	0.002	1.7121	1.000
.|.	.|.	15	-0.043	-0.043	2.2849	1.000
.|.	.|.	16	0.036	0.032	2.6736	1.000
.|.	.|.	17	0.018	0.016	2.7696	1.000
*|.	*|.	18	-0.120	-0.120	7.1856	0.988
.|.	.|.	19	0.011	0.008	7.2230	0.993
.|*	.|*	20	0.082	0.080	9.3170	0.979
.|*	.|*	21	0.099	0.100	12.376	0.929
*|.	*|.	22	-0.104	-0.111	15.725	0.829
.|.	.|*	23	0.071	0.082	17.320	0.793
.|.	.|.	24	-0.052	-0.056	18.177	0.794
.|*	.|.	25	0.078	0.072	20.120	0.741
.|.	.|.	26	-0.062	-0.060	21.345	0.724
.|.	.|.	27	0.014	0.029	21.404	0.767
.|.	.|.	28	0.049	0.037	22.177	0.773
.|.	.|.	29	-0.030	-0.021	22.471	0.800
.|.	.|.	30	0.018	0.016	22.570	0.833
.|*	.|*	31	0.098	0.113	25.692	0.736
.|.	.|.	32	0.067	0.064	27.168	0.710
.|.	.|.	33	0.021	0.028	27.307	0.746
.|.	.|.	34	0.008	0.009	27.329	0.784
.|.	.|.	35	-0.048	-0.017	28.088	0.790
.|.	*|.	36	-0.052	-0.080	28.984	0.790

F 2 Normality Test of the Residuals



F 3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.662436	Prob. F(13,180)	0.7977
Obs*R-squared	13.05825	Prob. Chi-Square(13)	0.4433

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/25/16 Time: 18:35
Sample: 1992M03 2015M12
Included observations: 286
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.092883	0.080882	1.148378	0.2523
C(2)	0.177512	0.417690	0.424986	0.6714
C(3)	0.160850	0.371050	0.433500	0.6652
C(4)	0.063445	0.341343	0.185868	0.8528
C(5)	-0.135260	0.315575	-0.428614	0.6687
C(6)	-0.290879	0.277450	-1.048401	0.2959
C(7)	0.167171	0.251625	0.664364	0.5073
C(8)	0.086895	0.237182	0.366364	0.7145
C(9)	-0.120134	0.219612	-0.547028	0.5850
C(10)	-0.132920	0.203198	-0.654141	0.5139
C(11)	0.117654	0.191850	0.613260	0.5405
C(12)	-0.271201	0.189588	-1.430477	0.1543
C(13)	0.160820	0.185696	0.866039	0.3876
C(14)	-0.028750	0.174668	-0.164599	0.8694
C(15)	0.350703	0.338740	1.035316	0.3019
C(16)	0.331560	0.314283	1.054972	0.2929
C(17)	0.155122	0.274734	0.564626	0.5730
C(18)	0.105969	0.258873	0.409349	0.6828
C(19)	0.173362	0.252296	0.687138	0.4929
C(20)	0.124379	0.219412	0.566875	0.5715
C(21)	0.023562	0.196808	0.119722	0.9048
C(22)	0.006423	0.200859	0.031977	0.9745
C(23)	0.062816	0.200400	0.313454	0.7543
C(24)	0.050007	0.187130	0.267232	0.7896
C(25)	-0.041002	0.184728	-0.221959	0.8246
C(26)	-0.032632	0.188023	-0.173551	0.8624
C(27)	0.065219	0.162625	0.401041	0.6889
C(28)	-0.037982	2.473234	-0.015357	0.9878
C(29)	0.365437	2.511445	0.145509	0.8845
C(30)	1.158736	2.583872	0.448449	0.6544
C(31)	0.089374	2.622141	0.034084	0.9728
C(32)	0.022151	2.885601	0.007677	0.9939
C(33)	-0.184336	2.878656	-0.064035	0.9490
C(34)	0.203648	2.810079	0.072470	0.9423
C(35)	1.137420	2.716148	0.418762	0.6759
C(36)	1.082717	2.422711	0.446903	0.6555
C(37)	-1.725782	2.583747	-0.667938	0.5050
C(38)	-0.488170	2.531843	-0.192812	0.8473
C(39)	0.200490	2.569207	0.078036	0.9379
C(40)	0.564406	2.547786	0.221528	0.8249
C(41)	-0.144793	0.965887	-0.149907	0.8810
C(42)	-0.157393	0.891642	-0.176520	0.8601
C(43)	-0.203510	0.918781	-0.221500	0.8250
C(44)	-0.170965	0.985511	-0.173479	0.8625
C(45)	-0.835486	1.080244	-0.773424	0.4403
C(46)	-0.532412	1.019237	-0.522363	0.6021
C(47)	0.064531	1.188450	0.054298	0.9568
C(48)	0.502316	1.146258	0.438222	0.6618
C(49)	-0.055194	1.115761	-0.049468	0.9606
C(50)	0.172540	1.051294	0.164121	0.8698

C(51)	0.154814	1.043926	0.148299	0.8823
C(52)	0.580869	0.994680	0.583976	0.5600
C(53)	0.077431	0.984124	0.078680	0.9374
C(54)	-0.645627	0.956056	-0.675303	0.5003
C(55)	-0.601900	0.917452	-0.656056	0.5126
C(56)	-0.328570	0.821386	-0.400019	0.6896
C(57)	-0.592626	0.915400	-0.647395	0.5182
C(58)	-0.314062	0.946743	-0.331729	0.7405
C(59)	-0.436372	0.889727	-0.490455	0.6244
C(60)	-0.622751	0.964140	-0.645913	0.5192
C(61)	-0.324231	0.945171	-0.343040	0.7320
C(62)	-0.452519	0.957785	-0.472464	0.6372
C(63)	-0.571901	0.975124	-0.586490	0.5583
C(64)	-0.241698	0.939429	-0.257281	0.7973
C(65)	-0.439791	0.886298	-0.496212	0.6204
C(66)	-0.054356	0.859293	-0.063257	0.9496
C(67)	-0.605711	0.998123	-0.606850	0.5447
C(68)	-0.321745	1.023858	-0.314248	0.7537
C(69)	-0.026063	0.922058	-0.028267	0.9775
C(70)	-0.092956	0.960215	-0.096808	0.9230
C(71)	-0.342034	0.980401	-0.348872	0.7276
C(72)	-0.406176	0.901673	-0.450470	0.6529
C(73)	0.003928	0.874316	0.004493	0.9964
C(74)	-0.188993	0.885121	-0.213522	0.8312
C(75)	-0.320888	0.842801	-0.380740	0.7038
C(76)	-0.311463	0.801802	-0.388453	0.6981
C(77)	-0.210369	0.900500	-0.233613	0.8156
C(78)	-0.524718	0.911843	-0.575447	0.5657
C(79)	-0.896329	0.979053	-0.915506	0.3612
C(80)	0.174377	0.207098	0.842001	0.4009
C(81)	0.137571	0.212606	0.647069	0.5184
C(82)	0.151099	0.207174	0.729334	0.4667
C(83)	0.156838	0.203413	0.771032	0.4417
C(84)	0.081590	0.202294	0.403323	0.6872
C(85)	0.114265	0.192525	0.593506	0.5536
C(86)	-0.031801	0.182627	-0.174129	0.8620
C(87)	0.038879	0.177184	0.219426	0.8266
C(88)	0.080649	0.181043	0.445469	0.6565
C(89)	0.042375	0.182543	0.232137	0.8167
C(90)	0.001511	0.173699	0.008699	0.9931
C(91)	0.069322	0.170663	0.406192	0.6851
C(92)	-0.004129	0.165953	-0.024883	0.9802
C(93)	0.053471	0.058356	0.916291	0.3607
RESID(-1)	-0.271186	0.454194	-0.597071	0.5512
RESID(-2)	-0.309056	0.397412	-0.777672	0.4378
RESID(-3)	-0.212590	0.362964	-0.585706	0.5588
RESID(-4)	0.003690	0.329774	0.011189	0.9911
RESID(-5)	0.200277	0.286270	0.699608	0.4851
RESID(-6)	-0.232038	0.259582	-0.893892	0.3726
RESID(-7)	-0.192684	0.238409	-0.808206	0.4200
RESID(-8)	0.062775	0.231745	0.270878	0.7868
RESID(-9)	0.040323	0.211707	0.190467	0.8492
RESID(-10)	-0.283976	0.206071	-1.378051	0.1699
RESID(-11)	0.202543	0.198168	1.022077	0.3081
RESID(-12)	-0.177045	0.196174	-0.902489	0.3680
RESID(-13)	-0.041003	0.182634	-0.224509	0.8226

R-squared	0.045658	Mean dependent var	-7.57E-17
Adjusted R-squared	-0.511041	S.D. dependent var	0.077623
S.E. of regression	0.095417	Akaike info criterion	-1.582893
Sum squared resid	1.638798	Schwarz criterion	-0.227875
Log likelihood	332.3537	Hannan-Quinn criter.	-1.039761
F-statistic	0.082016	Durbin-Watson stat	1.983803
Prob(F-statistic)	1.000000		

F 4 Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.131604	Prob. F(98,187)	0.2350
Obs*R-squared	106.4683	Prob. Chi-Square(98)	0.2625
Scaled explained SS	162.1926	Prob. Chi-Square(98)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/25/16 Time: 18:38
Sample: 1992M03 2015M12
Included observations: 286

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.119809	0.311889	0.384140	0.7013
LDSEGEN(-1)	0.029278	0.011731	2.495836	0.0134
LIPI(-1)	0.006964	0.024739	0.281504	0.7786
LINT(-1)	-0.116690	0.398758	-0.292633	0.7701
LCPI(-1)	-0.072711	0.144761	-0.502287	0.6161
LEXR(-1)	0.100283	0.122597	0.817984	0.4144
LM2(-1)	-0.137583	0.146558	-0.938761	0.3491
LGDPRICE(-1)	-0.055614	0.024781	-2.244233	0.0260
LDSEGEN(-2)	0.006507	0.017353	0.374977	0.7081
LDSEGEN(-3)	-0.012097	0.017363	-0.696722	0.4868
LDSEGEN(-4)	-0.006650	0.017312	-0.384103	0.7013
LDSEGEN(-5)	-0.003244	0.017444	-0.185954	0.8527
LDSEGEN(-6)	0.001901	0.017682	0.107494	0.9145
LDSEGEN(-7)	0.006992	0.018133	0.385610	0.7002
LDSEGEN(-8)	-0.003152	0.018592	-0.169565	0.8655
LDSEGEN(-9)	-0.002637	0.018706	-0.140972	0.8880
LDSEGEN(-10)	-0.016504	0.018945	-0.871145	0.3848
LDSEGEN(-11)	0.006533	0.019068	0.342615	0.7323
LDSEGEN(-12)	-0.010211	0.019289	-0.529388	0.5972
LDSEGEN(-13)	0.029645	0.019748	1.501209	0.1350
LDSEGEN(-14)	-0.015336	0.013578	-1.129448	0.2602
LIPI(-2)	0.014629	0.025577	0.571950	0.5680
LIPI(-3)	-0.032205	0.024220	-1.329659	0.1853
LIPI(-4)	-0.006604	0.024505	-0.269504	0.7878
LIPI(-5)	-0.001363	0.024334	-0.056009	0.9554
LIPI(-6)	-0.016450	0.024016	-0.684988	0.4942
LIPI(-7)	0.004313	0.024009	0.179645	0.8576
LIPI(-8)	0.006164	0.024014	0.256687	0.7977
LIPI(-9)	0.000448	0.023117	0.019380	0.9846
LIPI(-10)	-0.015216	0.022551	-0.674731	0.5007
LIPI(-11)	-0.014642	0.022691	-0.645271	0.5195
LIPI(-12)	0.010312	0.022451	0.459314	0.6465
LIPI(-13)	-0.031181	0.024018	-1.298258	0.1958
LIPI(-14)	0.010400	0.023047	0.451258	0.6523
LINT(-2)	0.577953	0.562104	1.028196	0.3052
LINT(-3)	0.058978	0.563128	0.104733	0.9167
LINT(-4)	-0.747413	0.583728	-1.280412	0.2020
LINT(-5)	0.351373	0.586248	0.599360	0.5497
LINT(-6)	0.128418	0.585802	0.219218	0.8267
LINT(-7)	0.004175	0.581509	0.007180	0.9943
LINT(-8)	0.243183	0.554338	0.438691	0.6614
LINT(-9)	-0.237406	0.527933	-0.449690	0.6535
LINT(-10)	-0.022215	0.512115	-0.043379	0.9654
LINT(-11)	-0.009915	0.521998	-0.018995	0.9849
LINT(-12)	-0.206968	0.514541	-0.402239	0.6880
LINT(-13)	0.461031	0.521609	0.883864	0.3779
LINT(-14)	-0.494880	0.385115	-1.285021	0.2004
LCPI(-2)	0.072783	0.206572	0.352337	0.7250
LCPI(-3)	0.173872	0.197717	0.879397	0.3803
LCPI(-4)	-0.244726	0.199842	-1.224596	0.2223
LCPI(-5)	-0.000801	0.199275	-0.004019	0.9968

LCPI(-6)	-0.228174	0.198108	-1.151768	0.2509
LCPI(-7)	0.554160	0.199616	2.776130	0.0061
LCPI(-8)	-0.396948	0.200241	-1.982354	0.0489
LCPI(-9)	0.104282	0.192747	0.541029	0.5891
LCPI(-10)	-0.014973	0.188774	-0.079318	0.9369
LCPI(-11)	-0.028736	0.190487	-0.150858	0.8803
LCPI(-12)	-0.093151	0.192218	-0.484614	0.6285
LCPI(-13)	0.132439	0.196215	0.674968	0.5005
LCPI(-14)	0.066122	0.138331	0.477996	0.6332
LEXR(-2)	-0.035658	0.170481	-0.209163	0.8345
LEXR(-3)	-0.145704	0.167567	-0.869524	0.3857
LEXR(-4)	0.143207	0.169219	0.846282	0.3985
LEXR(-5)	-0.040181	0.171546	-0.234229	0.8151
LEXR(-6)	0.362061	0.170310	2.125896	0.0348
LEXR(-7)	-0.525077	0.174519	-3.008711	0.0030
LEXR(-8)	0.314508	0.173259	1.815246	0.0711
LEXR(-9)	-0.288714	0.175413	-1.645910	0.1015
LEXR(-10)	0.004579	0.182636	0.025073	0.9800
LEXR(-11)	0.105444	0.182980	0.576262	0.5651
LEXR(-12)	0.075526	0.180051	0.419467	0.6754
LEXR(-13)	-0.153209	0.178647	-0.857610	0.3922
LEXR(-14)	0.075258	0.125179	0.601201	0.5484
LM2(-2)	-0.165117	0.155460	-1.062114	0.2896
LM2(-3)	0.236383	0.138351	1.708576	0.0892
LM2(-4)	-0.139144	0.139955	-0.994210	0.3214
LM2(-5)	0.099363	0.137696	0.721612	0.4714
LM2(-6)	0.019292	0.136349	0.141486	0.8876
LM2(-7)	-0.050314	0.134529	-0.373998	0.7088
LM2(-8)	0.108613	0.132923	0.817113	0.4149
LM2(-9)	-0.118216	0.131335	-0.900109	0.3692
LM2(-10)	0.271149	0.133158	2.036295	0.0431
LM2(-11)	-0.309943	0.132768	-2.334473	0.0206
LM2(-12)	0.057321	0.132890	0.431345	0.6667
LM2(-13)	0.065303	0.150206	0.434755	0.6642
LM2(-14)	0.083009	0.130259	0.637258	0.5247
LGDPRICE(-2)	0.028195	0.031800	0.886613	0.3764
LGDPRICE(-3)	0.025123	0.031940	0.786561	0.4325
LGDPRICE(-4)	0.033200	0.032140	1.033003	0.3029
LGDPRICE(-5)	-0.015719	0.031587	-0.497619	0.6193
LGDPRICE(-6)	-0.015623	0.032613	-0.479048	0.6325
LGDPRICE(-7)	0.005083	0.032529	0.156254	0.8760
LGDPRICE(-8)	0.008198	0.032080	0.255565	0.7986
LGDPRICE(-9)	0.000841	0.032528	0.025848	0.9794
LGDPRICE(-10)	-0.003350	0.032365	-0.103498	0.9177
LGDPRICE(-11)	0.015643	0.031961	0.489419	0.6251
LGDPRICE(-12)	-0.017138	0.031228	-0.548789	0.5838
LGDPRICE(-13)	0.008515	0.031316	0.271900	0.7860
LGDPRICE(-14)	-0.020453	0.024959	-0.819477	0.4136

R-squared	0.372267	Mean dependent var	0.006004
Adjusted R-squared	0.043294	S.D. dependent var	0.015558
S.E. of regression	0.015217	Akaike info criterion	-5.265358
Sum squared resid	0.043302	Schwarz criterion	-3.999822
Log likelihood	851.9461	Hannan-Quinn criter.	-4.758093
F-statistic	1.131604	Durbin-Watson stat	2.054082
Prob(F-statistic)	0.235008		

APPENDIX G: Granger Causality Test

VEC Granger Causality/Block Exogeneity Wald Tests
Sample: 1991M01 2015M12
Included observations: 287

Dependent variable: D(LDSEGEN)

Excluded	Chi-sq	df	Prob.
D(LIPI)	8.324574	12	0.7593
D(LINT)	4.883428	12	0.9618
D(LCPI)	11.36160	12	0.4982
D(LEXR)	4.698369	12	0.9673
D(LM2)	12.67572	12	0.3930
D(LGDPRICE)	6.075535	12	0.9122
All	48.19141	72	0.9861

Dependent variable: D(LIPI)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	**33.57122**	**12**	**0.0008**
D(LINT)	24.53852	12	0.0172
D(LCPI)	9.594977	12	0.6514
D(LEXR)	19.63923	12	0.0742
D(LM2)	34.56602	12	0.0005
D(LGDPRICE)	19.02375	12	0.0880
All	140.2462	72	0.0000

Dependent variable: D(LINT)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	17.24099	12	0.1408
D(LIPI)	10.37142	12	0.5834
D(LCPI)	13.72147	12	0.3188
D(LEXR)	47.56735	12	0.0000
D(LM2)	11.84145	12	0.4585
D(LGDPRICE)	16.41006	12	0.1732
All	131.3906	72	0.0000

Dependent variable: D(LCPI)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	12.33650	12	0.4190
D(LIPI)	19.30204	12	0.0815
D(LINT)	7.828167	12	0.7984
D(LEXR)	4.186493	12	0.9798
D(LM2)	12.02703	12	0.4435
D(LGDPRICE)	7.320290	12	0.8357
All	63.27458	72	0.7588

Dependent variable: D(LEXR)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	**26.43632**	**12**	**0.0093**
D(LIPI)	6.880521	12	0.8654
D(LINT)	11.38542	12	0.4962
D(LCPI)	7.922966	12	0.7911
D(LM2)	8.238660	12	0.7662
D(LGDPRICE)	5.667486	12	0.9319
All	73.46249	72	0.4299

Dependent variable: D(LM2)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	13.93450	12	0.3049
D(LIPI)	32.42559	12	0.0012
D(LINT)	9.569907	12	0.6536
D(LCPI)	20.41907	12	0.0596
D(LEXR)	6.051948	12	0.9134
D(LGDPRICE)	13.93218	12	0.3051
All	98.74080	72	0.0200

Dependent variable: D(LGDPRICE)

Excluded	Chi-sq	df	Prob.
D(LDSEGEN)	4.725250	12	0.9665
D(LIPI)	9.905839	12	0.6242
D(LINT)	16.88617	12	0.1539
D(LCPI)	8.212300	12	0.7683
D(LEXR)	16.02909	12	0.1899
D(LM2)	6.421675	12	0.8934
All	65.74339	72	0.6848

Appendix H: ARDL Test

H 1 Dependent Variable: LDSEGEN
Method: ARDL

Sample (adjusted): 1992M01 2015M12
Included observations: 288 after adjustments
Dependent lags: 12 (Fixed)
Dynamic regressors (5 lags, fixed): LIPI LCPI LEXR LM2 LGDPRICE
Fixed regressors: C @TREND

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	1.059667	0.063350	16.72723	0.0000
LDSEGEN(-2)	-0.113009	0.092589	-1.220551	0.2234
LDSEGEN(-3)	0.050972	0.092833	0.549072	0.5835
LDSEGEN(-4)	-0.017384	0.093595	-0.185739	0.8528
LDSEGEN(-5)	-0.139279	0.094451	-1.474621	0.1416
LDSEGEN(-6)	0.002622	0.094889	0.027628	0.9780
LDSEGEN(-7)	0.136665	0.095386	1.432764	0.1532
LDSEGEN(-8)	0.010246	0.096398	0.106286	0.9154
LDSEGEN(-9)	-0.064784	0.098098	-0.660397	0.5096
LDSEGEN(-10)	0.007887	0.097554	0.080849	0.9356
LDSEGEN(-11)	0.004967	0.097155	0.051125	0.9593
LDSEGEN(-12)	-0.064804	0.065848	-0.984144	0.3260
LIPI	-0.072473	0.109016	-0.664795	0.5068
LIPI(-1)	0.157258	0.114560	1.372711	0.1711
LIPI(-2)	0.136129	0.116537	1.168119	0.2439
LIPI(-3)	-0.074659	0.116061	-0.643274	0.5207
LIPI(-4)	0.096724	0.115759	0.835564	0.4042
LIPI(-5)	0.111237	0.107046	1.039152	0.2998
LCPI	-0.697106	0.675746	-1.031609	0.3033
LCPI(-1)	0.272478	1.048223	0.259943	0.7951
LCPI(-2)	0.714447	1.052649	0.678714	0.4980
LCPI(-3)	-0.349868	1.041573	-0.335903	0.7372
LCPI(-4)	0.802526	1.029972	0.779173	0.4366
LCPI(-5)	-1.415530	0.664743	-2.129440	0.0342
LEXR	0.029960	0.622093	0.048160	0.9616
LEXR(-1)	-0.360840	0.862728	-0.418255	0.6761
LEXR(-2)	0.280241	0.862162	0.325044	0.7454
LEXR(-3)	0.442630	0.866708	0.510703	0.6100
LEXR(-4)	-1.234061	0.867535	-1.422491	0.1562
LEXR(-5)	0.360146	0.616227	0.584437	0.5595
LM2	0.862471	0.481370	1.791701	0.0744
LM2(-1)	-1.407151	0.530481	-2.652594	0.0085
LM2(-2)	-0.343083	0.529787	-0.647587	0.5179
LM2(-3)	0.996859	0.525522	1.896893	0.0590
LM2(-4)	-0.741138	0.511621	-1.448607	0.1487
LM2(-5)	0.339919	0.462223	0.735400	0.4628
LGDPRICE	0.042509	0.128551	0.330677	0.7412
LGDPRICE(-1)	0.094329	0.163468	0.577047	0.5644
LGDPRICE(-2)	-0.194697	0.161741	-1.203757	0.2299
LGDPRICE(-3)	0.161333	0.161000	1.002070	0.3173
LGDPRICE(-4)	0.001529	0.161188	0.009485	0.9924
LGDPRICE(-5)	0.075939	0.131221	0.578713	0.5633
C	4.812805	1.759491	2.735339	0.0067
@TREND	0.005529	0.002561	2.158731	0.0318

R-squared	0.990697	Mean dependent var	6.134211
Adjusted R-squared	0.989058	S.D. dependent var	0.850811
S.E. of regression	0.088998	Akaike info criterion	-1.860648
Sum squared resid	1.932626	Schwarz criterion	-1.301029
Log likelihood	311.9333	Hannan-Quinn criter.	-1.636387
F-statistic	604.3141	Durbin-Watson stat	1.968276
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

H 2 ARDL Bounds Test

Date: 02/20/17 Time: 10:31
Sample: 1992M01 2015M12
Included observations: 288
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	**3.729042**	**5**

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.5%	3.11	4.13
1%	3.5	4.63

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 02/20/17 Time: 10:31
Sample: 1992M01 2015M12
Included observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.185903	0.061382	3.028637	0.0027
D(LDSEGEN(-2))	0.072893	0.063270	1.152095	0.2504
D(LDSEGEN(-3))	0.123865	0.063613	1.947166	0.0527
D(LDSEGEN(-4))	0.106481	0.064662	1.646726	0.1009
D(LDSEGEN(-5))	-0.032798	0.064951	-0.504973	0.6140
D(LDSEGEN(-6))	-0.030177	0.065820	-0.458472	0.6470
D(LDSEGEN(-7))	0.106488	0.065852	1.617079	0.1072
D(LDSEGEN(-8))	0.116734	0.067804	1.721626	0.0864
D(LDSEGEN(-9))	0.051950	0.068314	0.760456	0.4477
D(LDSEGEN(-10))	0.059837	0.067774	0.882895	0.3782
D(LDSEGEN(-11))	0.064804	0.065848	0.984144	0.3260
D(LIPI)	-0.072473	0.109016	-0.664795	0.5068
D(LIPI(-1))	-0.269431	0.163014	-1.652806	0.0997
D(LIPI(-2))	-0.133302	0.138227	-0.964369	0.3358
D(LIPI(-3))	-0.207961	0.121649	-1.709522	0.0886
D(LIPI(-4))	-0.111237	0.107046	-1.039152	0.2998
D(LCPI)	-0.697106	0.675746	-1.031609	0.3033
D(LCPI(-1))	0.248424	0.675453	0.367789	0.7133
D(LCPI(-2))	0.962871	0.677380	1.421464	0.1565
D(LCPI(-3))	0.613004	0.670861	0.913757	0.3617
D(LCPI(-4))	1.415530	0.664743	2.129440	0.0342
D(LEXR)	0.029960	0.622093	0.048160	0.9616
D(LEXR(-1))	0.151044	0.624853	0.241727	0.8092
D(LEXR(-2))	0.431284	0.627659	0.687132	0.4927
D(LEXR(-3))	0.873915	0.623288	1.402104	0.1622
D(LEXR(-4))	-0.360146	0.616227	-0.584437	0.5595
D(LM2)	0.862471	0.481370	1.791701	0.0744
D(LM2(-1))	-0.252556	0.509126	-0.496059	0.6203
D(LM2(-2))	-0.595640	0.502427	-1.185525	0.2370
D(LM2(-3))	0.401219	0.505470	0.793756	0.4281
D(LM2(-4))	-0.339919	0.462223	-0.735400	0.4628
D(LGDPRICE)	0.042509	0.128551	0.330677	0.7412
D(LGDPRICE(-1))	-0.044104	0.136699	-0.322635	0.7472
D(LGDPRICE(-2))	-0.238801	0.136028	-1.755529	0.0804
D(LGDPRICE(-3))	-0.077468	0.134746	-0.574921	0.5659
D(LGDPRICE(-4))	-0.075939	0.131221	-0.578713	0.5633

C	4.812805	1.759491	2.735339	0.0067
@TREND	0.005529	0.002561	2.158731	0.0318
LIPI(-1)	0.354216	0.187431	1.889843	0.0600
LCPI(-1)	-0.673052	0.221443	-3.039388	0.0026
LEXR(-1)	-0.481924	0.205645	-2.343479	0.0199
LM2(-1)	-0.292124	0.267452	-1.092247	0.2758
LGDPRICE(-1)	0.180941	0.058586	3.088467	0.0022
LDSEGEN(-1)	-0.126236	0.025967	-4.861450	0.0000

R-squared	0.212278	Mean dependent var	0.009592
Adjusted R-squared	0.073458	S.D. dependent var	0.092458
S.E. of regression	0.088998	Akaike info criterion	-1.860648
Sum squared resid	1.932626	Schwarz criterion	-1.301029
Log likelihood	311.9333	Hannan-Quinn criter.	-1.636387
F-statistic	1.529157	Durbin-Watson stat	1.968276
Prob(F-statistic)	0.025220		

H 3 ARDL Cointegrating And Long Run Form

Dependent Variable: LDSEGEN
Selected Model: ARDL(12, 5, 5, 5, 5, 5)
Date: 04/14/17 Time: 22:35
Sample: 1991M01 2015M12
Included observations: 288

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.185903	0.060127	3.091828	0.0022
D(LDSEGEN(-2))	0.072893	0.061746	1.180531	0.2389
D(LDSEGEN(-3))	0.123865	0.061932	2.000030	0.0466
D(LDSEGEN(-4))	0.106481	0.062851	1.694190	0.0915
D(LDSEGEN(-5))	-0.032798	0.062679	-0.523272	0.6013
D(LDSEGEN(-6))	-0.030177	0.063490	-0.475296	0.6350
D(LDSEGEN(-7))	0.106488	0.062965	1.691223	0.0921
D(LDSEGEN(-8))	0.116734	0.064602	1.806962	0.0720
D(LDSEGEN(-9))	0.051950	0.064491	0.805535	0.4213
D(LDSEGEN(-10))	0.059837	0.065466	0.914018	0.3616
D(LDSEGEN(-11))	0.064804	0.063474	1.020953	0.3083
D(LIPI)	-0.072473	0.102480	-0.707194	0.4801
D(LIPI(-1))	-0.269431	0.118456	-2.274533	0.0238
D(LIPI(-2))	-0.133302	0.109053	-1.222362	0.2228
D(LIPI(-3))	-0.207961	0.106198	-1.958240	0.0513
D(LIPI(-4))	-0.111237	0.100216	-1.109970	0.2681
D(LCPI)	-0.697106	0.652557	-1.068268	0.2865
D(LCPI(-1))	0.248424	0.659353	0.376769	0.7067
D(LCPI(-2))	0.962871	0.660809	1.457110	0.1464
D(LCPI(-3))	0.613004	0.659660	0.929272	0.3537
D(LCPI(-4))	1.415530	0.653387	2.166449	0.0312
D(LEXR)	0.029960	0.598264	0.050078	0.9601
D(LEXR(-1))	0.151044	0.606214	0.249159	0.8034
D(LEXR(-2))	0.431284	0.605819	0.711903	0.4772
D(LEXR(-3))	0.873915	0.604339	1.446067	0.1494
D(LEXR(-4))	-0.360146	0.596683	-0.603580	0.5467
D(LM2)	0.862471	0.454845	1.896188	0.0591
D(LM2(-1))	-0.252556	0.479456	-0.526756	0.5988
D(LM2(-2))	-0.595640	0.476573	-1.249839	0.2126
D(LM2(-3))	0.401219	0.484289	0.828471	0.4082
D(LM2(-4))	-0.339919	0.447149	-0.760191	0.4479
D(LGDPRICE)	0.042509	0.124678	0.340948	0.7334
D(LGDPRICE(-1))	-0.044104	0.126195	-0.349489	0.7270

D(LGDPRICE(-2))	-0.238801	0.122632	-1.947300	0.0526
D(LGDPRICE(-3))	-0.077468	0.123348	-0.628043	0.5306
D(LGDPRICE(-4))	-0.075939	0.123909	-0.612860	0.5405
C	4.818334	0.928736	5.188057	0.0000
CointEq(-1)	-0.126236	0.024410	-5.171574	0.0000

Cointeq = LDSEGEN - (2.8060*LIPI -5.3317*LCPI -3.8177*LEXR -2.3141 *LM2 + 1.4334*LGDPRICE + 0.0438*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	2.805986	1.328399	2.112307	0.0357
LCPI	-5.331708	1.644792	-3.241570	0.0014
LEXR	-3.817657	1.419371	-2.689682	0.0076
LM2	-2.314113	2.009226	-1.151743	0.2506
LGDPRICE	1.433363	0.370913	3.864420	0.0001
@TREND	0.043799	0.017795	2.461358	0.0145

H 4 VECM Results for Significance Test of the Coefficients

Estimation Command:

=========================

LS DLDSEGEN D(LDSEGEN(-1)) D(LDSEGEN(-2)) D(LDSEGEN(-3)) D(LDSEGEN(-4)) D(LDSEGEN(-5)) D(LDSEGEN(-6)) D(LDSEGEN(-7)) D(LDSEGEN(-8)) D(LDSEGEN(-9)) D(LDSEGEN(-10)) D(LDSEGEN(-11)) D(LIPI) D(LIPI(-1)) D(LIPI(-2)) D(LIPI(-3)) D(LIPI(-4)) D(LCPI) D(LCPI(-1)) D(LCPI(-2)) D(LCPI(-3)) D(LCPI(-4)) D(LEXR) D(LEXR(-1)) D(LEXR(-2)) D(LEXR(-3)) D(LEXR(-4)) D(LM2) D(LM2(-1)) D(LM2(-2)) D(LM2(-3)) D(LM2(-4)) D(LGDPRICE) D(LGDPRICE(-1)) D(LGDPRICE(-2)) D(LGDPRICE(-3)) D(LGDPRICE(-4)) C @TREND LIPI(-1) LCPI(-1) LEXR(-1) LM2(-1) LGDPRICE(-1) LDSEGEN(-1)

Estimation Equation:

=========================

DLDSEGEN = C(1)*D(LDSEGEN(-1)) + C(2)*D(LDSEGEN(-2)) + C(3)*D(LDSEGEN(-3)) + C(4)*D(LDSEGEN(-4)) + C(5)*D(LDSEGEN(-5)) + C(6)*D(LDSEGEN(-6)) + C(7)*D(LDSEGEN(-7)) + C(8)*D(LDSEGEN(-8)) + C(9)*D(LDSEGEN(-9)) + C(10)*D(LDSEGEN(-10)) + C(11)*D(LDSEGEN(-11)) + C(12)*D(LIPI) + C(13)*D(LIPI(-1)) + C(14)*D(LIPI(-2)) + C(15)*D(LIPI(-3)) + C(16)*D(LIPI(-4)) + C(17)*D(LCPI) + C(18)*D(LCPI(-1)) + C(19)*D(LCPI(-2)) + C(20)*D(LCPI(-3)) + C(21)*D(LCPI(-4)) + C(22)*D(LEXR) + C(23)*D(LEXR(-1)) + C(24)*D(LEXR(-2)) + C(25)*D(LEXR(-3)) + C(26)*D(LEXR(-4)) + C(27)*D(LM2) + C(28)*D(LM2(-1)) + C(29)*D(LM2(-2)) + C(30)*D(LM2(-3)) + C(31)*D(LM2(-4)) + C(32)*D(LGDPRICE) + C(33)*D(LGDPRICE(-1)) + C(34)*D(LGDPRICE(-2)) + C(35)*D(LGDPRICE(-3)) + C(36)*D(LGDPRICE(-4)) + C(37) + C(38)*@TREND + C(39)*LIPI(-1) + C(40)*LCPI(-1) + C(41)*LEXR(-1) + C(42)*LM2(-1) + C(43)*LGDPRICE(-1) + C(44)*LDSEGEN(-1)

Substituted Coefficients:

=========================

DLDSEGEN = 0.18590260982*D(LDSEGEN(-1)) + 0.0728933053537*D(LDSEGEN(-2)) + 0.123865273807*D(LDSEGEN(-3)) + 0.106481071258*D(LDSEGEN(-4)) - 0.0327983107168*D(LDSEGEN(-5)) - 0.0301766843322*D(LDSEGEN(-6)) + 0.106488235831*D(LDSEGEN(-7)) + 0.116733995803*D(LDSEGEN(-8)) + 0.0519501279797*D(LDSEGEN(-9)) + 0.0598372544249*D(LDSEGEN(-10)) + 0.0648043230683*D(LDSEGEN(-11)) - 0.0724732184792*D(LIPI) - 0.269431039656*D(LIPI(-1)) - 0.133302102048*D(LIPI(-2)) - 0.207961041338*D(LIPI(-3)) - 0.111236634768*D(LIPI(-4)) - 0.697105671694*D(LCPI) + 0.248423905767*D(LCPI(-1)) + 0.962871222108*D(LCPI(-2)) + 0.613003713159*D(LCPI(-3)) + 1.41552982129*D(LCPI(-4)) + 0.0299597749816*D(LEXR) + 0.151043879936*D(LEXR(-1)) + 0.431284442344*D(LEXR(-2)) + 0.873914613052*D(LEXR(-3)) - 0.360146054298*D(LEXR(-4)) + 0.862470847062*D(LM2) - 0.252556327558*D(LM2(-1)) - 0.595639571038*D(LM2(-2)) + 0.401219430886*D(LM2(-3)) - 0.339918759338*D(LM2(-4)) + 0.0425086899614*D(LGDPRICE) - 0.0441039432065*D(LGDPRICE(-1)) - 0.238801079244*D(LGDPRICE(-2)) - 0.0774680318815*D(LGDPRICE(-3)) - 0.07593911187*D(LGDPRICE(-4)) + 4.81280489031 + 0.00552899059958*@TREND + 0.354215506046*LIPI(-1) - 0.673051717555*LCPI(-1) - 0.481924494306*LEXR(-1) - 0.292123624614*LM2(-1) + 0.180941493131*LGDPRICE(-1) - 0.126235675352*LDSEGEN(-1)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.816910	(5, 244)	0.5386
Chi-square	4.084552	5	0.5373

Null Hypothesis: C(12)=C(13)=C(14)=C(15)=C(16)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(12)	-0.072473	0.109016
C(13)	-0.269431	0.163014
C(14)	-0.133302	0.138227
C(15)	-0.207961	0.121649
C(16)	-0.111237	0.107046

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.122167	(5, 244)	0.0634
Chi-square	10.61084	5	0.0597

Null Hypothesis: C(17)=C(18)=C(19)=C(20)=C(21)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(17)	-0.697106	0.675746
C(18)	0.248424	0.675453
C(19)	0.962871	0.677380
C(20)	0.613004	0.670861
C(21)	1.415530	0.664743

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.571753	(5, 244)	0.7216
Chi-square	2.858767	5	0.7217

Null Hypothesis: C(22)=C(23)=C(24)=C(25)=C(26)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(22)	0.029960	0.622093
C(23)	0.151044	0.624853
C(24)	0.431284	0.627659
C(25)	0.873915	0.623288
C(26)	-0.360146	0.616227

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.935822	(5, 244)	0.0890
Chi-square	9.679108	5	0.0849

Null Hypothesis: C(27)=C(28)=C(29)=C(30)=C(31)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(27)	0.862471	0.481370
C(28)	-0.252556	0.509126
C(29)	-0.595640	0.502427
C(30)	0.401219	0.505470
C(31)	-0.339919	0.462223

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.668233	(5, 244)	0.6479
Chi-square	3.341163	5	0.6475

Null Hypothesis: C(32)=C(33)=C(34)=C(35)=C(36)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(32)	0.042509	0.128551
C(33)	-0.044104	0.136699
C(34)	-0.238801	0.136028
C(35)	-0.077468	0.134746
C(36)	-0.075939	0.131221

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.226267	(6, 244)	0.0005
Chi-square	25.35760	6	0.0003

Null Hypothesis: C(39)=C(40)=C(41)=C(42)=C(43)=C(44)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(39)	0.354216	0.187431
C(40)	-0.673052	0.221443
C(41)	-0.481924	0.205645
C(42)	-0.292124	0.267452
C(43)	0.180941	0.058586
C(44)	-0.126236	0.025967

Restrictions are linear in coefficients.

APPENDIX I: Viability Check of the ARDL Model

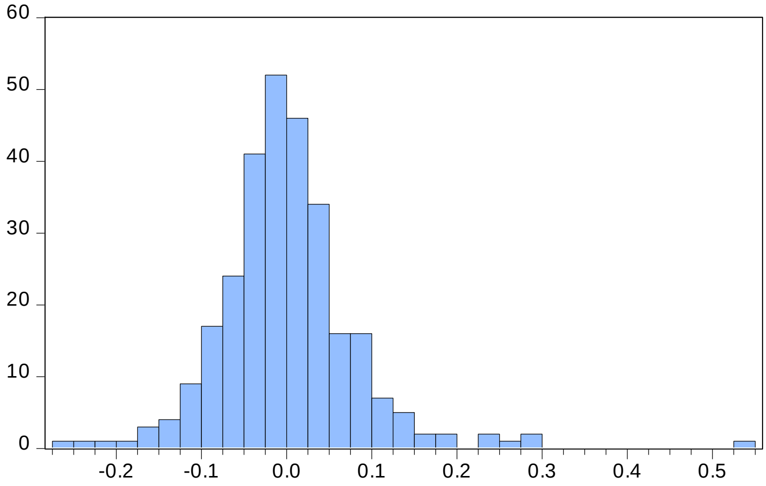
I 1 Correlogram of the Residuals

Date: 04/15/17 Time: 17:38
Sample: 1991M01 2015M12
Included observations: 288
Q-statistic probabilities adjusted for 12 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.015	0.015	0.0689	0.793
.|. |	.|. |	2	0.001	0.001	0.0691	0.966
.|. |	.|. |	3	-0.012	-0.012	0.1106	0.991
.|. |	.|. |	4	0.008	0.008	0.1292	0.998
.|. |	.|. |	5	-0.007	-0.007	0.1433	1.000
.|. |	.|. |	6	-0.004	-0.004	0.1493	1.000
.|. |	.|. |	7	0.013	0.013	0.2001	1.000
.|. |	.|. |	8	-0.000	-0.001	0.2001	1.000
.|. |	.|. |	9	0.008	0.008	0.2202	1.000
.|. |	.|. |	10	-0.042	-0.042	0.7521	1.000
.|. |	.|. |	11	-0.005	-0.004	0.7605	1.000
.|. |	.|. |	12	-0.034	-0.034	1.1140	1.000
.|. |	.|. |	13	-0.019	-0.019	1.2275	1.000
.|. |	.|. |	14	0.009	0.010	1.2506	1.000
.|. |	.|. |	15	-0.063	-0.065	2.4741	1.000
.|. |	.|. |	16	-0.037	-0.036	2.8941	1.000
.|. |	.|. |	17	-0.004	-0.002	2.8992	1.000
*|. |	*|. |	18	-0.136	-0.139	8.5956	0.968
.|. |	.|. |	19	0.021	0.027	8.7380	0.978
.|. |	.|. |	20	-0.032	-0.037	9.0648	0.982
.|* |	.|* |	21	0.122	0.121	13.728	0.881
*|. |	*|. |	22	-0.090	-0.098	16.279	0.802
.|. |	.|. |	23	0.045	0.049	16.912	0.814
.|. |	.|. |	24	-0.035	-0.040	17.298	0.836
.|* |	.|* |	25	0.098	0.103	20.372	0.727
.|. |	.|. |	26	-0.044	-0.060	20.995	0.742
.|. |	.|. |	27	-0.008	0.001	21.018	0.785
.|. |	.|. |	28	-0.019	-0.047	21.131	0.820
.|. |	.|. |	29	-0.056	-0.048	22.156	0.814
.|. |	.|. |	30	0.003	-0.019	22.159	0.848
.|* |	.|* |	31	0.117	0.134	26.587	0.693
.|* |	.|. |	32	0.076	0.053	28.465	0.646
.|. |	.|. |	33	0.028	0.030	28.725	0.680
.|. |	.|. |	34	0.035	0.017	29.124	0.705
.|. |	.|. |	35	-0.037	-0.033	29.577	0.727
*|. |	*|. |	36	-0.093	-0.109	32.423	0.639

*Probabilities may not be valid for this equation specification.

I 2 Normality Test of the Residuals



Series: Residuals
Sample 1992M01 2015M12
Observations 288

Mean	3.21e-15
Median	-0.003037
Maximum	0.544944
Minimum	-0.265850
Std. Dev.	0.082060
Skewness	1.301461
Kurtosis	10.65541
Jarque-Bera	784.5659
Probability	0.000000

I 3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.763942	Prob. F(5,239)	0.5766
Obs*R-squared	4.530425	Prob. Chi-Square(5)	0.4758

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 04/15/17 Time: 17:40
Sample: 1992M01 2015M12
Included observations: 288
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.622836	0.389796	-1.597850	0.1114
LDSEGEN(-2)	0.722921	0.576628	1.253703	0.2112
LDSEGEN(-3)	0.182149	0.457584	0.398066	0.6909
LDSEGEN(-4)	-0.442526	0.399777	-1.106932	0.2694
LDSEGEN(-5)	0.266911	0.384918	0.693423	0.4887
LDSEGEN(-6)	-0.221106	0.255751	-0.864537	0.3882
LDSEGEN(-7)	0.033039	0.109991	0.300384	0.7641
LDSEGEN(-8)	0.126130	0.126412	0.997767	0.3194
LDSEGEN(-9)	-0.015064	0.119536	-0.126020	0.8998
LDSEGEN(-10)	-0.094380	0.117996	-0.799859	0.4246
LDSEGEN(-11)	0.028892	0.112942	0.255810	0.7983
LDSEGEN(-12)	-0.004154	0.073817	-0.056273	0.9552
LIPI	0.018828	0.110991	0.169639	0.8654
LIPI(-1)	-0.032300	0.118913	-0.271628	0.7861
LIPI(-2)	0.082107	0.132548	0.619448	0.5362
LIPI(-3)	0.067016	0.128476	0.521627	0.6024
LIPI(-4)	-0.125740	0.135066	-0.930955	0.3528
LIPI(-5)	0.093261	0.122276	0.762713	0.4464
LCPI	-4.19E-05	0.705247	-5.94E-05	1.0000
LCPI(-1)	-0.325865	1.119957	-0.290962	0.7713
LCPI(-2)	0.051110	1.137596	0.044928	0.9642
LCPI(-3)	0.860205	1.148257	0.749140	0.4545

LCPI(-4)	-0.578494	1.118151	-0.517367	0.6054
LCPI(-5)	-0.235718	0.797226	-0.295672	0.7677
LEXR	-0.078581	0.626471	-0.125434	0.9003
LEXR(-1)	-0.000710	0.869561	-0.000816	0.9993
LEXR(-2)	-0.142374	0.872533	-0.163174	0.8705
LEXR(-3)	0.227198	0.889811	0.255333	0.7987
LEXR(-4)	0.259219	0.898804	0.288404	0.7733
LEXR(-5)	-0.447813	0.675804	-0.662637	0.5082
LM2	0.035961	0.519099	0.069276	0.9448
LM2(-1)	0.623601	0.625359	0.997189	0.3197
LM2(-2)	-0.974259	0.809711	-1.203217	0.2301
LM2(-3)	-0.247567	0.711539	-0.347931	0.7282
LM2(-4)	1.038255	0.774920	1.339822	0.1816
LM2(-5)	-0.549939	0.640546	-0.858548	0.3915
LGDPRICE	0.000580	0.129763	0.004467	0.9964
LGDPRICE(-1)	0.032674	0.165058	0.197957	0.8432
LGDPRICE(-2)	0.026907	0.165258	0.162817	0.8708
LGDPRICE(-3)	-0.116360	0.175725	-0.662168	0.5085
LGDPRICE(-4)	0.090501	0.181351	0.499035	0.6182
LGDPRICE(-5)	0.020514	0.140786	0.145708	0.8843
C	1.696235	2.617662	0.647996	0.5176
@TREND	0.001762	0.003282	0.537000	0.5918
RESID(-1)	0.642165	0.395636	1.623120	0.1059
RESID(-2)	-0.060430	0.325972	-0.185383	0.8531
RESID(-3)	-0.336630	0.266507	-1.263121	0.2078
RESID(-4)	0.150144	0.265412	0.565700	0.5721
RESID(-5)	-0.100914	0.229321	-0.440055	0.6603

R-squared	0.015731	Mean dependent var	3.21E-15
Adjusted R-squared	-0.181947	S.D. dependent var	0.082060
S.E. of regression	0.089214	Akaike info criterion	-1.841782
Sum squared resid	1.902225	Schwarz criterion	-1.218570
Log likelihood	314.2165	Hannan-Quinn criter.	-1.592036
F-statistic	0.079577	Durbin-Watson stat	2.011465
Prob(F-statistic)	1.000000		

I 4 Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.104790	Prob. F(43,244)	0.3140
Obs*R-squared	46.93460	Prob. Chi-Square(43)	0.3144
Scaled explained SS	162.6404	Prob. Chi-Square(43)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/15/17 Time: 17:40
Sample: 1992M01 2015M12
Included observations: 288

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.221705	0.409752	0.541071	0.5890
LDSEGEN(-1)	0.028698	0.014753	1.945245	0.0529
LDSEGEN(-2)	0.002712	0.021562	0.125789	0.9000
LDSEGEN(-3)	5.32E-05	0.021619	0.002460	0.9980
LDSEGEN(-4)	-0.017379	0.021797	-0.797351	0.4260

LDSEGEN(-5)	-0.000869	0.021996	-0.039508	0.9685
LDSEGEN(-6)	-0.008946	0.022098	-0.404840	0.6859
LDSEGEN(-7)	0.028955	0.022213	1.303497	0.1936
LDSEGEN(-8)	-0.012370	0.022449	-0.551014	0.5821
LDSEGEN(-9)	-0.017956	0.022845	-0.785965	0.4327
LDSEGEN(-10)	0.002104	0.022718	0.092624	0.9263
LDSEGEN(-11)	-0.004517	0.022626	-0.199619	0.8419
LDSEGEN(-12)	0.013319	0.015335	0.868573	0.3859
LIPI	-0.001676	0.025388	-0.066019	0.9474
LIPI(-1)	-0.003539	0.026679	-0.132649	0.8946
LIPI(-2)	0.025003	0.027139	0.921278	0.3578
LIPI(-3)	-0.013678	0.027028	-0.506077	0.6133
LIPI(-4)	-0.001791	0.026958	-0.066428	0.9471
LIPI(-5)	-0.024368	0.024929	-0.977481	0.3293
LCPI	-0.169926	0.157369	-1.079794	0.2813
LCPI(-1)	0.165170	0.244111	0.676619	0.4993
LCPI(-2)	0.098211	0.245142	0.400627	0.6890
LCPI(-3)	0.033435	0.242563	0.137840	0.8905
LCPI(-4)	-0.163249	0.239861	-0.680600	0.4968
LCPI(-5)	0.013476	0.154806	0.087048	0.9307
LEXR	0.000297	0.144874	0.002052	0.9984
LEXR(-1)	0.191046	0.200913	0.950890	0.3426
LEXR(-2)	-0.129599	0.200781	-0.645472	0.5192
LEXR(-3)	-0.057456	0.201840	-0.284660	0.7761
LEXR(-4)	0.008647	0.202032	0.042801	0.9659
LEXR(-5)	-0.011629	0.143508	-0.081032	0.9355
LM2	-0.092454	0.112102	-0.824731	0.4103
LM2(-1)	-0.056309	0.123539	-0.455803	0.6489
LM2(-2)	-0.119052	0.123377	-0.964943	0.3355
LM2(-3)	0.147686	0.122384	1.206743	0.2287
LM2(-4)	0.149036	0.119147	1.250859	0.2122
LM2(-5)	-0.056931	0.107643	-0.528886	0.5974
LGDPRICE	-0.013555	0.029937	-0.452779	0.6511
LGDPRICE(-1)	-0.036501	0.038069	-0.958829	0.3386
LGDPRICE(-2)	0.027998	0.037666	0.743318	0.4580
LGDPRICE(-3)	0.034560	0.037494	0.921763	0.3576
LGDPRICE(-4)	-0.001113	0.037538	-0.029646	0.9764
LGDPRICE(-5)	-0.001605	0.030559	-0.052508	0.9582
@TREND	0.000352	0.000596	0.590222	0.5556

R-squared	0.162967	Mean dependent var	0.006711
Adjusted R-squared	0.015458	S.D. dependent var	0.020888
S.E. of regression	0.020726	Akaike info criterion	-4.775103
Sum squared resid	0.104813	Schwarz criterion	-4.215484
Log likelihood	731.6148	Hannan-Quinn criter.	-4.550841
F-statistic	1.104790	Durbin-Watson stat	1.888101
Prob(F-statistic)	0.313962		

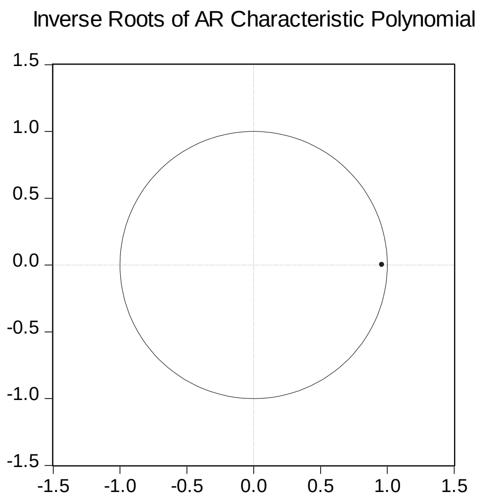
Appendix J: Stability of VAR and Optimal Lags of Variables for Different Periods

J.1 For Bubble Period (March 1992 to November 1996)

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17   Time: 00:08

Root	Modulus
0.962000	0.962000

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Date: 04/19/17   Time: 00:10
Sample: 1992M03 1996M11
Included observations: 57

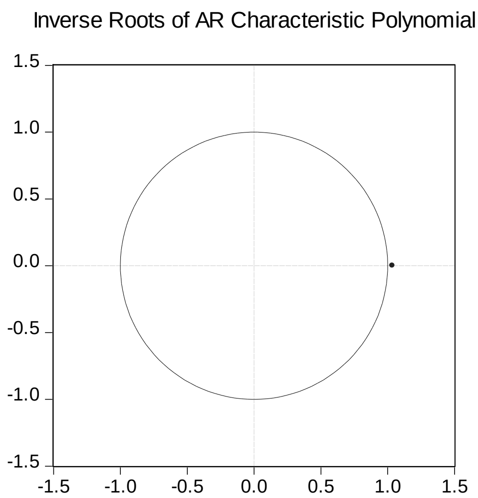
Lag	LogL	LR	FPE	AIC	SC	HQ
0	3.671099	NA	0.055217	-0.058635	0.013051	-0.030775
1	42.99385	74.50626	0.014392	-1.403293	-1.295764*	-1.361503
2	43.74040	1.388316	0.014523	-1.394400	-1.251028	-1.338681
3	46.03995	4.195679*	0.013878	-1.439998	-1.260783	-1.370349
4	47.54994	2.702089	0.013637*	-1.457893*	-1.242835	-1.374314*
5	47.56789	0.031484	0.014121	-1.423435	-1.172534	-1.325926

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17   Time: 00:13

Root	Modulus
1.035240	1.035240

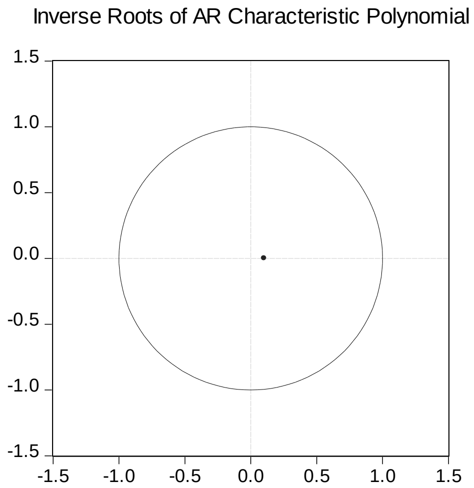
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:15

Root	Modulus
0.100648	0.100648

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:16
Sample: 1992M03 1996M11
Included observations: 57

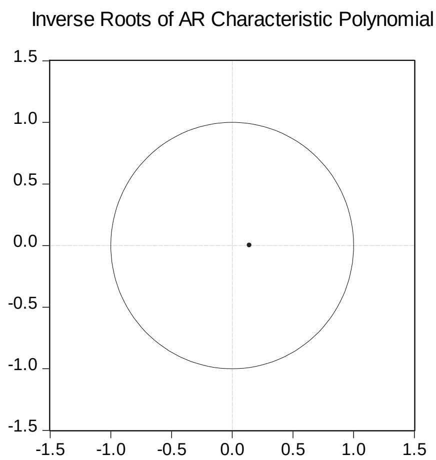
Lag	LogL	LR	FPE	AIC	SC	HQ
0	42.86191	NA*	0.013959*	-1.433751*	-1.362065*	-1.405891*
1	43.15061	0.547021	0.014313	-1.408793	-1.301264	-1.367004
2	44.46533	2.444910	0.014158	-1.419836	-1.276464	-1.364117
3	45.08409	1.128962	0.014352	-1.406459	-1.227244	-1.336810
4	45.26048	0.315657	0.014777	-1.377561	-1.162503	-1.293982
5	45.37305	0.197481	0.015252	-1.346423	-1.095522	-1.248914

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:16

Root	Modulus
0.143540	0.143540

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C
Date: 04/19/17 Time: 00:16
Sample: 1992M03 1996M11
Included observations: 57

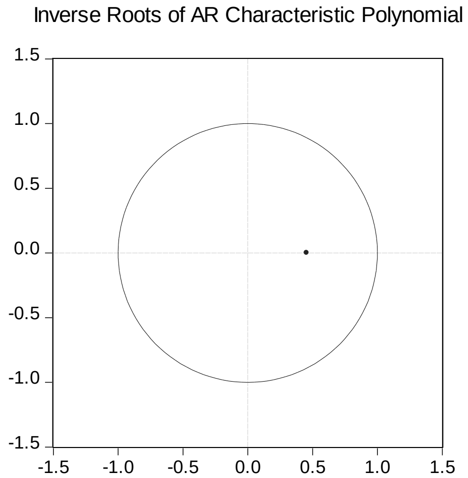
Lag	LogL	LR	FPE	AIC	SC	HQ
0	41.57806	NA*	0.014099	-1.423791	-1.387948*	-1.409862*
1	42.17404	1.150150	0.014300	-1.409616	-1.337930	-1.381756
2	43.63139	2.761279	0.014074*	-1.425663*	-1.318134	-1.383873
3	44.21367	1.082842	0.014283	-1.411006	-1.267634	-1.355287
4	44.40025	0.340427	0.014700	-1.382465	-1.203250	-1.312816
5	44.51285	0.201500	0.015170	-1.351328	-1.136270	-1.267749

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:20

Root	Modulus
0.454904	0.454904

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:20
Sample: 1992M03 1996M11
Included observations: 57

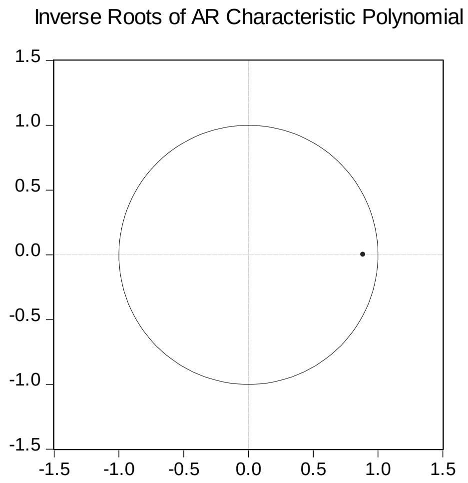
Lag	LogL	LR	FPE	AIC	SC	HQ
0	74.32910	NA	0.004628	-2.537863	-2.466177	-2.510004
1	80.72729	12.12288*	0.003829*	-2.727273*	-2.619744*	-2.685484*
2	81.34662	1.151749	0.003881	-2.713917	-2.570545	-2.658197
3	82.13755	1.443099	0.003911	-2.706581	-2.527366	-2.636932
4	82.23268	0.170222	0.004038	-2.674831	-2.459773	-2.591252
5	83.01460	1.371787	0.004071	-2.667179	-2.416278	-2.569670

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:20

Root	Modulus
0.887371	0.887371

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C
Date: 04/19/17 Time: 00:21
Sample: 1992M03 1996M11
Included observations: 57

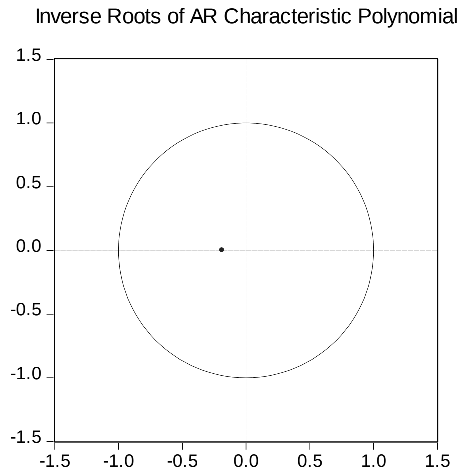
Lag	LogL	LR	FPE	AIC	SC	HQ
0	28.35337	NA	0.022424	-0.959767	-0.923924	-0.945838
1	73.66138	87.43651	0.004737	-2.514434	-2.442748	-2.486575
2	74.23483	1.086529	0.004809	-2.499468	-2.391939	-2.457678
3	78.42080	7.784451	0.004301	-2.611256	-2.467884*	-2.555537*
4	78.69737	0.504619	0.004413	-2.585873	-2.406658	-2.516224
5	81.11392	4.324339*	0.004200*	-2.635576*	-2.420518	-2.551997
6	81.28159	0.294169	0.004326	-2.606372	-2.355471	-2.508863

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:22

Root	Modulus
-0.187210	0.187210

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:22
Sample: 1992M03 1996M11
Included observations: 57

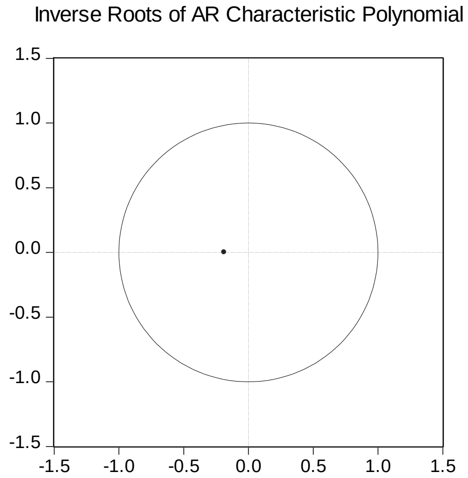
Lag	LogL	LR	FPE	AIC	SC	HQ
0	71.93482	NA	0.005033	-2.453853	-2.382167	-2.425994
1	72.94202	1.908377	0.005032	-2.454106	-2.346577	-2.412317
2	77.78320	9.002883	0.004398	-2.588884	-2.445512*	-2.533165
3	78.15889	0.685475	0.004497	-2.566979	-2.387764	-2.497330
4	80.76611	4.665561*	0.004252*	-2.623372*	-2.408314	-2.539794*
5	80.97077	0.359049	0.004374	-2.595466	-2.344565	-2.497957

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:22

Root	Modulus
-0.186194	0.186194

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C
Date: 04/19/17 Time: 00:22
Sample: 1992M03 1996M11
Included observations: 57

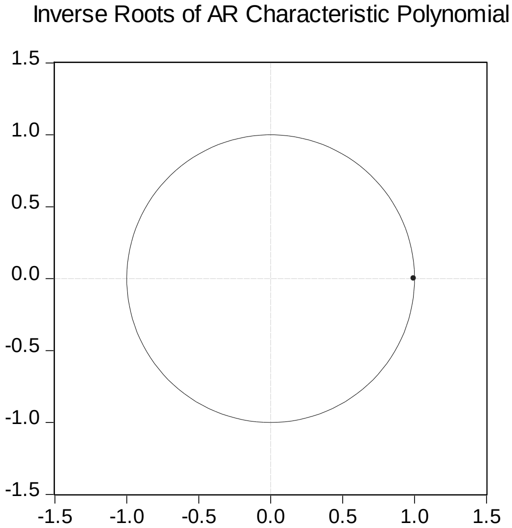
Lag	LogL	LR	FPE	AIC	SC	HQ
0	71.92369	NA	0.004861	-2.488550	-2.452707	-2.474621
1	72.92085	1.924337	0.004862	-2.488451	-2.416765	-2.460591
2	77.74631	9.142983	0.004252	-2.622677	-2.515148*	-2.580888
3	78.11455	0.684791	0.004347	-2.600510	-2.457138	-2.544791
4	80.68867	4.696656*	0.004115*	-2.655743*	-2.476528	-2.586094*
5	80.88219	0.346290	0.004234	-2.627445	-2.412387	-2.543866

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:23

Root	Modulus
0.994869	0.994869

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:23
Sample: 1992M03 1996M11
Included observations: 57

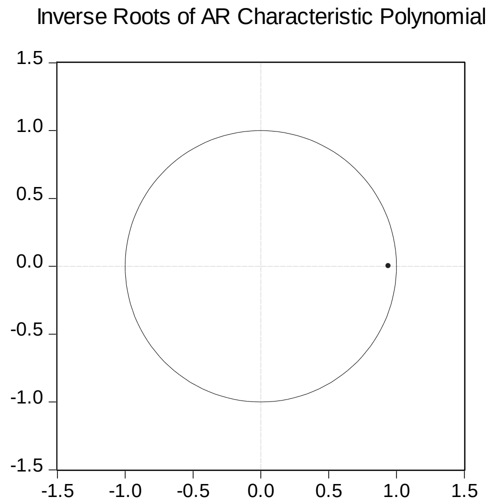
Lag	LogL	LR	FPE	AIC	SC	HQ
0	181.7665	NA	0.000107	-6.307595	-6.235909	-6.279735
1	275.6730	177.9282*	4.10e-06*	-9.567474*	-9.459945*	-9.525685*
2	275.7036	0.056852	4.24e-06	-9.533459	-9.390087	-9.477740
3	276.7770	1.958565	4.23e-06	-9.536036	-9.356821	-9.466387
4	276.9056	0.230076	4.36e-06	-9.505460	-9.290402	-9.421881
5	277.5466	1.124611	4.42e-06	-9.492864	-9.241963	-9.395355

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:24

Root	Modulus
0.942868	0.942868

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C
Date: 04/19/17 Time: 00:24
Sample: 1992M03 1996M11
Included observations: 57

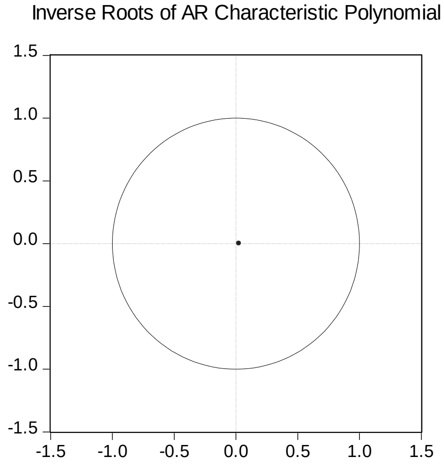
Lag	LogL	LR	FPE	AIC	SC	HQ
0	160.6226	NA	0.000216	-5.600795	-5.564952	-5.586865
1	272.3820	215.6760*	4.44e-06*	-9.487089*	-9.415403*	-9.459230*
2	273.3661	1.864582	4.44e-06	-9.486531	-9.379002	-9.444741
3	273.4190	0.098268	4.59e-06	-9.453297	-9.309925	-9.397578
4	273.7556	0.614184	4.70e-06	-9.430021	-9.250806	-9.360372
5	273.7913	0.063870	4.87e-06	-9.396185	-9.181127	-9.312606

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:25

Root	Modulus
0.025652	0.025652

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:25
Sample: 1992M03 1996M11
Included observations: 57

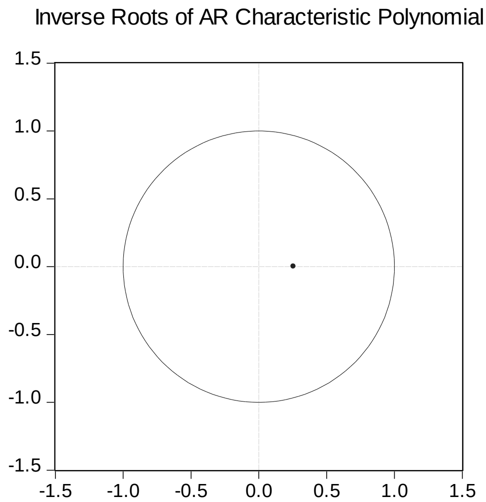
Lag	LogL	LR	FPE	AIC	SC	HQ
0	275.6533	NA*	3.96e-06*	-9.601871*	-9.530185*	-9.574012*
1	275.6725	0.036295	4.10e-06	-9.567456	-9.459927	-9.525666
2	276.7765	2.053099	4.08e-06	-9.571106	-9.427734	-9.515386
3	276.8922	0.211062	4.21e-06	-9.540077	-9.360862	-9.470428
4	277.4177	0.940350	4.28e-06	-9.523427	-9.308369	-9.439848
5	277.8398	0.740481	4.37e-06	-9.503149	-9.252248	-9.405640

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:26

Root	Modulus
0.257155	0.257155

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C
Date: 04/19/17 Time: 00:26
Sample: 1992M03 1996M11
Included observations: 57

Lag	LogL	LR	FPE	AIC	SC	HQ
0	267.6255	NA	5.07e-06	-9.355279	-9.319436*	-9.341349
1	269.5753	3.762912	4.90e-06*	-9.388608*	-9.316922	-9.360748*
2	269.6318	0.106926	5.06e-06	-9.355500	-9.247971	-9.313711
3	270.4666	1.552468	5.09e-06	-9.349704	-9.206332	-9.293985
4	270.6457	0.326800	5.24e-06	-9.320901	-9.141686	-9.251252
5	272.9773	4.172343*	5.01e-06	-9.367624	-9.152566	-9.284045

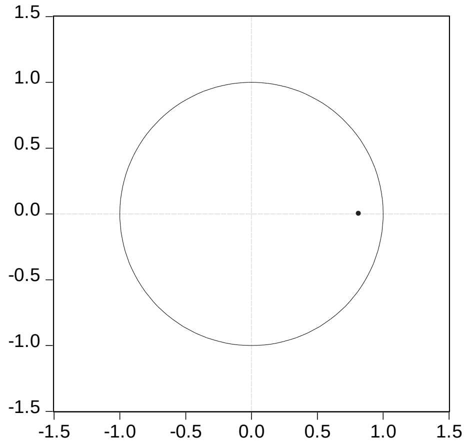
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:27

Root	Modulus
0.817012	0.817012

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: LCPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:27
Sample: 1992M03 1996M11
Included observations: 57

Lag	LogL	LR	FPE	AIC	SC	HQ
0	139.6266	NA	0.000468	-4.829002	-4.757316	-4.801142
1	170.9094	59.27273	0.000162	-5.891557	-5.784028*	-5.849768
2	171.5640	1.217398	0.000164	-5.879439	-5.736067	-5.823720
3	172.2731	1.293741	0.000165	-5.869231	-5.690016	-5.799582
4	175.5988	5.951191*	0.000153*	-5.950834*	-5.735776	-5.867255*
5	175.6566	0.101485	0.000158	-5.917776	-5.666875	-5.820267

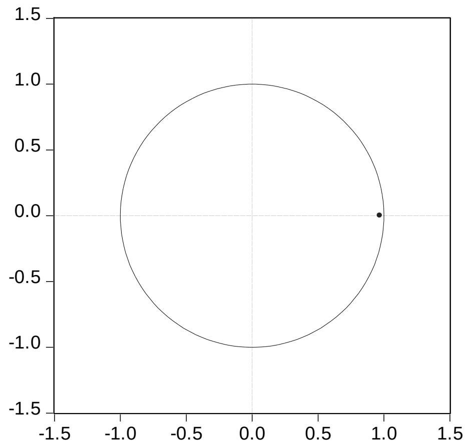
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:27

Root	Modulus
0.969259	0.969259

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: LCPI
Exogenous variables: C
Date: 04/19/17 Time: 00:28
Sample: 1992M03 1996M11
Included observations: 57

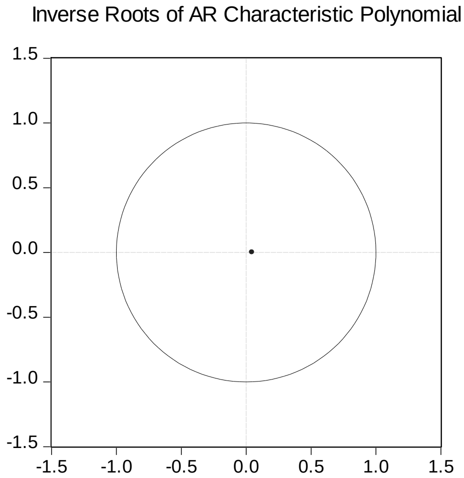
Lag	LogL	LR	FPE	AIC	SC	HQ
0	90.85458	NA	0.002502	-3.152792	-3.116949	-3.138862
1	168.5922	150.0200*	0.000169*	-5.845341*	-5.773655*	-5.817481*
2	168.6974	0.199377	0.000175	-5.813945	-5.706416	-5.772156
3	168.7610	0.118281	0.000181	-5.781089	-5.637717	-5.725370
4	169.7521	1.808298	0.000181	-5.780776	-5.601561	-5.711127
5	170.3424	1.056264	0.000183	-5.766400	-5.551342	-5.682821

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:28

Root	Modulus
0.045798	0.045798

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:28
Sample: 1992M03 1996M11
Included observations: 57

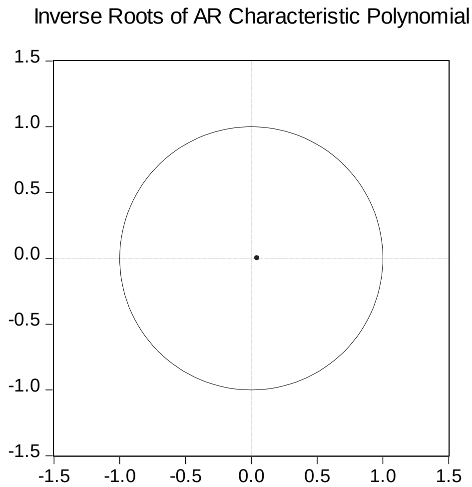
Lag	LogL	LR	FPE	AIC	SC	HQ
0	168.1884	NA	0.000172*	-5.831170*	-5.759484*	-5.803311*
1	168.2489	0.114727	0.000178	-5.798207	-5.690678	-5.756418
2	168.2713	0.041712	0.000184	-5.763907	-5.620535	-5.708187
3	168.9491	1.236597	0.000186	-5.752600	-5.573385	-5.682951
4	169.8514	1.614692	0.000187	-5.749172	-5.534114	-5.665594
5	172.4949	4.637730*	0.000176	-5.806839	-5.555938	-5.709331

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:29

Root	Modulus
0.045662	0.045662

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C
Date: 04/19/17 Time: 00:29
Sample: 1992M03 1996M11
Included observations: 57

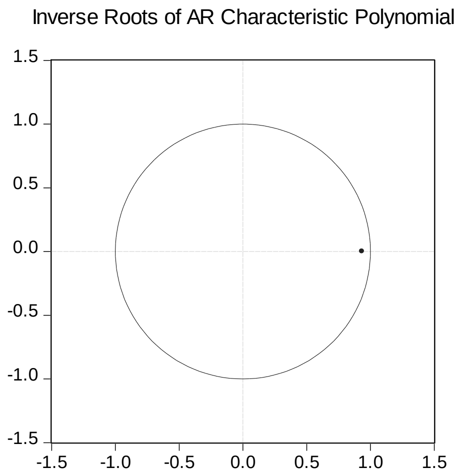
Lag	LogL	LR	FPE	AIC	SC	HQ
0	168.1853	NA	0.000166*	-5.866150*	-5.830307*	-5.852221*
1	168.2455	0.116164	0.000171	-5.833175	-5.761489	-5.805315
2	168.2681	0.042779	0.000177	-5.798879	-5.691350	-5.757090
3	168.9490	1.266334	0.000180	-5.787685	-5.644313	-5.731965
4	169.8462	1.636987	0.000180	-5.784077	-5.604862	-5.714428
5	172.4741	4.702629*	0.000170	-5.841198	-5.626140	-5.757619

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:30

Root	Modulus
0.933835	0.933835

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:30
Sample: 1992M03 1996M11
Included observations: 57

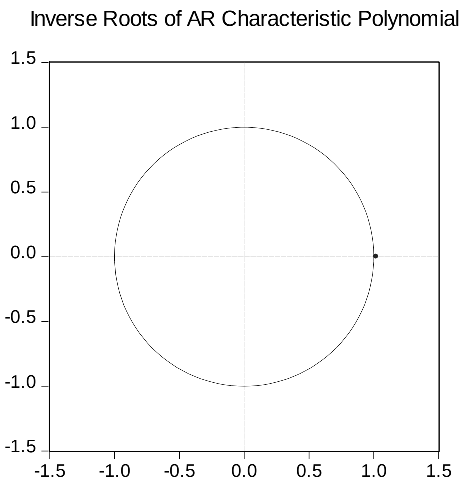
Lag	LogL	LR	FPE	AIC	SC	HQ
0	186.1725	NA	9.14e-05	-6.462193	-6.390507	-6.434334
1	234.4246	91.42493*	1.74e-05*	-8.120160*	-8.012631*	-8.078370*
2	234.4291	0.008449	1.80e-05	-8.085232	-7.941860	-8.029512
3	234.6025	0.316457	1.86e-05	-8.056230	-7.877015	-7.986581
4	236.0068	2.512866	1.83e-05	-8.070414	-7.855356	-7.986835
5	236.0588	0.091286	1.89e-05	-8.037152	-7.786251	-7.939643

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:31

Root	Modulus
1.018833	1.018833

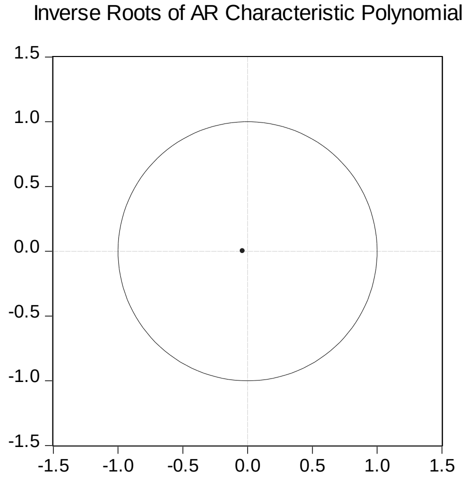
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:32

Root	Modulus
-0.036738	0.036738

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:33
Sample: 1992M03 1996M11
Included observations: 57

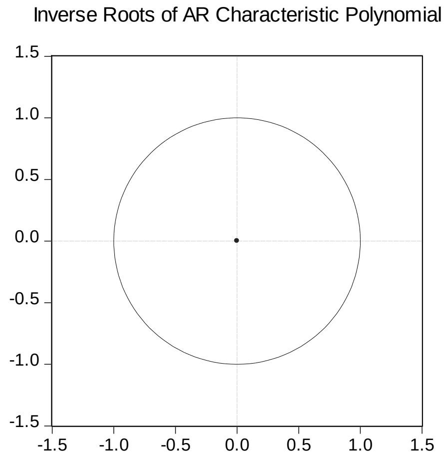
Lag	LogL	LR	FPE	AIC	SC	HQ
0	233.7968	NA*	1.72e-05*	-8.133222*	-8.061536*	-8.105362*
1	233.8350	0.072269	1.78e-05	-8.099473	-7.991944	-8.057683
2	234.2946	0.854748	1.81e-05	-8.080512	-7.937140	-8.024793
3	235.1328	1.529292	1.82e-05	-8.074834	-7.895619	-8.005185
4	235.1436	0.019461	1.89e-05	-8.040128	-7.825070	-7.956549
5	236.0711	1.627148	1.89e-05	-8.037583	-7.786682	-7.940074

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:33

Root	Modulus
0.000202	0.000202

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C
Date: 04/19/17 Time: 00:33
Sample: 1992M03 1996M11
Included observations: 57

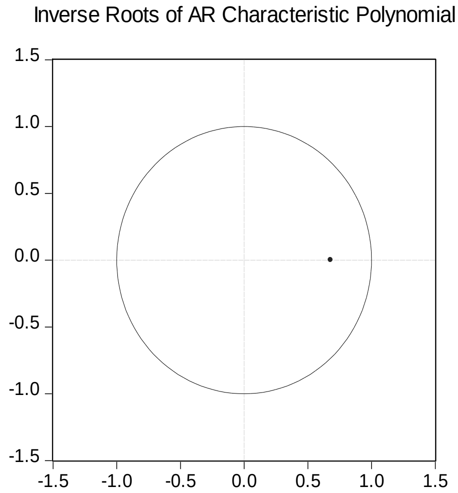
Lag	LogL	LR	FPE	AIC	SC	HQ
0	232.8893	NA*	1.71e-05*	-8.136466*	-8.100623*	-8.122536*
1	232.8893	2.24e-06	1.77e-05	-8.101378	-8.029692	-8.073519
2	233.1139	0.425671	1.82e-05	-8.074173	-7.966644	-8.032384
3	234.0780	1.792785	1.83e-05	-8.072912	-7.929540	-8.017193
4	234.0857	0.013985	1.89e-05	-8.038093	-7.858878	-7.968444
5	234.8244	1.321965	1.91e-05	-8.028926	-7.813868	-7.945347

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:34

Root	Modulus
0.679903	0.679903

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LM2
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:34
Sample: 1992M03 1996M11
Included observations: 57

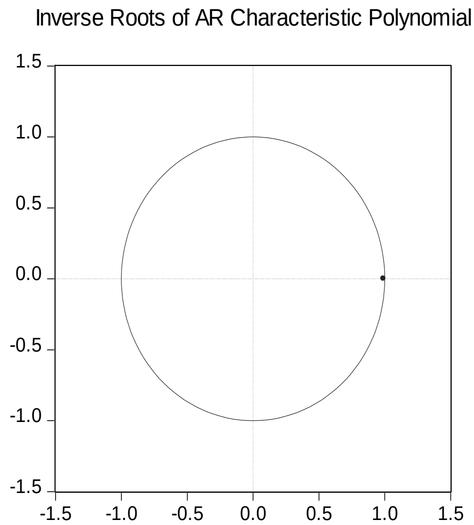
Lag	LogL	LR	FPE	AIC	SC	HQ
0	134.9755	NA	0.000551	-4.665806	-4.594120	-4.637946
1	151.8674	32.00570*	0.000316	-5.223416	-5.115887*	-5.181627
2	153.3499	2.757101	0.000310	-5.240349	-5.096977	-5.184630*
3	154.6863	2.438341	0.000307*	-5.252153*	-5.072938	-5.182503
4	155.0943	0.730060	0.000313	-5.231380	-5.016322	-5.147801
5	155.7101	1.080375	0.000318	-5.217900	-4.966998	-5.120391

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:35

Root	Modulus
0.989276	0.989276

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LM2
Exogenous variables: C
Date: 04/19/17 Time: 00:36
Sample: 1992M03 1996M11
Included observations: 57

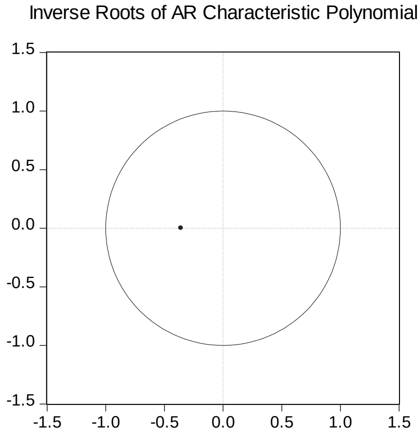
Lag	LogL	LR	FPE	AIC	SC	HQ
0	17.65110	NA	0.032643	-0.584249	-0.548406	-0.570319
1	147.3897	250.3727	0.000356	-5.101392	-5.029706	-5.073532
2	151.2481	7.310744	0.000322	-5.201688	-5.094159	-5.159899
3	153.6649	4.494405*	0.000307*	-5.251401*	-5.108029*	-5.195681*
4	153.7473	0.150376	0.000317	-5.219205	-5.039990	-5.149556
5	154.9562	2.163255	0.000315	-5.226534	-5.011476	-5.142955

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
-0.358079	0.358079

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C @TREND
Sample: 1992M03 1996M11
Included observations: 57

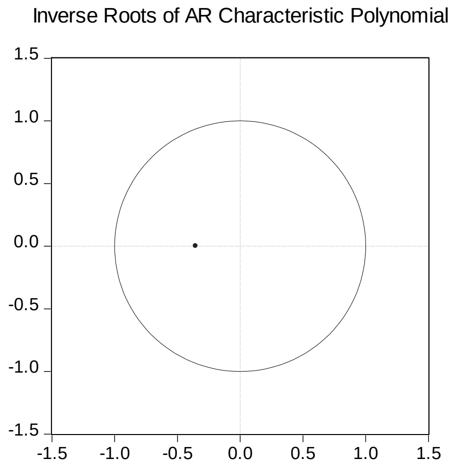
Lag	LogL	LR	FPE	AIC	SC	HQ
0	147.1675	NA	0.000359	-5.093595	-5.021909	-5.065735
1	151.0792	7.411684	0.000324	-5.195761	-5.088232	-5.153971
2	153.5486	4.592171	0.000308	-5.247318	-5.103946	-5.191599
3	153.6253	0.140078	0.000318	-5.214924	-5.035709	-5.145275
4	154.8530	2.196889	0.000316	-5.222912	-5.007854	-5.139334
5	160.8723	10.56013	0.000265	-5.399027	-5.148126	-5.301519
6	171.0563	17.50941	0.000192	-5.721275	-5.434531	-5.609836
7	174.5193	5.832457*	0.000176	-5.807696	-5.485109*	-5.682328
8	176.4725	3.220944	0.000171*	-5.841139*	-5.482709	-5.701841*
9	176.7138	0.389483	0.000176	-5.814519	-5.420246	-5.661291

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:38

Root	Modulus
-0.353830	0.353830

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C
Date: 04/19/17 Time: 00:38
Sample: 1992M03 1996M11
Included observations: 57

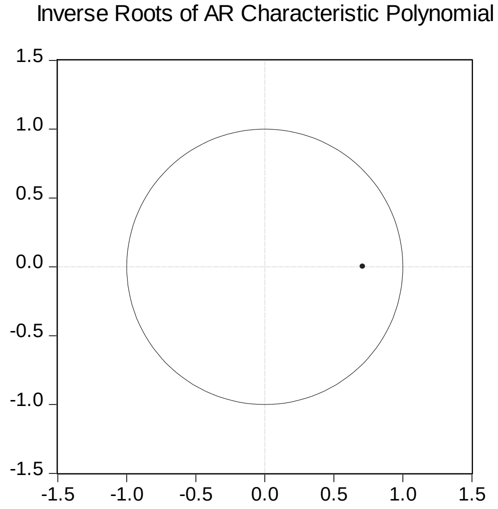
Lag	LogL	LR	FPE	AIC	SC	HQ
0	147.0771	NA	0.000348	-5.125512	-5.089669	-5.111582
1	150.8898	7.357930	0.000315	-5.224205	-5.152519	-5.196345
2	153.3184	4.601489	0.000300	-5.274330	-5.166801	-5.232540
3	153.4173	0.183873	0.000310	-5.242711	-5.099339	-5.186992
4	154.5399	2.048300	0.000308	-5.247014	-5.067799	-5.177365
5	160.1768	10.08706	0.000262	-5.409712	-5.194654	-5.326133
6	170.8326	18.69443	0.000187	-5.748513	-5.497612	-5.651004
7	174.3593	6.063375*	0.000171	-5.837167	-5.550423*	-5.725729
8	176.2972	3.263810	0.000166*	-5.870076*	-5.547489	-5.744707*
9	176.5314	0.386377	0.000170	-5.843209	-5.484779	-5.703911

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:38

Root	Modulus
0.710747	0.710747

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:39
Sample: 1992M03 1996M11
Included observations: 57

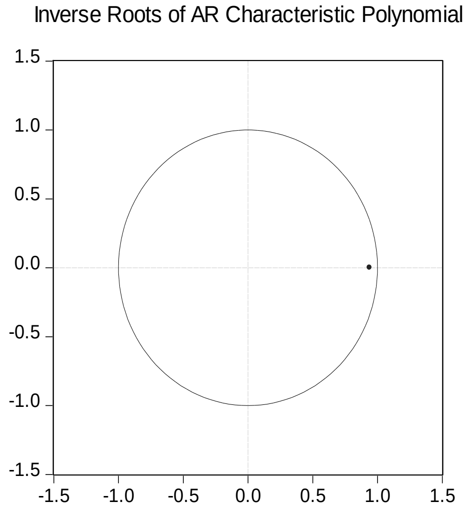
Lag	LogL	LR	FPE	AIC	SC	HQ
0	140.7257	NA	0.000450	-4.867568	-4.795882	-4.839709
1	161.2800	38.94498*	0.000227*	-5.553684*	-5.446155*	-5.511894*
2	161.2807	0.001303	0.000235	-5.518621	-5.375249	-5.462901
3	161.6703	0.710879	0.000240	-5.497204	-5.317989	-5.427555
4	161.9951	0.581247	0.000246	-5.473513	-5.258455	-5.389934
5	162.1857	0.334394	0.000253	-5.445113	-5.194212	-5.347604

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:39

Root	Modulus
0.940348	0.940348

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LGDPRICE
Exogenous variables: C
Date: 04/19/17 Time: 00:39
Sample: 1992M03 1996M11
Included observations: 57

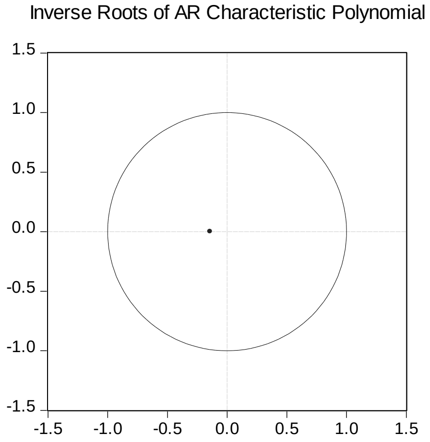
Lag	LogL	LR	FPE	AIC	SC	HQ
0	96.60562	NA	0.002045	-3.354583	-3.318740	-3.340653
1	157.5248	117.5633*	0.000250	-5.457011	-5.385325*	-5.429151*
2	157.9086	0.727099	0.000255	-5.435388	-5.327859	-5.393599
3	159.5338	3.022305	0.000250*	-5.457325*	-5.313953	-5.401606
4	159.5471	0.024382	0.000259	-5.422706	-5.243491	-5.353057
5	160.2973	1.342501	0.000261	-5.413942	-5.198884	-5.330363

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 00:40

Root	Modulus
-0.142932	0.142932

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Date: 04/19/17 Time: 00:40
Sample: 1992M03 1996M11
Included observations: 57

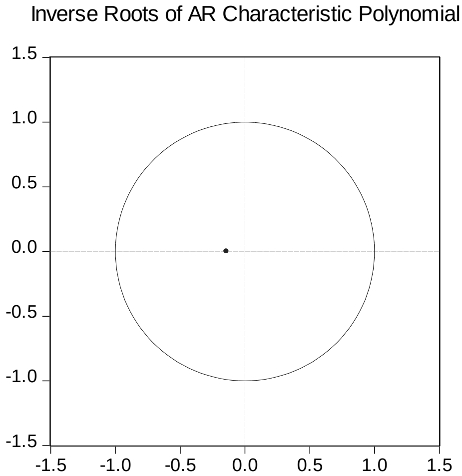
Lag	LogL	LR	FPE	AIC	SC	HQ
0	156.6826	NA*	0.000257	-5.427460	-5.355774*	-5.399601*
1	157.2708	1.114522	0.000261	-5.413012	-5.305483	-5.371222
2	159.0938	3.389998	0.000254*	-5.441886*	-5.298514	-5.386167
3	159.0952	0.002588	0.000263	-5.406848	-5.227633	-5.337199
4	159.9657	1.557758	0.000264	-5.402305	-5.187247	-5.318726
5	159.9839	0.031883	0.000273	-5.367855	-5.116954	-5.270346

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 00:40

Root	Modulus
-0.142768	0.142768

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C
Date: 04/19/17 Time: 00:41
Sample: 1992M03 1996M11
Included observations: 57

Lag	LogL	LR	FPE	AIC	SC	HQ
0	156.6798	NA*	0.000248	-5.462449	-5.426606*	-5.448519*
1	157.2667	1.132636	0.000252	-5.447955	-5.376269	-5.420095
2	159.0930	3.460296	0.000245*	-5.476947*	-5.369418	-5.435157
3	159.0944	0.002676	0.000254	-5.441909	-5.298537	-5.386190
4	159.9643	1.587186	0.000255	-5.437344	-5.258129	-5.367695
5	159.9817	0.031034	0.000264	-5.402865	-5.187807	-5.319286

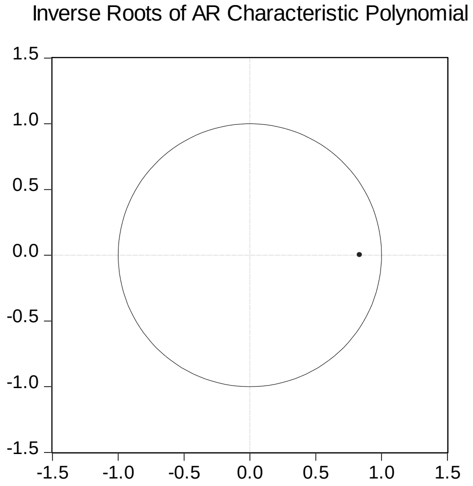
* indicates lag order selected by the criterion

J.2 For Meltdown Period (November 1996 to December 1999)

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:31

Root	Modulus
0.836033	0.836033

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:32
Sample: 1996M11 1999M12
Included observations: 38

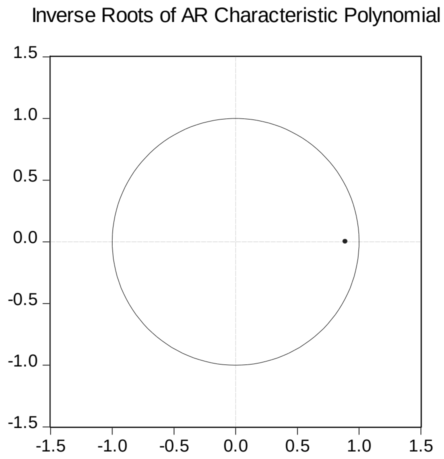
Lag	LogL	LR	FPE	AIC	SC	HQ
0	3.374410	NA	0.054469	-0.072337	0.013851	-0.041672
1	36.25684	60.57290*	0.010174	-1.750360	-1.621077*	-1.704362
2	37.94314	3.017596	0.009818*	-1.786481*	-1.614104	-1.725151*
3	38.83965	1.557099	0.009879	-1.781034	-1.565563	-1.704371

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:32

Root	Modulus
0.889354	0.889354

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN
Exogenous variables: C
Date: 04/19/17 Time: 15:33
Sample: 1996M11 1999M12
Included observations: 38

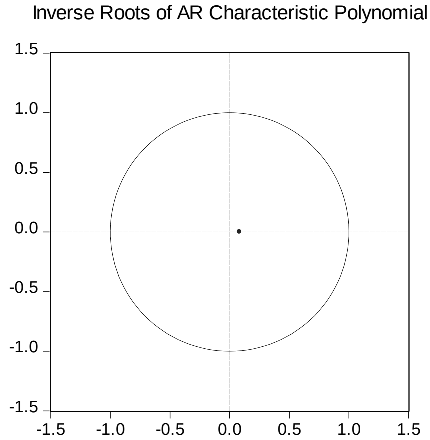
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-24.00659	NA	0.218334	1.316136	1.359231	1.331469
1	35.79614	113.3104*	0.009887	-1.778744	-1.692556*	-1.748079
2	36.73117	1.722426	0.009923	-1.775325	-1.646042	-1.729327
3	38.42967	3.039406	0.009569*	-1.812088*	-1.639710	-1.750757*
4	39.21301	1.360544	0.009686	-1.800685	-1.585213	-1.724021
5	39.60226	0.655581	0.010014	-1.768540	-1.509974	-1.676544

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:33

Root	Modulus
0.083786	0.083786

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:34
Sample: 1996M11 1999M12
Included observations: 38

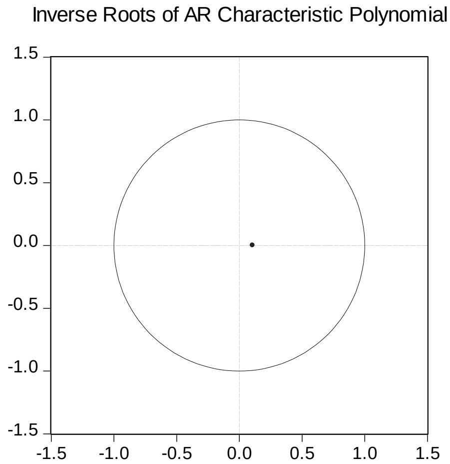
Lag	LogL	LR	FPE	AIC	SC	HQ
0	33.13388	NA	0.011374	-1.638625	-1.552437*	-1.607960
1	33.41683	0.521223	0.011814	-1.600886	-1.471603	-1.554888
2	36.47182	5.466823*	0.010608*	-1.709043*	-1.536666	-1.647713*
3	36.68577	0.371588	0.011064	-1.667672	-1.452200	-1.591009

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:35

Root	Modulus
0.106909	0.106909

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C
Date: 04/19/17 Time: 15:35
Sample: 1996M11 1999M12
Included observations: 38

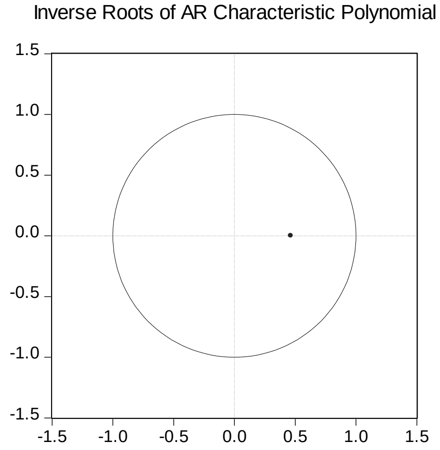
Lag	LogL	LR	FPE	AIC	SC	HQ
0	30.16712	NA	0.012614	-1.535111	-1.492017*	-1.519779
1	30.56520	0.754264	0.013021	-1.503432	-1.417243	-1.472766
2	33.39861	5.219437*	0.011826*	-1.599927*	-1.470644	-1.553929*
3	33.54675	0.265088	0.012374	-1.555092	-1.382714	-1.493761

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:36

Root	Modulus
0.463395	0.463395

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C @TREND
Sample: 1996M11 1999M12
Included observations: 38

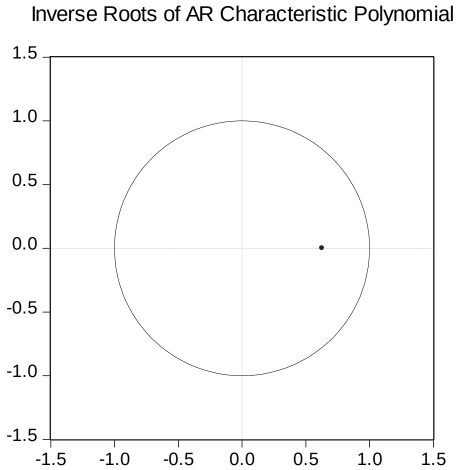
Lag	LogL	LR	FPE	AIC	SC	HQ
0	43.14010	NA	0.006717	-2.165268	-2.079079	-2.134603
1	47.52144	8.070889	0.005624	-2.343233	-2.213950	-2.297236
2	50.26399	4.907719*	0.005133*	-2.434947*	-2.262569*	-2.373616*
3	50.43476	0.296615	0.005366	-2.391303	-2.175831	-2.314640
4	50.43924	0.007538	0.005661	-2.338907	-2.080341	-2.246911
5	50.44802	0.014331	0.005974	-2.286738	-1.985077	-2.179410

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:36

Root	Modulus
0.628062	0.628062

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C
Date: 04/19/17 Time: 15:37
Sample: 1996M11 1999M12
Included observations: 38

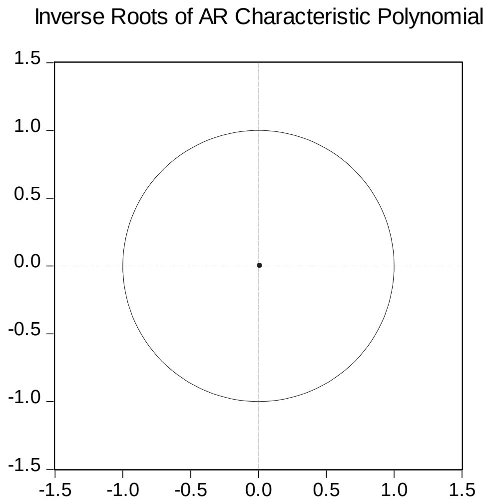
Lag	LogL	LR	FPE	AIC	SC	HQ
0	36.57982	NA	0.009000	-1.872622	-1.829528	-1.857290
1	45.42026	16.75029*	0.005958*	-2.285277	-2.199088*	-2.254611*
2	46.42085	1.843196	0.005959	-2.285308*	-2.156025	-2.239310
3	46.58403	0.292006	0.006230	-2.241265	-2.068887	-2.179934
4	47.27561	1.201168	0.006337	-2.225032	-2.009560	-2.148369
5	47.53444	0.435930	0.006596	-2.186023	-1.927457	-2.094027

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:37

Root	Modulus
0.012334	0.012334

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:38
Sample: 1996M11 1999M12
Included observations: 38

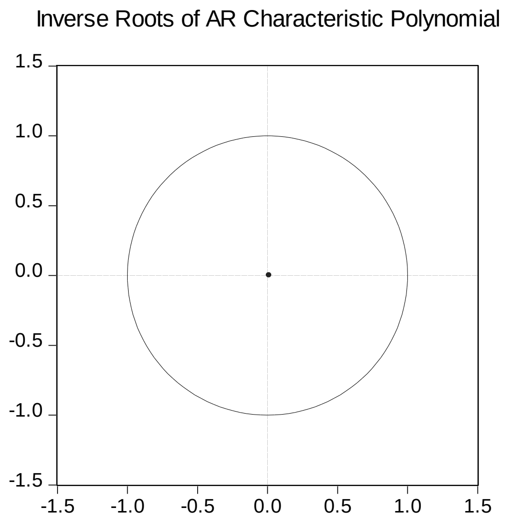
Lag	LogL	LR	FPE	AIC	SC	HQ
0	41.85083	NA*	0.007189	-2.097412	-2.011223*	-2.066747*
1	41.85352	0.004952	0.007578	-2.044922	-1.915639	-1.998924
2	43.66008	3.232794	0.007267	-2.087373	-1.914995	-2.026042
3	45.61426	3.394093	0.006916*	-2.137592*	-1.922121	-2.060929
4	46.47689	1.452858	0.006974	-2.130363	-1.871796	-2.038367

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:38

Root	Modulus
0.011708	0.011708

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C
Date: 04/19/17 Time: 15:38
Sample: 1996M11 1999M12
Included observations: 38

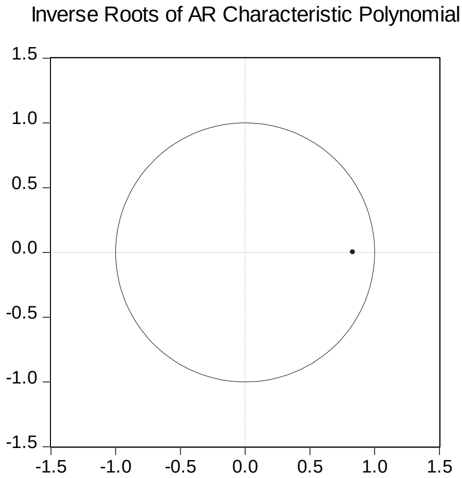
Lag	LogL	LR	FPE	AIC	SC	HQ
0	41.83337	NA*	0.006826	-2.149125	-2.106030*	-2.133792*
1	41.83579	0.004587	0.007195	-2.096620	-2.010432	-2.065955
2	43.63453	3.313472	0.006900	-2.138659	-2.009376	-2.092661
3	45.58921	3.497850	0.006565*	-2.188906*	-2.016528	-2.127575
4	46.43357	1.466521	0.006624	-2.180714	-1.965242	-2.104051

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:39

Root	Modulus
0.832444	0.832444

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:39
Sample: 1996M11 1999M12
Included observations: 38

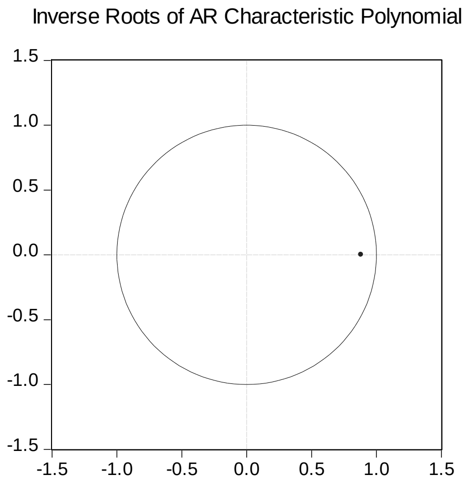
Lag	LogL	LR	FPE	AIC	SC	HQ
0	158.0837	NA	1.58e-05	-8.214930	-8.128742	-8.184265
1	172.9593	27.40253*	7.63e-06	-8.945228	-8.815945*	-8.899230
2	174.2677	2.341218	7.52e-06*	-8.961456*	-8.789078	-8.900125*
3	174.2938	0.045388	7.92e-06	-8.910200	-8.694728	-8.833537
4	174.3347	0.068862	8.34e-06	-8.859720	-8.601154	-8.767724
5	174.5723	0.387771	8.69e-06	-8.819597	-8.517937	-8.712269

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:40

Root	Modulus
0.882093	0.882093

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C
Date: 04/19/17 Time: 15:40
Sample: 1996M11 1999M12
Included observations: 38

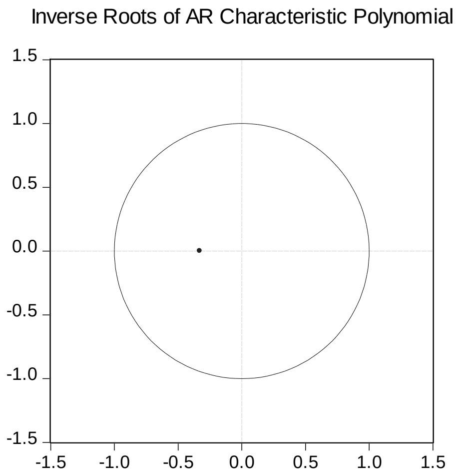
Lag	LogL	LR	FPE	AIC	SC	HQ
0	138.2537	NA	4.27e-05	-7.223882	-7.180787	-7.208549
1	172.8517	65.55402*	7.28e-06	-8.992195	-8.906006*	-8.961530*
2	174.1316	2.357722	7.18e-06*	-9.006927*	-8.877644	-8.960929
3	174.1395	0.014145	7.57e-06	-8.954711	-8.782334	-8.893381
4	174.2998	0.278373	7.91e-06	-8.910515	-8.695044	-8.833852
5	174.4050	0.177197	8.31e-06	-8.863421	-8.604855	-8.771425

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:40

Root	Modulus
-0.328223	0.328223

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:41
Sample: 1996M11 1999M12
Included observations: 38

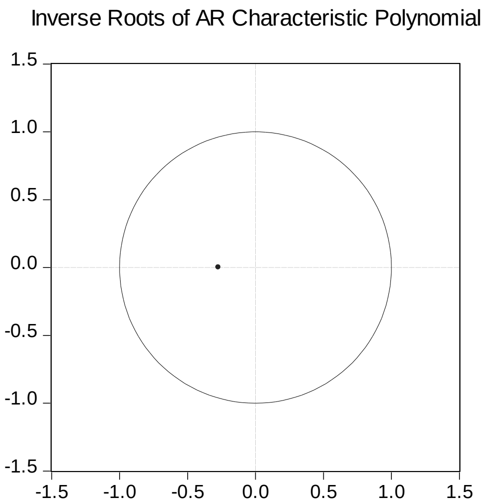
Lag	LogL	LR	FPE	AIC	SC	HQ
0	172.0663	NA	7.59e-06	-8.950856	-8.864667	-8.920190
1	174.2251	3.976799*	7.14e-06*	-9.011847*	-8.882564*	-8.965849*
2	174.2872	0.111105	7.51e-06	-8.962483	-8.790106	-8.901153
3	174.3005	0.023135	7.91e-06	-8.910553	-8.695081	-8.833889
4	174.5659	0.446927	8.24e-06	-8.871888	-8.613321	-8.779892
5	175.4715	1.477673	8.29e-06	-8.866923	-8.565262	-8.759594

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:41

Root	Modulus
-0.271550	0.271550

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C
Date: 04/19/17 Time: 15:41
Sample: 1996M11 1999M12
Included observations: 38

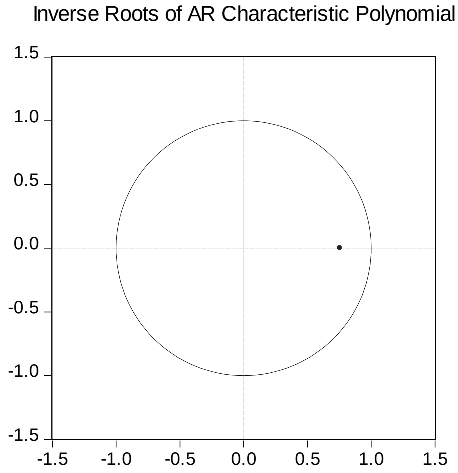
Lag	LogL	LR	FPE	AIC	SC	HQ
0	171.1706	NA*	7.55e-06	-8.956350	-8.913255*	-8.941017
1	172.6128	2.732463	7.38e-06*	-8.979620*	-8.893431	-8.948955*
2	172.6182	0.009925	7.77e-06	-8.927272	-8.797989	-8.881274
3	172.7617	0.256797	8.14e-06	-8.882193	-8.709816	-8.820863
4	172.8751	0.196957	8.53e-06	-8.835530	-8.620058	-8.758867
5	173.3921	0.870798	8.76e-06	-8.810111	-8.551545	-8.718115

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 19:37

Root	Modulus
0.755458	0.755458

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LCPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 19:37
Sample: 1996M11 1999M12
Included observations: 38

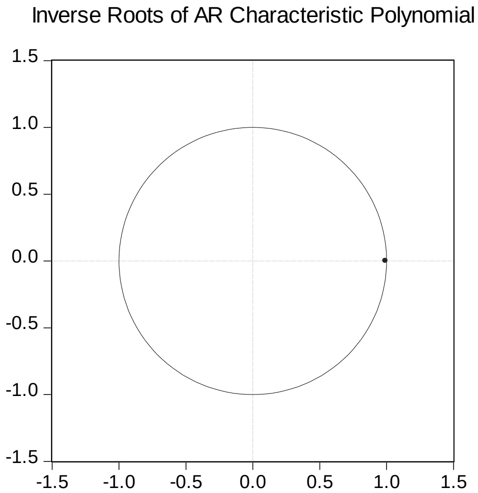
Lag	LogL	LR	FPE	AIC	SC	HQ
0	113.7331	NA	0.000164	-5.880690	-5.794502	-5.850025
1	129.7213	29.45188*	7.43e-05	-6.669541	-6.540258*	-6.623543*
2	130.8566	2.031647	7.38e-05*	-6.676664*	-6.504286	-6.615333
3	131.6505	1.378818	7.47e-05	-6.665815	-6.450343	-6.589151
4	131.6632	0.021420	7.88e-05	-6.613852	-6.355286	-6.521857
5	131.6957	0.052989	8.30e-05	-6.562930	-6.261270	-6.455602

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 19:37

Root	Modulus
0.991662	0.991662

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LCPI
Exogenous variables: C
Date: 04/19/17 Time: 19:38
Sample: 1996M11 1999M12
Included observations: 38

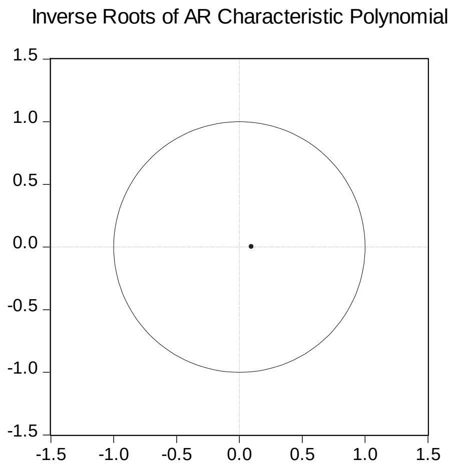
Lag	LogL	LR	FPE	AIC	SC	HQ
0	48.11322	NA	0.004905	-2.479643	-2.436549	-2.464311
1	127.3451	150.1236*	7.99e-05*	-6.597112*	-6.510923*	-6.566446*
2	127.5613	0.398174	8.33e-05	-6.555856	-6.426573	-6.509859
3	127.5718	0.018919	8.78e-05	-6.503781	-6.331404	-6.442451
4	128.0629	0.852816	9.02e-05	-6.476993	-6.261521	-6.400329
5	128.4378	0.631479	9.33e-05	-6.444095	-6.185529	-6.352099

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 19:38

Root	Modulus
0.098247	0.098247

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Date: 04/19/17 Time: 19:38
Sample: 1996M11 1999M12
Included observations: 38

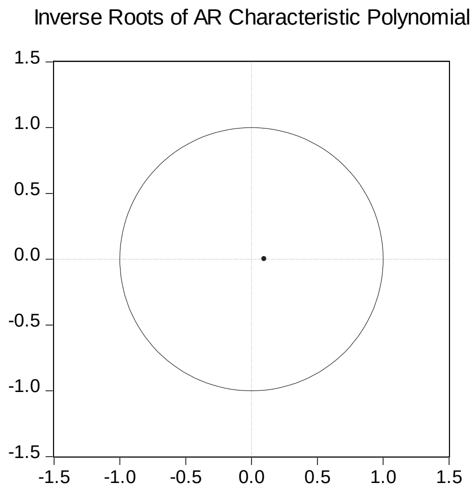
Lag	LogL	LR	FPE	AIC	SC	HQ
0	127.2602	NA*	8.02e-05*	-6.592644*	-6.506455*	-6.561979*
1	127.4466	0.343331	8.38e-05	-6.549822	-6.420539	-6.503824
2	127.4511	0.007994	8.83e-05	-6.497426	-6.325048	-6.436095
3	127.9866	0.930082	9.06e-05	-6.472978	-6.257506	-6.396315
4	128.3793	0.661335	9.36e-05	-6.441013	-6.182447	-6.349017
5	128.6264	0.403310	9.76e-05	-6.401392	-6.099731	-6.294063

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 19:39

Root	Modulus
0.097766	0.097766

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C
Date: 04/19/17 Time: 19:39
Sample: 1996M11 1999M12
Included observations: 38

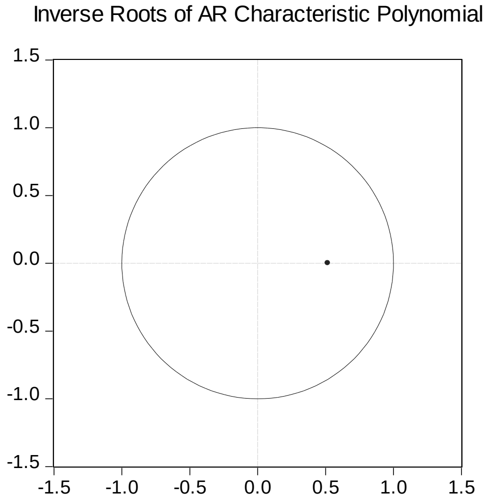
Lag	LogL	LR	FPE	AIC	SC	HQ
0	127.2597	NA*	7.61e-05*	-6.645249*	-6.602154*	-6.629916*
1	127.4447	0.350493	7.95e-05	-6.602353	-6.516164	-6.571688
2	127.4489	0.007737	8.38e-05	-6.549943	-6.420659	-6.503945
3	127.9864	0.961744	8.59e-05	-6.525598	-6.353220	-6.464267
4	128.3790	0.681956	8.87e-05	-6.493631	-6.278159	-6.416968
5	128.6264	0.416756	9.24e-05	-6.454023	-6.195457	-6.362027

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:42

Root	Modulus
0.516937	0.516937

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:42
Sample: 1996M11 1999M12
Included observations: 38

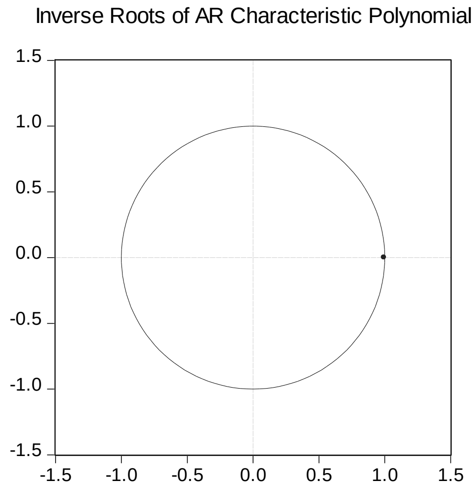
Lag	LogL	LR	FPE	AIC	SC	HQ
0	127.7008	NA	7.84e-05	-6.615830	-6.529641	-6.585165
1	133.5610	10.79507*	6.07e-05*	-6.871629*	-6.742346*	-6.825631*
2	133.6396	0.140809	6.38e-05	-6.823139	-6.650761	-6.761808
3	133.9563	0.550073	6.62e-05	-6.787176	-6.571704	-6.710513
4	134.2528	0.499338	6.87e-05	-6.750149	-6.491583	-6.658153
5	135.5388	2.098168	6.78e-05	-6.765200	-6.463540	-6.657872

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:43

Root	Modulus
0.994742	0.994742

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: C
Date: 04/19/17 Time: 15:43
Sample: 1996M11 1999M12
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	57.71001	NA	0.002960	-2.984737	-2.941643	-2.969405
1	128.3339	133.8137*	7.58e-05	-6.649152	-6.562963*	-6.618486
2	129.0402	1.301161	7.70e-05	-6.633696	-6.504413	-6.587698
3	131.0049	3.515652	7.33e-05*	-6.684466*	-6.512089	-6.623135*
4	131.0268	0.038070	7.72e-05	-6.632988	-6.417516	-6.556325
5	131.0982	0.120223	8.11e-05	-6.584114	-6.325547	-6.492118

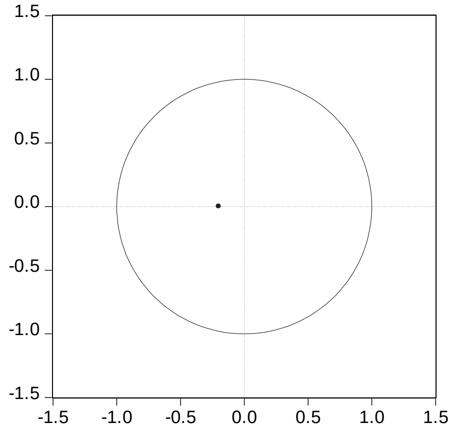
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:44

Root	Modulus
-0.200165	0.200165

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:44
Sample: 1996M11 1999M12
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	128.3510	NA*	7.58e-05	-6.650052	-6.563864*	-6.619387
1	129.1219	1.420060	7.67e-05	-6.637994	-6.508711	-6.591996
2	131.0574	3.463495	7.31e-05*	-6.687230*	-6.514852	-6.625899*
3	131.0771	0.034247	7.70e-05	-6.635636	-6.420164	-6.558973
4	131.1544	0.130186	8.09e-05	-6.587073	-6.328506	-6.495077
5	131.1992	0.073159	8.52e-05	-6.536801	-6.235140	-6.429473

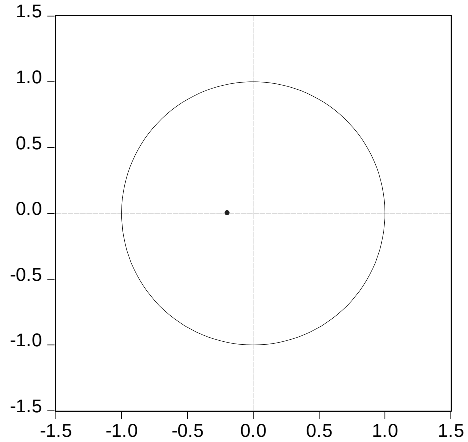
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:44

Root	Modulus
-0.193835	0.193835

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C
Date: 04/19/17 Time: 15:44
Sample: 1996M11 1999M12
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	128.3126	NA*	7.20e-05	-6.700662	-6.657568*	-6.685330
1	129.0402	1.378659	7.31e-05	-6.686327	-6.600138	-6.655662
2	131.0042	3.617896	6.95e-05*	-6.737064*	-6.607781	-6.691066*
3	131.0260	0.039034	7.32e-05	-6.685580	-6.513203	-6.624250
4	131.0974	0.123980	7.69e-05	-6.636706	-6.421234	-6.560042
5	131.1397	0.071277	8.10e-05	-6.586302	-6.327735	-6.494306

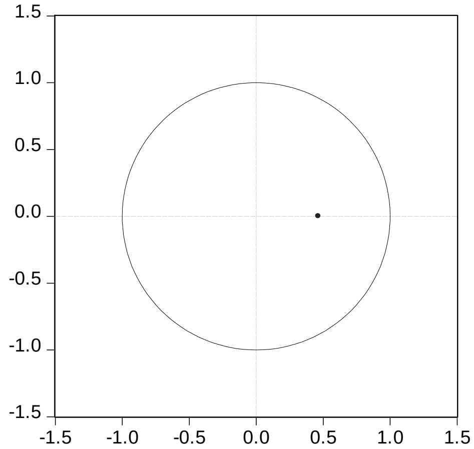
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:45

Root	Modulus
0.463639	0.463639

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: LM2
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:45
Sample: 1996M11 1999M12
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	102.1438	NA	0.000301	-5.270725	-5.184536	-5.240060
1	105.4825	6.150231*	0.000266*	-5.393814*	-5.264531*	-5.347816*
2	106.0581	1.030036	0.000272	-5.371478	-5.199100	-5.310147
3	106.0659	0.013645	0.000287	-5.319260	-5.103788	-5.242597
4	107.3791	2.211666	0.000283	-5.335743	-5.077177	-5.243747
5	107.8353	0.744363	0.000291	-5.307123	-5.005462	-5.199794

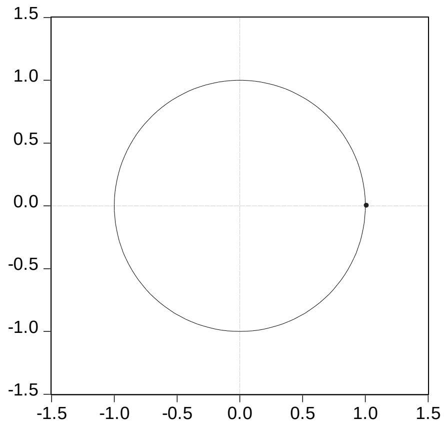
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:45

Root	Modulus
1.011466	1.011466

Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.

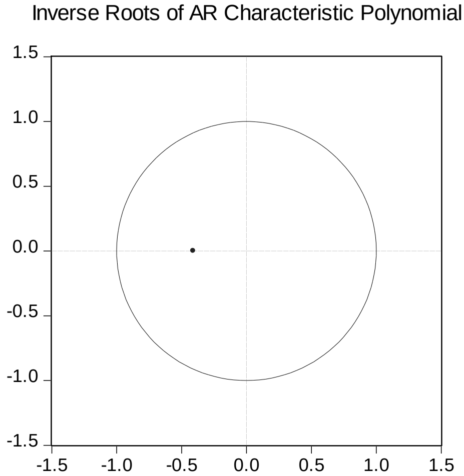
Inverse Roots of AR Characteristic Polynomial



Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:46

Root	Modulus
-0.408966	0.408966

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:47
Sample: 1996M11 1999M12
Included observations: 38

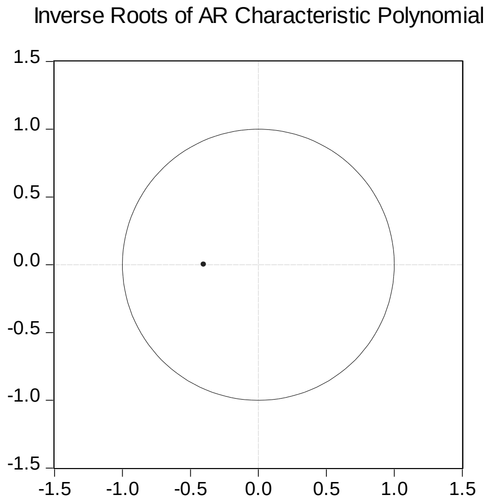
Lag	LogL	LR	FPE	AIC	SC	HQ
0	101.1352	NA	0.000317	-5.217643	-5.131454	-5.186977
1	104.2073	5.659027	0.000285	-5.326698	-5.197414*	-5.280700
2	104.5441	0.602851	0.000295	-5.291797	-5.119419	-5.230466
3	107.1012	4.441220*	0.000272*	-5.373748*	-5.158276	-5.297085*
4	107.8157	1.203290	0.000276	-5.358719	-5.100153	-5.266723

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:47

Root	Modulus
-0.400519	0.400519

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C
Date: 04/19/17 Time: 15:47
Sample: 1996M11 1999M12
Included observations: 38

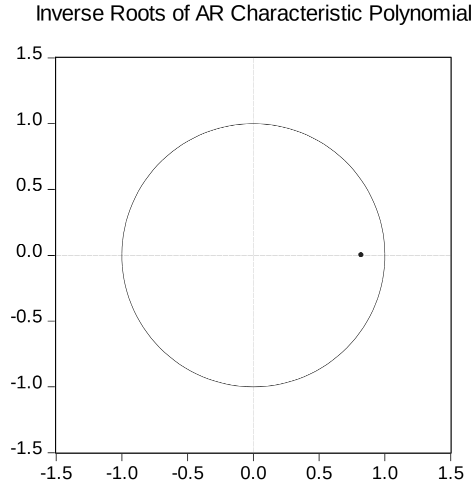
Lag	LogL	LR	FPE	AIC	SC	HQ
0	100.7988	NA	0.000306	-5.252566	-5.209471	-5.237233
1	103.6877	5.473872*	0.000277	-5.351986	-5.265798*	-5.321321*
2	103.9371	0.459421	0.000289	-5.312481	-5.183198	-5.266483
3	106.0222	3.731169	0.000273*	-5.369590*	-5.197212	-5.308259
4	106.3281	0.531358	0.000283	-5.333060	-5.117588	-5.256397

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:48

Root	Modulus
0.821554	0.821554

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:48
Sample: 1996M11 1999M12
Included observations: 38

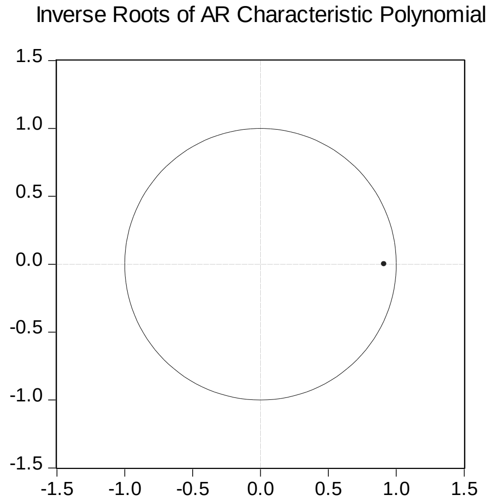
Lag	LogL	LR	FPE	AIC	SC	HQ
0	79.12167	NA	0.001011	-4.059035	-3.972846	-4.028370
1	94.56613	28.45032	0.000473*	-4.819270*	-4.689987*	-4.773272*
2	94.57845	0.022053	0.000498	-4.767287	-4.594909	-4.705956
3	94.62542	0.081584	0.000524	-4.717128	-4.501656	-4.640464
4	94.80584	0.303853	0.000548	-4.673991	-4.415425	-4.581995
5	98.28468	5.676004*	0.000482	-4.804457	-4.502796	-4.697128

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:48

Root	Modulus
0.912045	0.912045

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LGDPRICE
Exogenous variables: C
Date: 04/19/17 Time: 15:48
Sample: 1996M11 1999M12
Included observations: 38

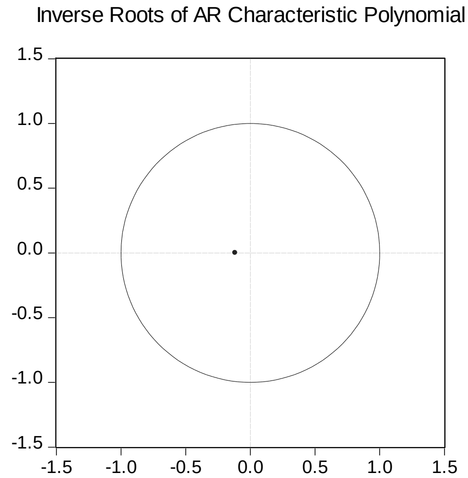
Lag	LogL	LR	FPE	AIC	SC	HQ
0	58.23801	NA	0.002879	-3.012527	-2.969433	-2.997194
1	94.17461	68.09040	0.000458*	-4.851295*	-4.765106*	-4.820630*
2	94.26485	0.166225	0.000480	-4.803413	-4.674130	-4.757415
3	94.26486	2.88e-05	0.000507	-4.750782	-4.578405	-4.689452
4	94.30770	0.074400	0.000533	-4.700405	-4.484933	-4.623742
5	96.90490	4.374236*	0.000491	-4.784468	-4.525902	-4.692473

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 04/19/17 Time: 15:49

Root	Modulus
-0.115532	0.115532

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Date: 04/19/17 Time: 15:49
Sample: 1996M11 1999M12
Included observations: 38

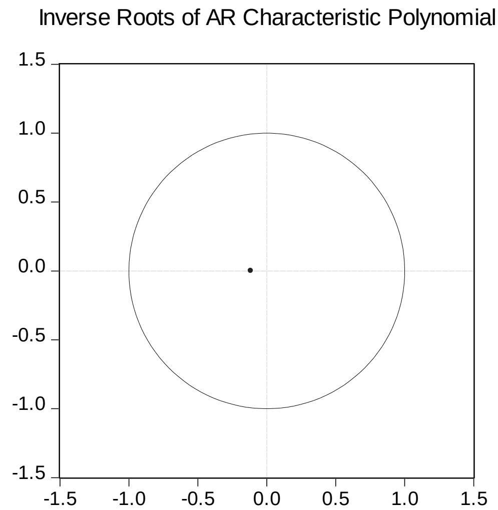
Lag	LogL	LR	FPE	AIC	SC	HQ
0	93.47374	NA*	0.000475*	-4.814408*	-4.728219*	-4.783742*
1	93.69467	0.406971	0.000495	-4.773404	-4.644121	-4.727406
2	93.71822	0.042141	0.000521	-4.722012	-4.549634	-4.660681
3	93.72296	0.008243	0.000550	-4.669630	-4.454158	-4.592966
4	95.74401	3.403859	0.000522	-4.723369	-4.464803	-4.631373
5	96.93851	1.948925	0.000517	-4.733606	-4.431945	-4.626277

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 04/19/17 Time: 15:49

Root	Modulus
-0.114506	0.114506

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C
Date: 04/19/17 Time: 15:49
Sample: 1996M11 1999M12
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	93.20518	NA*	0.000457*	-4.852904*	-4.809810*	-4.837572*
1	93.41913	0.405375	0.000476	-4.811533	-4.725344	-4.780868
2	93.43190	0.023521	0.000502	-4.759574	-4.630290	-4.713576
3	93.43922	0.013101	0.000529	-4.707327	-4.534950	-4.645997
4	95.32564	3.276413	0.000505	-4.753981	-4.538509	-4.677318
5	96.64659	2.224761	0.000497	-4.770873	-4.512307	-4.678877

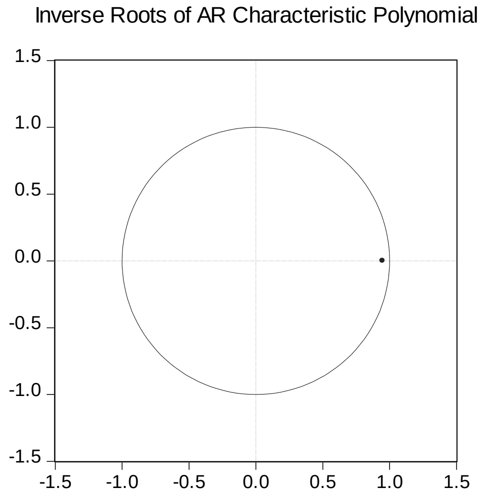
* indicates lag order selected by the criterion

J.3 For Recovery Period (January 2000 to December 2009)

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:21

Root	Modulus
0.946787	0.946787

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN
Exogenous variables: C @TREND
Date: 06/12/17 Time: 15:22
Sample: 2000M01 2009M12
Included observations: 120

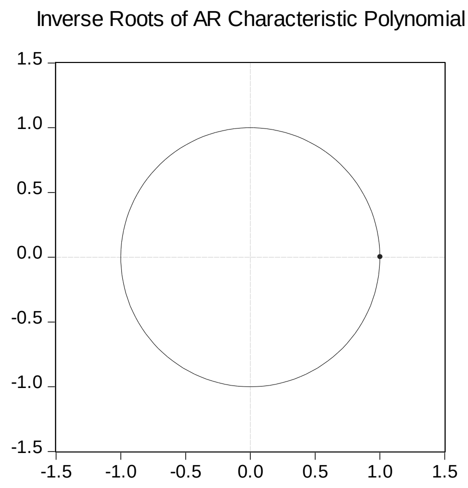
Lag	LogL	LR	FPE	AIC	SC	HQ
0	35.15791	NA	0.033692	-0.552632	-0.506174	-0.533765
1	158.4501	240.4197	0.004389	-2.590834	-2.521147*	-2.562534
2	159.3556	1.750736	0.004396	-2.589260	-2.496344	-2.551526
3	159.4511	0.183039	0.004463	-2.574185	-2.458040	-2.527018
4	160.6966	2.366457	0.004445	-2.578277	-2.438902	-2.521676
5	161.2246	0.994442	0.004480	-2.570411	-2.407807	-2.504376
6	164.5603	6.226532	0.004309	-2.609338	-2.423505	-2.533870
7	165.5033	1.744556	0.004314	-2.608388	-2.399326	-2.523487
8	165.5333	0.055035	0.004384	-2.592222	-2.359931	-2.497887
9	171.0844	10.08449	0.004065	-2.668073	-2.412553	-2.564305
10	173.5898	4.509667*	0.003965*	-2.693163*	-2.414414	-2.579961*
11	173.7452	0.277240	0.004021	-2.679087	-2.377109	-2.556452
12	174.3901	1.139264	0.004046	-2.673168	-2.347961	-2.541100

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:22

Root	Modulus
1.004780	1.004780

Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.

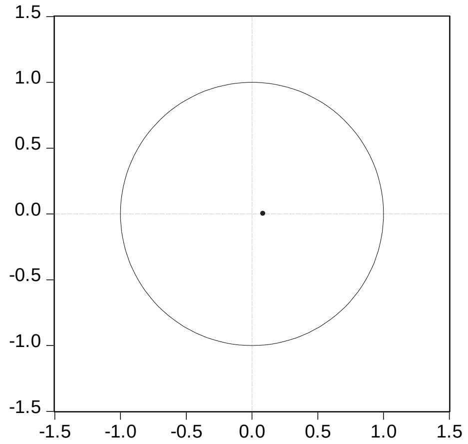


Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:22

Root	Modulus
0.086388	0.086388

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C @TREND
Date: 06/12/17 Time: 15:23
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	157.1738	NA	0.004409	-2.586230	-2.539772*	-2.567363*
1	157.6234	0.876665	0.004450	-2.577056	-2.507369	-2.548756
2	157.6271	0.007187	0.004524	-2.560451	-2.467535	-2.522718
3	158.3135	1.315677	0.004548	-2.555225	-2.439080	-2.508058
4	158.4638	0.285600	0.004613	-2.541064	-2.401689	-2.484463
5	160.3483	3.549039	0.004546	-2.555805	-2.393201	-2.489771
6	160.4696	0.226381	0.004613	-2.541159	-2.355327	-2.465692
7	161.1033	1.172370	0.004642	-2.535055	-2.325993	-2.450154
8	168.9514	14.38815*	0.004142	-2.649189	-2.416898	-2.554855
9	170.4870	2.789776	0.004105*	-2.658117*	-2.402597	-2.554349
10	170.4871	0.000139	0.004175	-2.641451	-2.362702	-2.528250
11	170.5964	0.194988	0.004238	-2.626607	-2.324629	-2.503972
12	170.9619	0.645615	0.004284	-2.616031	-2.290824	-2.483963

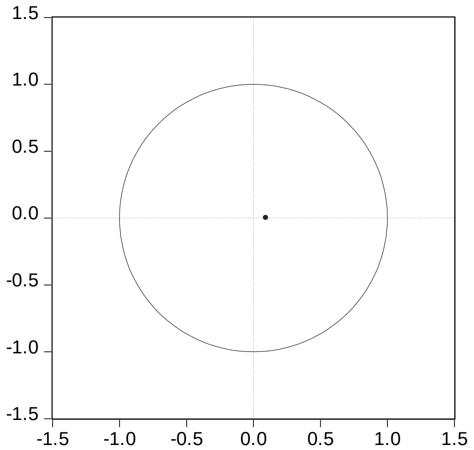
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:23

Root	Modulus
0.094406	0.094406

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN
Exogenous variables: C
Date: 06/12/17 Time: 15:23
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	156.6513	NA	0.004374	-2.594189	-2.570960*	-2.584755*

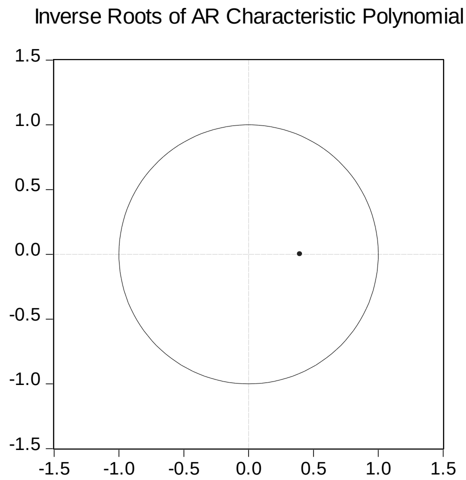
1	157.1887	1.056916	0.004408	-2.586479	-2.540021	-2.567612
2	157.1982	0.018413	0.004481	-2.569970	-2.500283	-2.541670
3	157.9140	1.383876	0.004503	-2.565233	-2.472317	-2.527499
4	158.0753	0.309093	0.004566	-2.551254	-2.435109	-2.504087
5	160.0061	3.668694	0.004496	-2.566769	-2.427395	-2.510168
6	160.1439	0.259420	0.004561	-2.552398	-2.389795	-2.486364
7	160.7736	1.175455	0.004590	-2.546227	-2.360394	-2.470759
8	168.5635	14.41141*	0.004099	-2.659392	-2.450331	-2.574492
9	170.1490	2.906685	0.004060*	-2.669150*	-2.436859	-2.574816
10	170.1493	0.000439	0.004128	-2.652488	-2.396968	-2.548720
11	170.2780	0.231693	0.004190	-2.637966	-2.359217	-2.524765
12	170.5884	0.553599	0.004239	-2.626473	-2.324495	-2.503839

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:24

Root	Modulus
0.397188	0.397188

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C @TREND
Date: 06/12/17 Time: 15:25
Sample: 2000M01 2009M12
Included observations: 120

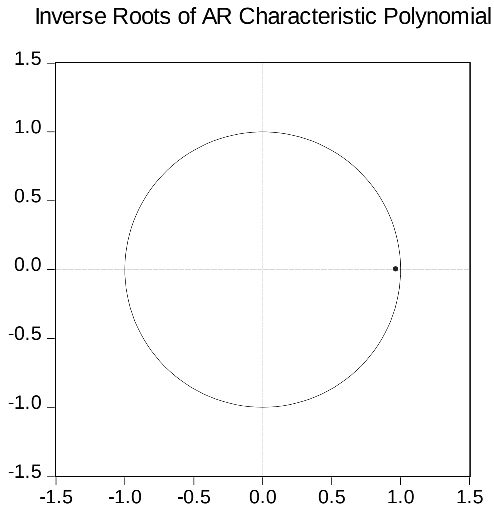
Lag	LogL	LR	FPE	AIC	SC	HQ
0	172.4929	NA	0.003416	-2.841548	-2.795090	-2.822681
1	183.4016	21.27195	0.002896	-3.006693	-2.937005	-2.978392
2	185.4741	4.006835	0.002844	-3.024568	-2.931651	-2.986834
3	188.2364	5.294487	0.002762	-3.053940	-2.937794	-3.006773
4	188.2371	0.001349	0.002809	-3.037285	-2.897910	-2.980684
5	192.1497	7.368714	0.002676	-3.085828	-2.923225	-3.019794
6	192.2198	0.130776	0.002718	-3.070329	-2.884496	-2.994862
7	192.9604	1.370136	0.002730	-3.066006	-2.856944	-2.981105
8	194.3366	2.523026	0.002713	-3.072276	-2.839985	-2.977942
9	194.8192	0.876834	0.002737	-3.063654	-2.808134	-2.959886
10	195.5776	1.365044	0.002748	-3.059626	-2.780877	-2.946425
11	199.6197	7.208399	0.002613	-3.110328	-2.808350	-2.987693
12	212.2466	22.30750*	0.002153*	-3.304109*	-2.978902*	-3.172041*
13	212.2778	0.054716	0.002189	-3.287964	-2.939527	-3.146462

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LIPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:25

Root	Modulus
0.967735	0.967735

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LIPI
Exogenous variables: C
Date: 06/12/17 Time: 15:26
Sample: 2000M01 2009M12
Included observations: 120

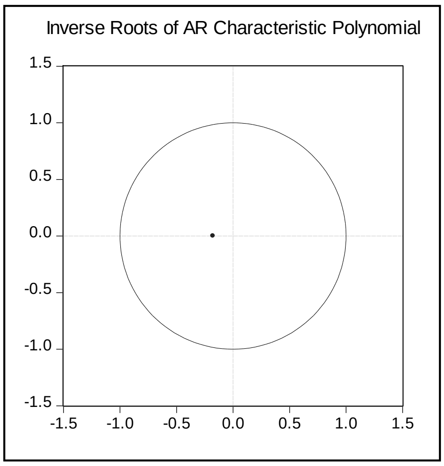
Lag	LogL	LR	FPE	AIC	SC	HQ
0	7.031236	NA	0.052951	-0.100521	-0.077292	-0.091087
1	161.4675	303.7246	0.004105	-2.657791	-2.611333	-2.638925
2	163.1806	3.340557	0.004056	-2.669677	-2.599989	-2.641376
3	164.6152	2.773524	0.004027	-2.676920	-2.584003	-2.639186
4	170.8590	11.96732	0.003690	-2.764317	-2.648171	-2.717149
5	183.0302	23.12519	0.003063	-2.950503	-2.811128	-2.893902
6	184.4829	2.735932	0.003040	-2.958048	-2.795444	-2.892014
7	184.4836	0.001455	0.003092	-2.941394	-2.755561	-2.865926
8	184.5148	0.057633	0.003142	-2.925247	-2.716185	-2.840346
9	187.1514	4.833861	0.003058	-2.952524	-2.720233	-2.858190
10	189.7266	4.678227	0.002979	-2.978777	-2.723257	-2.875009
11	196.0931	11.45965	0.002725	-3.068218	-2.789469	-2.955017
12	210.6132	25.89413*	0.002175*	-3.293553*	-2.991574*	-3.170918*
13	210.6943	0.143339	0.002209	-3.278238	-2.953031	-3.146170

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:26

Root	Modulus
-0.177052	0.177052

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C @TREND
Date: 06/12/17 Time: 15:26
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	160.7253	NA	0.004156	-2.645422	-2.598964	-2.626555

1	162.7200	3.889609	0.004087	-2.662000	-2.592313	-2.633699
2	164.3365	3.125234	0.004046	-2.672275	-2.579358	-2.634541
3	170.7953	12.37944	0.003694	-2.763255	-2.647110	-2.716088
4	183.1416	23.45801	0.003058	-2.952361	-2.812986	-2.895760
5	184.6220	2.787972	0.003033	-2.960366	-2.797763	-2.894332
6	184.6220	9.82e-05	0.003084	-2.943701	-2.757868	-2.868233
7	184.6482	0.048451	0.003135	-2.927470	-2.718409	-2.842569
8	187.3111	4.881970	0.003050	-2.955185	-2.722894	-2.860851
9	189.8969	4.697523	0.002971	-2.981615	-2.726095	-2.877847
10	196.2489	11.43362	0.002718	-3.070815	-2.792066	-2.957614
11	210.7587	25.87580*	0.002170*	-3.295979*	-2.994000*	-3.173344*
12	210.8433	0.149379	0.002204	-3.280721	-2.955514	-3.148653

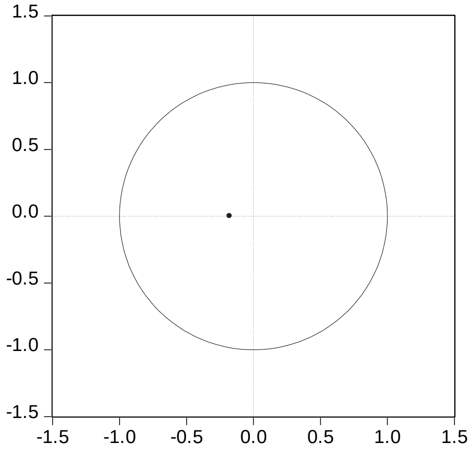
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLIPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:26

Root	Modulus
-0.177227	0.177227

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: DLIPI
Exogenous variables: C
Date: 06/12/17 Time: 15:27
Sample: 2000M01 2009M12
Included observations: 120

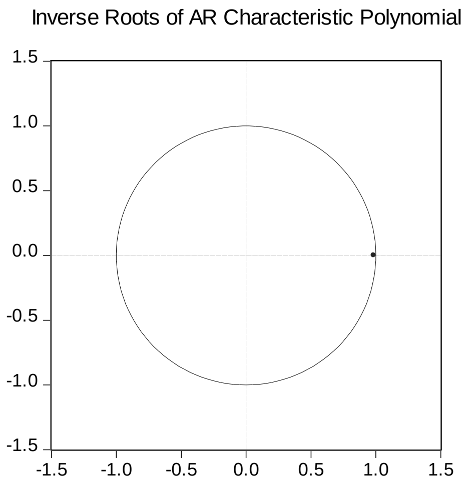
Lag	LogL	LR	FPE	AIC	SC	HQ
0	160.6647	NA	0.004091	-2.661078	-2.637849	-2.651645
1	162.6614	3.926859	0.004024	-2.677690	-2.631232	-2.658823
2	164.2774	3.151279	0.003983	-2.687957	-2.618270	-2.659657
3	170.7343	12.48330	0.003636	-2.778905	-2.685989	-2.741171
4	183.0270	23.56107	0.003013	-2.967117	-2.850972	-2.919950
5	184.4819	2.764311	0.002990	-2.974699	-2.835324	-2.918098
6	184.4829	0.001783	0.003040	-2.958048	-2.795444	-2.892014
7	184.5146	0.059249	0.003090	-2.941910	-2.756078	-2.866443
8	187.1366	4.850708	0.003008	-2.968944	-2.759882	-2.884043
9	189.6784	4.659879	0.002932	-2.994640	-2.762349	-2.900305
10	195.9871	11.46084	0.002684	-3.083118	-2.827598	-2.979351
11	210.3347	25.82569*	0.002149*	-3.305579*	-3.026829*	-3.192377*
12	210.3889	0.096572	0.002183	-3.289814	-2.987836	-3.167180

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:27

Root	Modulus
0.983922	0.983922

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

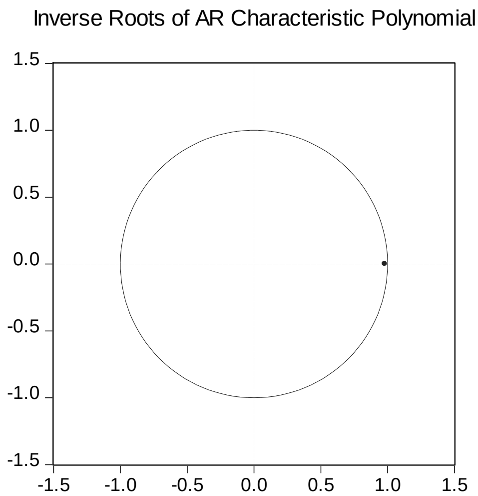
Lag	LogL	LR	FPE	AIC	SC	HQ
0	380.4117	NA	0.000107	-6.306862	-6.260404	-6.287995
1	581.3503	391.8301	3.81e-06	-9.639171	-9.569484*	-9.610871*
2	582.4508	2.127664	3.81e-06	-9.640846	-9.547930	-9.603113
3	582.4533	0.004741	3.87e-06	-9.624221	-9.508076	-9.577054
4	582.5528	0.189097	3.93e-06	-9.609213	-9.469838	-9.552612
5	582.5530	0.000434	4.00e-06	-9.592550	-9.429947	-9.526516
6	582.5590	0.011249	4.06e-06	-9.575984	-9.390151	-9.500516
7	584.7409	4.036527	3.98e-06	-9.595682	-9.386621	-9.510781
8	588.8343	7.504507*	3.78e-06	-9.647239	-9.414948	-9.552904
9	590.3955	2.836063	3.75e-06*	-9.656591*	-9.401071	-9.552823
10	591.2911	1.612134	3.76e-06	-9.654851	-9.376102	-9.541650
11	591.6286	0.601962	3.80e-06	-9.643811	-9.341832	-9.521176
12	591.6657	0.065542	3.86e-06	-9.627762	-9.302555	-9.495694

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LINT
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:28

Root	Modulus
0.979102	0.979102

No root lies outside the unit circle.
VAR satisfies the stability condition.



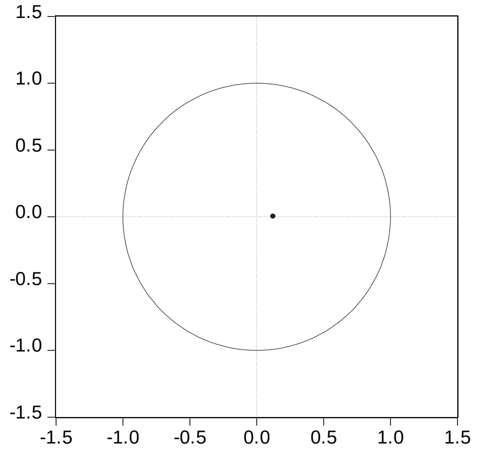
VAR Lag Order Selection Criteria
Endogenous variables: LINT
Exogenous variables: C
Date: 06/12/17 Time: 15:28
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	370.0946	NA	0.000125	-6.151576	-6.128347	-6.142143
1	581.1192	415.0151	3.76e-06	-9.651987	-9.605529*	-9.633120*
2	582.3452	2.390634	3.75e-06	-9.655753	-9.586066	-9.627453

3	582.3452	4.98e-08	3.81e-06	-9.639087	-9.546170	-9.601353
4	582.4111	0.126236	3.87e-06	-9.623518	-9.507372	-9.576350
5	582.4187	0.014586	3.94e-06	-9.606979	-9.467604	-9.550378
6	582.4435	0.046679	4.00e-06	-9.590725	-9.428122	-9.524691
7	584.2153	3.307332	3.95e-06	-9.603588	-9.417756	-9.528121
8	588.8060	8.492780*	3.72e-06	-9.663433	-9.454371	-9.578532
9	590.3705	2.868244	3.69e-06*	-9.672841*	-9.440550	-9.578507
10	591.1491	1.414566	3.70e-06	-9.669152	-9.413632	-9.565385
11	591.5881	0.790153	3.74e-06	-9.659802	-9.381053	-9.546601
12	591.6067	0.033096	3.80e-06	-9.643445	-9.341466	-9.520810

* indicates lag order selected by the criterion

Inverse Roots of AR Characteristic Polynomial



Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
0.124831	0.124831

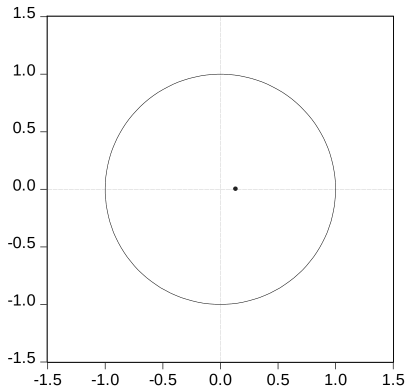
No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	580.9117	NA	3.78e-06	-9.648528	-9.602070*	-9.629662*
1	581.8564	1.842205	3.78e-06	-9.647607	-9.577920	-9.619307
2	581.8754	0.036649	3.84e-06	-9.631256	-9.538340	-9.593523
3	582.0337	0.303445	3.90e-06	-9.617228	-9.501083	-9.570061
4	582.0370	0.006210	3.96e-06	-9.600616	-9.461242	-9.544015
5	582.0371	0.000341	4.03e-06	-9.583952	-9.421349	-9.517918
6	584.4741	4.549024	3.94e-06	-9.607902	-9.422069	-9.532435
7	588.1528	6.805494*	3.76e-06	-9.652546	-9.443484	-9.567645
8	589.3257	2.150413	3.75e-06*	-9.655429*	-9.423138	-9.561094
9	589.8675	0.984292	3.78e-06	-9.647792	-9.392272	-9.544024
10	590.5479	1.224667	3.80e-06	-9.642465	-9.363716	-9.529264
11	590.5490	0.002022	3.87e-06	-9.625817	-9.323839	-9.503183
12	590.5526	0.006232	3.93e-06	-9.609209	-9.284002	-9.477141

* indicates lag order selected by the criterion

Inverse Roots of AR Characteristic Polynomial



Roots of Characteristic Polynomial
Endogenous variables: DLINT
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:29

Root	Modulus
0.135422	0.135422

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Lag Order Selection Criteria
Endogenous variables: DLINT
Exogenous variables: C
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	580.2324	NA	3.76e-06	-9.653873	-9.630643*	-9.644439*
1	581.3482	2.194508	3.75e-06	-9.655803	-9.609345	-9.636937
2	581.3513	0.006108	3.81e-06	-9.639189	-9.569502	-9.610889
3	581.4411	0.173518	3.87e-06	-9.624018	-9.531102	-9.586284
4	581.4463	0.009910	3.94e-06	-9.607438	-9.491292	-9.560270
5	581.4634	0.032563	4.00e-06	-9.591057	-9.451682	-9.534456
6	583.2567	3.377307	3.95e-06	-9.604278	-9.441674	-9.538244
7	587.7137	8.319721*	3.73e-06	-9.661894	-9.476061	-9.586427
8	589.1341	2.627843	3.70e-06*	-9.668902*	-9.459840	-9.584001
9	589.7705	1.166642	3.73e-06	-9.662841	-9.430550	-9.568507
10	590.3323	1.020600	3.75e-06	-9.655538	-9.400018	-9.551770
11	590.3339	0.002872	3.82e-06	-9.638898	-9.360148	-9.525696
12	590.3471	0.023628	3.88e-06	-9.622452	-9.320473	-9.499817

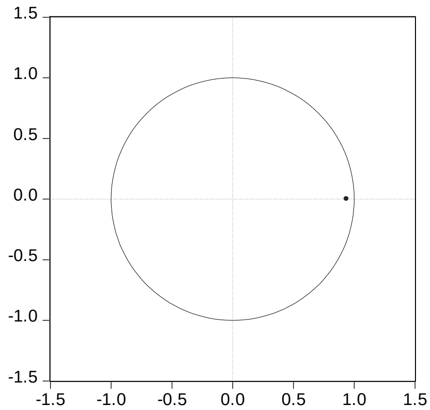
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:30

Root	Modulus
0.936125	0.936125

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: LCPI
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

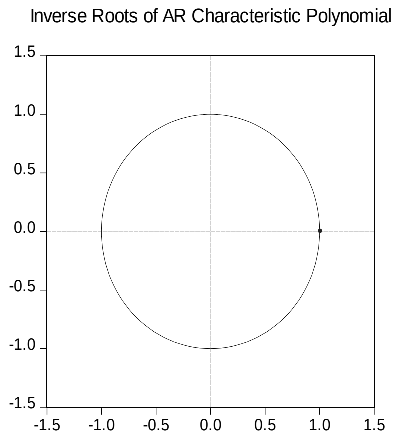
Lag	LogL	LR	FPE	AIC	SC	HQ
0	250.9347	NA	0.000924	-4.148911	-4.102453	-4.130044
1	412.2488	314.5626	6.39e-05	-6.820813	-6.751126	-6.792513
2	421.9063	18.67115	5.53e-05	-6.965105	-6.872188	-6.927371
3	425.5374	6.959725	5.29e-05	-7.008957	-6.892812*	-6.961790
4	425.5928	0.105210	5.38e-05	-6.993214	-6.853839	-6.936613
5	427.2703	3.159352	5.32e-05	-7.004506	-6.841902	-6.938472
6	427.8857	1.148649	5.35e-05	-6.998095	-6.812262	-6.922627
7	429.4948	2.976927	5.30e-05	-7.008247	-6.799185	-6.923346
8	431.8637	4.342853	5.18e-05	-7.031061	-6.798770	-6.936727
9	432.3468	0.877768	5.22e-05	-7.022447	-6.766927	-6.918680
10	438.5104	11.09432*	4.79e-05*	-7.108506*	-6.829757	-6.995305*
11	439.5051	1.774036	4.79e-05	-7.108419	-6.806441	-6.985784
12	439.7278	0.393419	4.86e-05	-7.095464	-6.770257	-6.963396

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LCPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:30

Root	Modulus
1.008313	1.008313

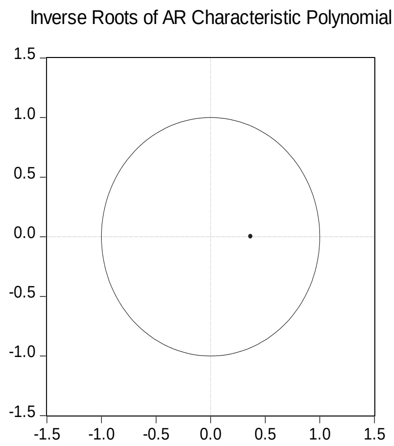
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
0.367982	0.367982

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

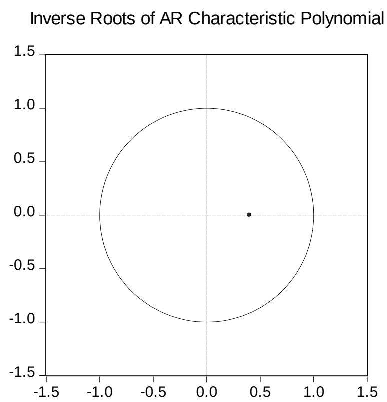
Lag	LogL	LR	FPE	AIC	SC	HQ
0	408.5360	NA	6.68e-05	-6.775600	-6.729142	-6.756733
1	417.2051	16.90484	5.88e-05	-6.903419	-6.833732	-6.875119
2	421.9930	9.256498	5.52e-05	-6.966550	-6.873633*	-6.928816
3	421.9968	0.007297	5.61e-05	-6.949947	-6.833801	-6.902779
4	424.0612	3.922433	5.51e-05	-6.967687	-6.828313	-6.911087
5	424.8179	1.425004	5.54e-05	-6.963631	-6.801028	-6.897597
6	426.3915	2.937512	5.49e-05	-6.973192	-6.787360	-6.897725
7	428.5593	4.010394	5.38e-05	-6.992655	-6.783594	-6.907754
8	428.9395	0.696960	5.44e-05	-6.982325	-6.750034	-6.887990
9	434.3193	9.773352	5.05e-05	-7.055322	-6.799802	-6.951554
10	434.8605	0.974162	5.09e-05	-7.047675	-6.768926	-6.934474
11	435.3637	0.897386	5.14e-05	-7.039395	-6.737417	-6.916761
12	444.0300	15.31049*	4.52e-05	-7.167167	-6.841960	-7.035099*
13	445.1176	1.903280	4.52e-05*	-7.168627*	-6.820191	-7.027125
14	445.6571	0.935102	4.55e-05	-7.160952	-6.789286	-7.010017

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLCPI
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
0.400787	0.400787

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLCPI
Exogenous variables: C
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	405.4017	NA	6.92e-05	-6.740028	-6.716798	-6.730594
1	415.8943	20.63555	5.91e-05	-6.898238	-6.851780	-6.879372
2	419.6085	7.242689	5.65e-05	-6.943475	-6.873788*	-6.915175
3	419.7229	0.221160	5.73e-05	-6.928715	-6.835799	-6.890981
4	420.9527	2.357055	5.71e-05	-6.932544	-6.816399	-6.885377
5	421.1983	0.466755	5.78e-05	-6.919972	-6.780598	-6.863371
6	421.9080	1.336642	5.81e-05	-6.915134	-6.752530	-6.849100
7	422.7294	1.533218	5.83e-05	-6.912157	-6.726324	-6.836689
8	422.7296	0.000349	5.93e-05	-6.895493	-6.686432	-6.810592
9	424.8147	3.822677	5.82e-05	-6.913578	-6.681287	-6.819244
10	424.9485	0.243049	5.91e-05	-6.899141	-6.643621	-6.795374
11	427.8672	5.253663	5.72e-05	-6.931120	-6.652371	-6.817919
12	440.6709	22.83327*	4.70e-05	-7.127848	-6.825870	-7.005213
13	442.6399	3.478652	4.63e-05*	-7.143999*	-6.818792	-7.011931*
14	442.7632	0.215757	4.70e-05	-7.129387	-6.780951	-6.987886

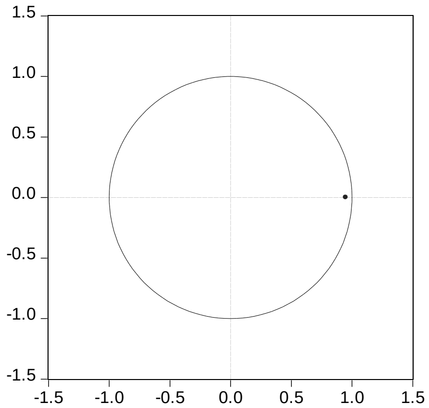
* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:33

Root	Modulus
0.949155	0.949155

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

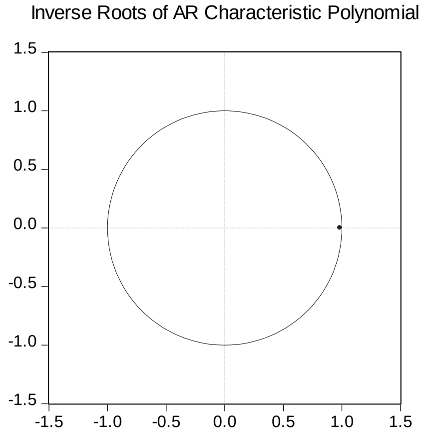
Lag	LogL	LR	FPE	AIC	SC	HQ
0	248.3375	NA	0.000965	-4.105625	-4.059167	-4.086759
1	377.2048	251.2912	0.000115	-6.236747	-6.167059*	-6.208446*
2	377.2058	0.002037	0.000116	-6.220097	-6.127181	-6.182364
3	377.2901	0.161522	0.000118	-6.204835	-6.088690	-6.157668
4	377.6879	0.755761	0.000119	-6.194798	-6.055424	-6.138197
5	377.8255	0.259152	0.000121	-6.180425	-6.017821	-6.114391
6	378.1630	0.629971	0.000123	-6.169383	-5.983550	-6.093915
7	380.5658	4.445133	0.000120	-6.192763	-5.983701	-6.107862
8	380.8113	0.450227	0.000121	-6.180189	-5.947898	-6.085854
9	381.0797	0.487528	0.000123	-6.167995	-5.912475	-6.064227
10	388.6932	13.70433*	0.000110*	-6.278220*	-5.999471	-6.165019
11	388.9954	0.538866	0.000111	-6.266590	-5.964611	-6.143955
12	389.0733	0.137629	0.000113	-6.251221	-5.926014	-6.119153

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LEXR
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
0.984316	0.984316

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LEXR
Exogenous variables: C
Sample: 2000M01 2009M12
Included observations: 120

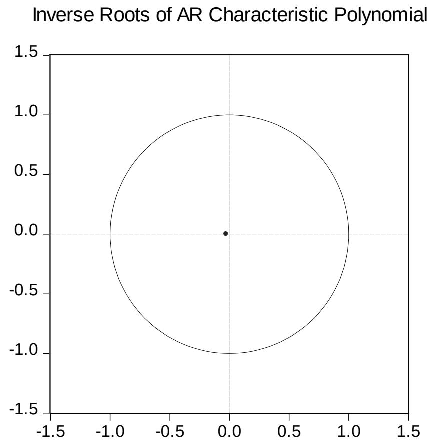
Lag	LogL	LR	FPE	AIC	SC	HQ
0	104.8549	NA	0.010370	-1.730914	-1.707685	-1.721481
1	376.5257	534.2860	0.000114	-6.242095	-6.195636*	-6.223228*
2	376.5512	0.049781	0.000116	-6.225853	-6.156166	-6.197553
3	376.7617	0.406869	0.000117	-6.212694	-6.119778	-6.174960
4	377.3594	1.145635	0.000118	-6.205990	-6.089844	-6.158822
5	377.5947	0.447138	0.000120	-6.193245	-6.053871	-6.136645
6	377.8091	0.403721	0.000121	-6.180151	-6.017548	-6.114117
7	380.4940	5.011806	0.000118	-6.208233	-6.022400	-6.132765
8	380.7854	0.539130	0.000119	-6.196423	-5.987361	-6.111522
9	381.0106	0.412802	0.000121	-6.183509	-5.951218	-6.089175
10	387.9607	12.62611*	0.000109*	-6.282679*	-6.027158	-6.178911
11	388.0693	0.195372	0.000111	-6.267821	-5.989072	-6.154620
12	388.0700	0.001262	0.000113	-6.251166	-5.949188	-6.128531

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:35

Root	Modulus
-0.026597	0.026597

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	375.9161	NA	0.000115	-6.231934	-6.185476*	-6.213067*
1	375.9586	0.082881	0.000117	-6.215976	-6.146289	-6.187676
2	376.1993	0.465493	0.000118	-6.203322	-6.110406	-6.165589
3	376.8565	1.259620	0.000119	-6.197609	-6.081463	-6.150442

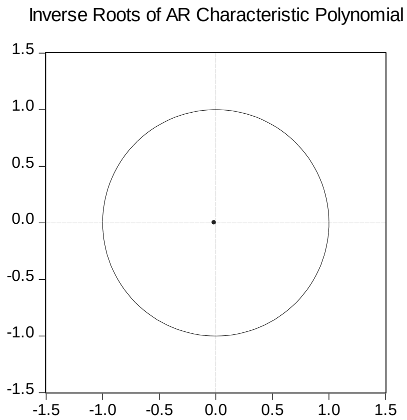
4	377.1355	0.530101	0.000121	-6.185592	-6.046218	-6.128992
5	377.3107	0.329901	0.000122	-6.171845	-6.009241	-6.105811
6	380.1295	5.261777	0.000119	-6.202158	-6.016326	-6.126691
7	380.4832	0.654280	0.000120	-6.191386	-5.982324	-6.106485
8	380.6596	0.323440	0.000122	-6.177660	-5.945369	-6.083325
9	387.3801	12.20886*	0.000111*	-6.273001*	-6.017481	-6.169233
10	387.4631	0.149414	0.000112	-6.257718	-5.978969	-6.144517
11	387.4637	0.001026	0.000114	-6.241061	-5.939083	-6.118426
12	387.5204	0.100288	0.000116	-6.225340	-5.900133	-6.093272

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLEXR
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
-0.013817	0.013817

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLEXR
Exogenous variables: C
Sample: 2000M01 2009M12
Included observations: 120

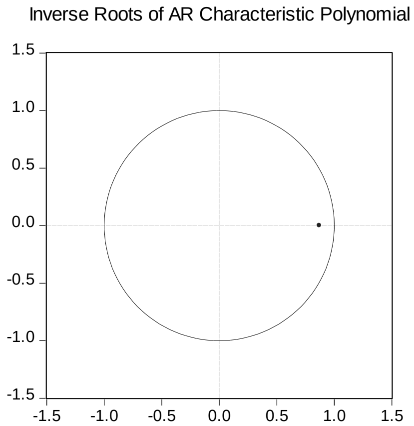
Lag	LogL	LR	FPE	AIC	SC	HQ
0	375.1469	NA	0.000115	-6.235781	-6.212552*	-6.226348*
1	375.1583	0.022540	0.000117	-6.219306	-6.172848	-6.200439
2	375.2855	0.248043	0.000118	-6.204759	-6.135072	-6.176459
3	375.7198	0.839463	0.000119	-6.195329	-6.102413	-6.157595
4	375.8479	0.245540	0.000121	-6.180798	-6.064652	-6.133630
5	376.1870	0.644364	0.000122	-6.169783	-6.030409	-6.113183
6	378.3391	4.053159	0.000120	-6.188985	-6.026382	-6.122951
7	378.4502	0.207434	0.000122	-6.174171	-5.988338	-6.098703
8	378.9076	0.846029	0.000123	-6.165126	-5.956064	-6.080225
9	386.5320	13.97815*	0.000110*	-6.275533*	-6.043242	-6.181199
10	386.6858	0.279332	0.000112	-6.261429	-6.005909	-6.157662
11	386.6889	0.005662	0.000114	-6.244815	-5.966066	-6.131614
12	386.7151	0.046634	0.000116	-6.228584	-5.926606	-6.105950

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 06/12/17 Time: 15:37

Root	Modulus
0.870761	0.870761

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LM2
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

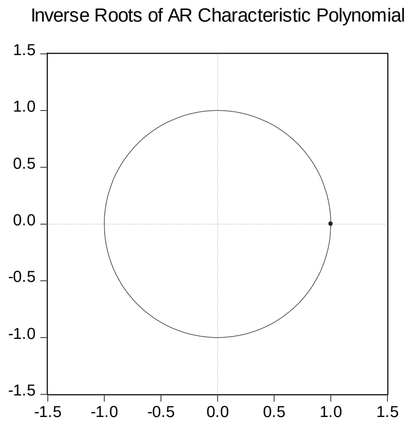
Lag	LogL	LR	FPE	AIC	SC	HQ
0	263.5112	NA	0.000749	-4.358520	-4.312062	-4.339653
1	342.3254	153.6876	0.000205	-5.655423	-5.585735	-5.627122
2	345.8761	6.864839	0.000196	-5.697936	-5.605019	-5.660202
3	346.9482	2.054886	0.000196	-5.699137	-5.582992	-5.651970
4	347.0380	0.170606	0.000199	-5.683967	-5.544593	-5.627367
5	349.5697	4.767984	0.000194	-5.709495	-5.546892	-5.643461
6	356.7731	13.44639	0.000175	-5.812886	-5.627053	-5.737418
7	366.5017	17.99792	0.000151	-5.958362	-5.749301	-5.873461
8	366.9188	0.764521	0.000153	-5.948646	-5.716355	-5.854311
9	374.9089	14.51551	0.000136	-6.065149	-5.809629	-5.961381
10	375.4206	0.921058	0.000137	-6.057011	-5.778262	-5.943809
11	376.6106	2.122051	0.000137	-6.060176	-5.758198	-5.937542
12	379.7479	5.542630	0.000132	-6.095799	-5.770591	-5.963730
13	413.0622	58.29995*	7.71e-05*	-6.634370*	-6.285933*	-6.492868*
14	413.0693	0.012429	7.84e-05	-6.617822	-6.246157	-6.466887

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LM2
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
1.002732	1.002732

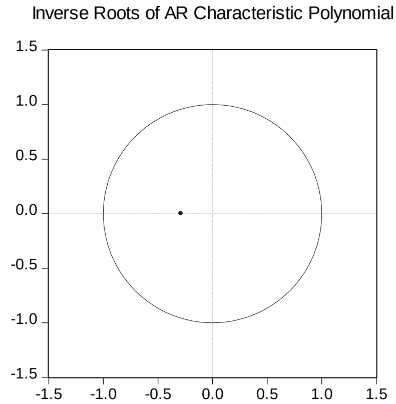
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
-0.289657	0.289657

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	338.8346	NA	0.000214	-5.613910	-5.567452	-5.595043
1	344.3776	10.80890	0.000198	-5.689627	-5.619940	-5.661327
2	346.0745	3.280706	0.000196	-5.701242	-5.608326	-5.663508

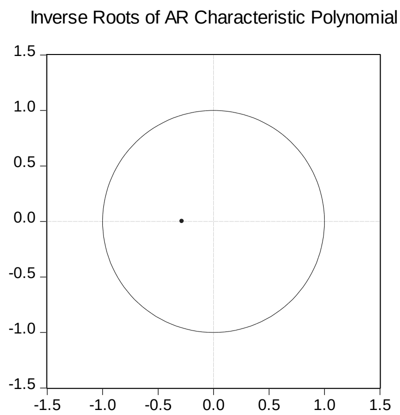
3	346.3450	0.518381	0.000198	-5.689083	-5.572938	-5.641916
4	349.3582	5.725034	0.000192	-5.722636	-5.583262	-5.666035
5	356.7645	13.94855	0.000172	-5.829408	-5.666804	-5.763374
6	366.1812	17.57782	0.000150	-5.969686	-5.783853	-5.894219
7	366.4554	0.507329	0.000151	-5.957590	-5.748528	-5.872689
8	374.8893	15.46213	0.000134	-6.081488	-5.849197	-5.987154
9	375.4203	0.964654	0.000135	-6.073672	-5.818152	-5.969904
10	376.5853	2.096982	0.000135	-6.076421	-5.797672	-5.963220
11	379.5284	5.248641	0.000130	-6.108807	-5.806829	-5.986173
12	412.7251	58.64744*	7.62e-05*	-6.645419*	-6.320211*	-6.513350*
13	412.7652	0.070126	7.74e-05	-6.629420	-6.280983	-6.487918

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLM2
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
-0.282896	0.282896

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLM2
Exogenous variables: C
Sample: 2000M01 2009M12
Included observations: 120

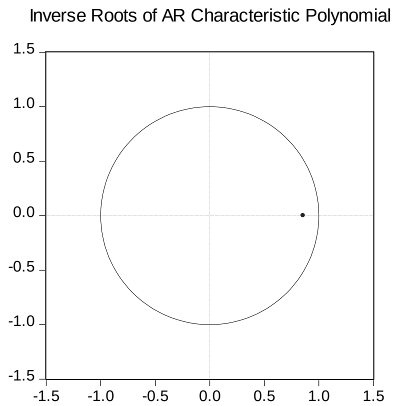
Lag	LogL	LR	FPE	AIC	SC	HQ
0	338.2577	NA	0.000212	-5.620961	-5.597732	-5.611528
1	343.5002	10.31035	0.000198	-5.691670	-5.645212	-5.672803
2	345.0026	2.929680	0.000196	-5.700044	-5.630356	-5.671743
3	345.1785	0.340061	0.000199	-5.686309	-5.593392	-5.648575
4	347.7534	4.935164	0.000193	-5.712556	-5.596411	-5.665389
5	354.0753	12.01172	0.000177	-5.801256	-5.661881	-5.744655
6	364.4715	19.57946	0.000151	-5.957859	-5.795255	-5.891824
7	364.8006	0.614247	0.000153	-5.946676	-5.760843	-5.871209
8	372.6338	14.49148	0.000137	-6.060563	-5.851502	-5.975662
9	372.9608	0.599492	0.000138	-6.049347	-5.817056	-5.955012
10	373.7757	1.480306	0.000139	-6.046261	-5.790741	-5.942493
11	375.7253	3.509361	0.000136	-6.062088	-5.783339	-5.948887
12	411.6308	64.03156*	7.63e-05*	-6.643847*	-6.341869*	-6.521213*
13	411.6449	0.024869	7.76e-05	-6.627415	-6.302208	-6.495347

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
0.855587	0.855587

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LGDPRICE
Exogenous variables: C @TREND
Sample: 2000M01 2009M12
Included observations: 120

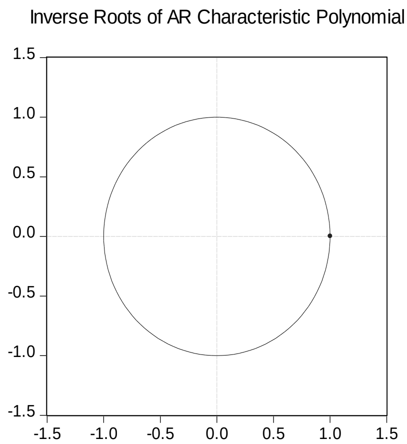
Lag	LogL	LR	FPE	AIC	SC	HQ
0	92.24802	NA	0.013010	-1.504134	-1.457675	-1.485267
1	174.9511	161.2710	0.003334	-2.865852	-2.796164*	-2.837551
2	176.1240	2.267639	0.003324	-2.868734	-2.775817	-2.831000
3	176.9030	1.493008	0.003336	-2.865050	-2.748904	-2.817883
4	177.7914	1.688053	0.003343	-2.863191	-2.723816	-2.806590
5	181.6526	7.271841*	0.003187*	-2.910876*	-2.748273	-2.844842*
6	182.4230	1.438041	0.003200	-2.907049	-2.721217	-2.831582
7	183.1662	1.374999	0.003214	-2.902770	-2.693708	-2.817869
8	183.1987	0.059618	0.003266	-2.886645	-2.654354	-2.792311
9	183.4381	0.434841	0.003308	-2.873968	-2.618448	-2.770200
10	183.4752	0.066726	0.003362	-2.857919	-2.579170	-2.744718
11	183.6018	0.225797	0.003412	-2.843363	-2.541385	-2.720728
12	183.9739	0.657449	0.003449	-2.832899	-2.507691	-2.700830

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: LGDPRICE
Exogenous variables: C
Lag specification: 1 1

Root	Modulus
1.002430	1.002430

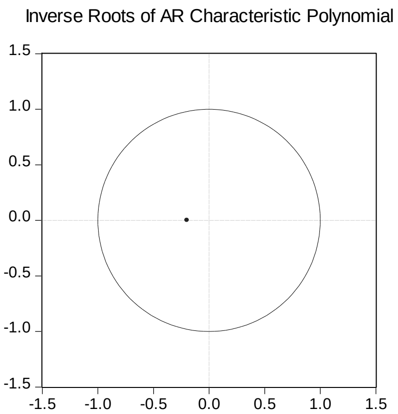
Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.



Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Lag specification: 1 1

Root	Modulus
-0.198193	0.198193

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C @TREND
Date: 06/12/17 Time: 15:47
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	170.0800	NA	0.003556	-2.801334	-2.754876*	-2.782467
1	172.4114	4.546180	0.003478	-2.823523	-2.753836	-2.795223*
2	173.8341	2.750523	0.003453	-2.830568	-2.737652	-2.792834
3	174.2513	0.799588	0.003487	-2.820854	-2.704709	-2.773687
4	176.5471	4.362161*	0.003413	-2.842452	-2.703078	-2.785852

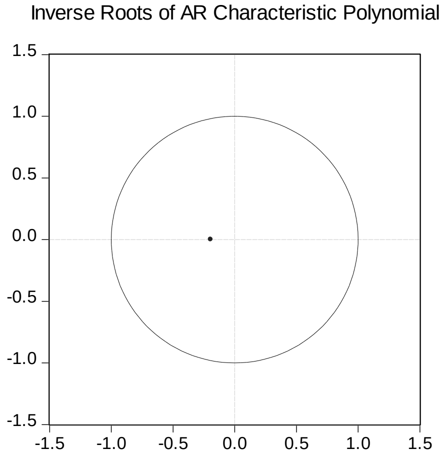
5	178.4116	3.511444	0.003364	-2.856860	-2.694257	-2.790826
6	179.8777	2.736757	0.003338*	-2.864629*	-2.678796	-2.789161
7	179.8885	0.019960	0.003394	-2.848142	-2.639080	-2.763241
8	180.4383	1.007984	0.003420	-2.840639	-2.608348	-2.746304
9	180.6186	0.327464	0.003467	-2.826976	-2.571456	-2.723209
10	180.6322	0.024421	0.003525	-2.810536	-2.531787	-2.697335
11	181.3282	1.241262	0.003544	-2.805470	-2.503492	-2.682835
12	181.3581	0.052909	0.003603	-2.789302	-2.464095	-2.657234

* indicates lag order selected by the criterion

Roots of Characteristic Polynomial
Endogenous variables: DLGDPRICE
Exogenous variables: C
Lag specification: 1 1
Date: 06/12/17 Time: 15:47

Root	Modulus
-0.193595	0.193595

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLGDPRICE
Exogenous variables: C
Date: 06/12/17 Time: 15:48
Sample: 2000M01 2009M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	169.6369	NA	0.003523	-2.810616	-2.787387*	-2.801182
1	171.8478	4.348084	0.003452	-2.830797	-2.784339	-2.811930*
2	173.1630	2.564529	0.003434	-2.836050	-2.766362	-2.807749
3	173.6323	0.907293	0.003465	-2.827204	-2.734288	-2.789471
4	176.0534	4.640459*	0.003384	-2.850890	-2.734744	-2.803722
5	177.7801	3.280714	0.003343	-2.863001	-2.723627	-2.806400
6	179.0507	2.393076	0.003328*	-2.867512*	-2.704908	-2.801478
7	179.0508	7.65e-05	0.003385	-2.850846	-2.665013	-2.775379
8	179.4494	0.737498	0.003419	-2.840824	-2.631762	-2.755923
9	179.5352	0.157282	0.003472	-2.825587	-2.593296	-2.731252
10	179.6017	0.120823	0.003527	-2.810029	-2.554508	-2.706261
11	180.0494	0.805896	0.003560	-2.800824	-2.522075	-2.687623
12	180.1778	0.229009	0.003613	-2.786297	-2.484319	-2.663663

* indicates lag order selected by the criterion

Appendix K: Unit Root Tests of the Variables for Different Periods

K 1 For Bubble Period

K 1.1 ADF Unit Root Tests

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.053402	0.5600
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 04/20/17 Time: 18:11
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.207747	0.101172	-2.053402	0.0453
D(LDSEGEN(-1))	0.165403	0.155320	1.064918	0.2920
D(LDSEGEN(-2))	0.422705	0.179064	2.360643	0.0222
D(LDSEGEN(-3))	0.322993	0.195712	1.650347	0.1051
D(LDSEGEN(-4))	0.035330	0.199080	0.177466	0.8599
C	0.910433	0.445825	2.042131	0.0464
@TREND("1992M03")	0.007561	0.003234	2.337581	0.0235

R-squared	0.189553	Mean dependent var	0.045328
Adjusted R-squared	0.092299	S.D. dependent var	0.117710
S.E. of regression	0.112147	Akaike info criterion	-1.423435
Sum squared resid	0.628843	Schwarz criterion	-1.172534
Log likelihood	47.56789	Hannan-Quinn criter.	-1.325926
F-statistic	1.949059	Durbin-Watson stat	1.984063
Prob(F-statistic)	0.091006		

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.625643	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Date: 04/20/17 Time: 18:16
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.899352	0.135738	-6.625643	0.0000
C	0.003779	0.030489	0.123942	0.9018
@TREND("1992M03")	0.001324	0.000965	1.372008	0.1757

R-squared	0.448553	Mean dependent var	0.000746
Adjusted R-squared	0.428129	S.D. dependent var	0.154199
S.E. of regression	0.116608	Akaike info criterion	-1.408793
Sum squared resid	0.734267	Schwarz criterion	-1.301264
Log likelihood	43.15061	Hannan-Quinn criter.	-1.367004
F-statistic	21.96209	Durbin-Watson stat	2.018573
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.263620	0.0069
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 04/20/17 Time: 18:16
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.635708	0.149100	-4.263620	0.0001
D(LIPI(-1))	0.152780	0.141587	1.079053	0.2855
C	2.967571	0.694033	4.275836	0.0001
@TREND("1992M03")	0.005082	0.001311	3.875801	0.0003

R-squared	0.281529	Mean dependent var	0.005305
Adjusted R-squared	0.240860	S.D. dependent var	0.069120
S.E. of regression	0.060224	Akaike info criterion	-2.713917
Sum squared resid	0.192224	Schwarz criterion	-2.570545
Log likelihood	81.34662	Hannan-Quinn criter.	-2.658197
F-statistic	6.922573	Durbin-Watson stat	1.947506
Prob(F-statistic)	0.000511		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.240552	0.9906
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 04/20/17 Time: 18:17
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.006619	0.027515	-0.240552	0.8108
D(LINT(-1))	0.033258	0.139446	0.238500	0.8124
C	-0.001765	0.002702	-0.653152	0.5165
@TREND("1992M03")	5.98E-05	2.81E-05	2.128398	0.0380

R-squared	0.246814	Mean dependent var	-0.000594
Adjusted R-squared	0.204181	S.D. dependent var	0.002231
S.E. of regression	0.001990	Akaike info criterion	-9.533459
Sum squared resid	0.000210	Schwarz criterion	-9.390087
Log likelihood	275.7036	Hannan-Quinn criter.	-9.477740
F-statistic	5.789248	Durbin-Watson stat	2.015905
Prob(F-statistic)	0.001685		

Null Hypothesis: LINT has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.771669	0.0687
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 04/20/17 Time: 18:17
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.051139	0.018451	-2.771669	0.0076
D(LINT(-1))	0.174397	0.126616	1.377370	0.1741

C	0.003253	0.001362	2.387696	0.0205

R-squared	0.182437	Mean dependent var	-0.000594
Adjusted R-squared	0.152157	S.D. dependent var	0.002231
S.E. of regression	0.002054	Akaike info criterion	-9.486531
Sum squared resid	0.000228	Schwarz criterion	-9.379002
Log likelihood	273.3661	Hannan-Quinn criter.	-9.444741
F-statistic	6.024970	Durbin-Watson stat	2.025063
Prob(F-statistic)	0.004346		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.237537	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Date: 04/20/17 Time: 18:18
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-0.974348	0.134624	-7.237537	0.0000
C	-0.002398	0.000608	-3.940164	0.0002
@TREND("1992M03")	6.49E-05	1.81E-05	3.589052	0.0007

R-squared	0.492486	Mean dependent var	0.000000
Adjusted R-squared	0.473689	S.D. dependent var	0.002719
S.E. of regression	0.001973	Akaike info criterion	-9.567456
Sum squared resid	0.000210	Schwarz criterion	-9.459927
Log likelihood	275.6725	Hannan-Quinn criter.	-9.525666
F-statistic	26.20052	Durbin-Watson stat	2.014055
Prob(F-statistic)	0.000000		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.360946	0.0670
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 04/20/17 Time: 18:18
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.342268	0.101837	-3.360946	0.0015
D(LCPI(-1))	0.197240	0.130473	1.511730	0.1369
D(LCPI(-2))	0.192056	0.133641	1.437106	0.1569
D(LCPI(-3))	0.331719	0.132153	2.510118	0.0154
D(LCPI(-4))	0.044242	0.138807	0.318729	0.7513
C	1.593550	0.473449	3.365829	0.0015
@TREND("1992M03")	0.000914	0.000285	3.201411	0.0024

R-squared	0.230606	Mean dependent var	0.002876
Adjusted R-squared	0.138278	S.D. dependent var	0.012769
S.E. of regression	0.011854	Akaike info criterion	-5.917776
Sum squared resid	0.007025	Schwarz criterion	-5.666875
Log likelihood	175.6566	Hannan-Quinn criter.	-5.820267
F-statistic	2.497696	Durbin-Watson stat	2.004066
Prob(F-statistic)	0.034262		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.929071	0.7719
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 04/20/17 Time: 18:19
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.032574	0.035060	-0.929071	0.3570
D(LCPI(-1))	0.060335	0.134998	0.446929	0.6567
C	0.156724	0.165753	0.945526	0.3486

R-squared	0.017810	Mean dependent var	0.002876
Adjusted R-squared	-0.018568	S.D. dependent var	0.012769
S.E. of regression	0.012887	Akaike info criterion	-5.813945
Sum squared resid	0.008969	Schwarz criterion	-5.706416
Log likelihood	168.6974	Hannan-Quinn criter.	-5.772156
F-statistic	0.489585	Durbin-Watson stat	2.011148
Prob(F-statistic)	0.615574		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.060782	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 04/20/17 Time: 18:19
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.954202	0.135141	-7.060782	0.0000
C	0.002500	0.003426	0.729555	0.4688
@TREND("1992M03")	8.43E-06	0.000105	0.080613	0.9360

R-squared	0.480185	Mean dependent var	-0.000199
Adjusted R-squared	0.460933	S.D. dependent var	0.017691
S.E. of regression	0.012989	Akaike info criterion	-5.798207
Sum squared resid	0.009111	Schwarz criterion	-5.690678
Log likelihood	168.2489	Hannan-Quinn criter.	-5.756418
F-statistic	24.94155	Durbin-Watson stat	2.014779
Prob(F-statistic)	0.000000		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.056632	0.9272
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 04/20/17 Time: 18:20
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.068107	0.064457	-1.056632	0.2955
D(LEXR(-1))	0.013277	0.144442	0.091922	0.9271
C	0.319158	0.301733	1.057750	0.2950

@TREND("1992M03")	0.000132	8.85E-05	1.491973	0.1416

R-squared	0.052595	Mean dependent var	0.001559
Adjusted R-squared	-0.001032	S.D. dependent var	0.004104
S.E. of regression	0.004106	Akaike info criterion	-8.085232
Sum squared resid	0.000893	Schwarz criterion	-7.941860
Log likelihood	234.4291	Hannan-Quinn criter.	-8.029512
F-statistic	0.980763	Durbin-Watson stat	1.967007
Prob(F-statistic)	0.408865		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.588872	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 04/20/17 Time: 18:20
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-1.036738	0.136613	-7.588872	0.0000
C	0.000339	0.001075	0.315653	0.7535
@TREND("1992M03")	4.56E-05	3.38E-05	1.349773	0.1827

R-squared	0.516221	Mean dependent var	0.000000
Adjusted R-squared	0.498303	S.D. dependent var	0.005803
S.E. of regression	0.004110	Akaike info criterion	-8.099473
Sum squared resid	0.000912	Schwarz criterion	-7.991944
Log likelihood	233.8350	Hannan-Quinn criter.	-8.057683
F-statistic	28.81063	Durbin-Watson stat	1.973944
Prob(F-statistic)	0.000000		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.642452	0.7634
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 04/20/17 Time: 18:21
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.204395	0.124445	-1.642452	0.1066
D(LM2(-1))	-0.279121	0.166895	-1.672435	0.1006
D(LM2(-2))	-0.140953	0.157713	-0.893729	0.3757
D(LM2(-3))	0.116264	0.135585	0.857502	0.3952
C	0.985393	0.588436	1.674597	0.1001
@TREND("1992M03")	0.002129	0.001355	1.571072	0.1224

R-squared	0.245203	Mean dependent var	0.010239
Adjusted R-squared	0.171203	S.D. dependent var	0.018493
S.E. of regression	0.016835	Akaike info criterion	-5.231380
Sum squared resid	0.014455	Schwarz criterion	-5.016322
Log likelihood	155.0943	Hannan-Quinn criter.	-5.147801
F-statistic	3.313567	Durbin-Watson stat	1.971425
Prob(F-statistic)	0.011467		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.778278	0.8175
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 04/20/17 Time: 18:21
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.009873	0.012686	-0.778278	0.4399
D(LM2(-1))	-0.432100	0.137446	-3.143786	0.0028
D(LM2(-2))	-0.249653	0.143713	-1.737157	0.0883
D(LM2(-3))	0.050769	0.130825	0.388064	0.6996
C	0.066292	0.064244	1.031877	0.3069

R-squared	0.208673	Mean dependent var	0.010239
Adjusted R-squared	0.147801	S.D. dependent var	0.018493
S.E. of regression	0.017071	Akaike info criterion	-5.219205
Sum squared resid	0.015154	Schwarz criterion	-5.039990
Log likelihood	153.7473	Hannan-Quinn criter.	-5.149556
F-statistic	3.428096	Durbin-Watson stat	1.984747
Prob(F-statistic)	0.014627		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.190584	0.4854
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 04/20/17 Time: 18:22
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.174015	0.535937	-2.190584	0.0336
D(LM2(-1),2)	-0.229635	0.512909	-0.447712	0.6565
D(LM2(-2),2)	-0.128655	0.502114	-0.256227	0.7989
D(LM2(-3),2)	-0.115951	0.482310	-0.240407	0.8111
D(LM2(-4),2)	-0.314982	0.416622	-0.756038	0.4535
D(LM2(-5),2)	-0.424554	0.353675	-1.200405	0.2361
D(LM2(-6),2)	0.158938	0.305954	0.519482	0.6059
D(LM2(-7),2)	0.369955	0.240126	1.540674	0.1302
D(LM2(-8),2)	0.088659	0.141762	0.625409	0.5348
C	0.013631	0.006896	1.976548	0.0541
@TREND("1992M03")	-5.44E-05	0.000100	-0.543357	0.5895

R-squared	0.869461	Mean dependent var	0.000191
Adjusted R-squared	0.841083	S.D. dependent var	0.030431
S.E. of regression	0.012131	Akaike info criterion	-5.814519
Sum squared resid	0.006770	Schwarz criterion	-5.420246
Log likelihood	176.7138	Hannan-Quinn criter.	-5.661291
F-statistic	30.63843	Durbin-Watson stat	1.998006
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant
Lag Length: 8 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.140519	0.2301
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 04/20/17 Time: 18:22
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.114598	0.520714	-2.140519	0.0375
D(LM2(-1),2)	-0.282261	0.499890	-0.564647	0.5750
D(LM2(-2),2)	-0.173410	0.491585	-0.352758	0.7258
D(LM2(-3),2)	-0.151089	0.474358	-0.318513	0.7515
D(LM2(-4),2)	-0.339942	0.410966	-0.827180	0.4123
D(LM2(-5),2)	-0.439739	0.349916	-1.256700	0.2151
D(LM2(-6),2)	0.153468	0.303487	0.505682	0.6154
D(LM2(-7),2)	0.368268	0.238299	1.545405	0.1290
D(LM2(-8),2)	0.087627	0.140682	0.622872	0.5364
C	0.011494	0.005622	2.044358	0.0465

R-squared	0.868623	Mean dependent var	0.000191
Adjusted R-squared	0.843466	S.D. dependent var	0.030431
S.E. of regression	0.012040	Akaike info criterion	-5.843209
Sum squared resid	0.006813	Schwarz criterion	-5.484779
Log likelihood	176.5314	Hannan-Quinn criter.	-5.703911
F-statistic	34.52764	Durbin-Watson stat	1.998872
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 10 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.953657	0.0159
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,3)
Method: Least Squares
Date: 04/21/17 Time: 17:52
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1),2)	-7.819311	1.977741	-3.953657	0.0003
D(LM2(-1),3)	5.647306	1.937313	2.915020	0.0056
D(LM2(-2),3)	4.695111	1.843550	2.546777	0.0144
D(LM2(-3),3)	3.782379	1.706057	2.217030	0.0318
D(LM2(-4),3)	2.944535	1.529831	1.924745	0.0607
D(LM2(-5),3)	2.219817	1.301822	1.705162	0.0952
D(LM2(-6),3)	1.838882	1.029469	1.786243	0.0810
D(LM2(-7),3)	1.623577	0.764902	2.122595	0.0395
D(LM2(-8),3)	1.257228	0.526208	2.389224	0.0212
D(LM2(-9),3)	0.925772	0.312286	2.964498	0.0049

D(LM2(-10),3)	0.501057	0.125667	3.987190	0.0002
C	0.000248	0.002847	0.087066	0.9310
@TREND("1992M03")	-1.42E-05	8.79E-05	-0.161159	0.8727

R-squared	0.968386	Mean dependent var	-0.000249
Adjusted R-squared	0.959764	S.D. dependent var	0.054121
S.E. of regression	0.010856	Akaike info criterion	-6.010921
Sum squared resid	0.005186	Schwarz criterion	-5.544962
Log likelihood	184.3113	Hannan-Quinn criter.	-5.829834
F-statistic	112.3170	Durbin-Watson stat	1.872443
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.829661	0.1931
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 04/20/17 Time: 18:23
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.287934	0.101756	-2.829661	0.0066
D(LGDPRICE(-1))	-0.004901	0.135785	-0.036093	0.9713
C	1.309502	0.462512	2.831280	0.0065
@TREND("1992M03")	0.000697	0.000270	2.580126	0.0127

R-squared	0.149078	Mean dependent var	0.000970
Adjusted R-squared	0.100913	S.D. dependent var	0.015625
S.E. of regression	0.014816	Akaike info criterion	-5.518621
Sum squared resid	0.011634	Schwarz criterion	-5.375249
Log likelihood	161.2807	Hannan-Quinn criter.	-5.462901
F-statistic	3.095124	Durbin-Watson stat	2.002616
Prob(F-statistic)	0.034558		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.912461	0.7773
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 04/20/17 Time: 18:23
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.043290	0.047443	-0.912461	0.3657
D(LGDPRICE(-1))	-0.146610	0.141284	-1.037694	0.3042
D(LGDPRICE(-2))	-0.213717	0.126905	-1.684066	0.0982
D(LGDPRICE(-3))	0.021020	0.134599	0.156167	0.8765
C	0.201114	0.218731	0.919460	0.3621

R-squared	0.095712	Mean dependent var	0.000970
Adjusted R-squared	0.026152	S.D. dependent var	0.015625
S.E. of regression	0.015420	Akaike info criterion	-5.422706
Sum squared resid	0.012364	Schwarz criterion	-5.243491
Log likelihood	159.5471	Hannan-Quinn criter.	-5.353057
F-statistic	1.375958	Durbin-Watson stat	1.989455
Prob(F-statistic)	0.255042		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.079624	0.0006
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Date: 04/20/17 Time: 18:23
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.398096	0.275236	-5.079624	0.0000
D(LGDPRICE(-1),2)	0.223412	0.201147	1.110691	0.2718
D(LGDPRICE(-2),2)	-0.006857	0.134778	-0.050877	0.9596
C	0.001672	0.004116	0.406201	0.6863
@TREND("1992M03")	-4.69E-06	0.000125	-0.037357	0.9703

R-squared	0.598019	Mean dependent var	0.000000
Adjusted R-squared	0.567098	S.D. dependent var	0.023622
S.E. of regression	0.015542	Akaike info criterion	-5.406848
Sum squared resid	0.012562	Schwarz criterion	-5.227633
Log likelihood	159.0952	Hannan-Quinn criter.	-5.337199
F-statistic	19.33986	Durbin-Watson stat	1.993829
Prob(F-statistic)	0.000000		

K 1.2 PP Unit Root Tests

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.298263	0.8784
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.012953
HAC corrected variance (Bartlett kernel)	0.019730

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 04/24/17 Time: 16:30
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.038000	0.075913	-0.500574	0.6187
C	0.172126	0.337946	0.509330	0.6126
@TREND("1992M03")	0.002718	0.002631	1.033212	0.3061

R-squared	0.048463	Mean dependent var	0.045328
Adjusted R-squared	0.013221	S.D. dependent var	0.117710
S.E. of regression	0.116930	Akaike info criterion	-1.403293
Sum squared resid	0.738317	Schwarz criterion	-1.295764
Log likelihood	42.99385	Hannan-Quinn criter.	-1.361503
F-statistic	1.375149	Durbin-Watson stat	1.735913
Prob(F-statistic)	0.261512		

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.625643	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.012882
HAC corrected variance (Bartlett kernel)	0.012882

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Date: 04/24/17 Time: 16:31
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.899352	0.135738	-6.625643	0.0000
C	0.003779	0.030489	0.123942	0.9018
@TREND("1992M03")	0.001324	0.000965	1.372008	0.1757

R-squared	0.448553	Mean dependent var	0.000746
Adjusted R-squared	0.428129	S.D. dependent var	0.154199
S.E. of regression	0.116608	Akaike info criterion	-1.408793
Sum squared resid	0.734267	Schwarz criterion	-1.301264
Log likelihood	43.15061	Hannan-Quinn criter.	-1.367004
F-statistic	21.96209	Durbin-Watson stat	2.018573
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.494445	0.0035
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003446
HAC corrected variance (Bartlett kernel)	0.003665

Phillips-Perron Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 04/24/17 Time: 16:31
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.545096	0.123392	-4.417596	0.0000
C	2.546809	0.575009	4.429168	0.0000
@TREND("1992M03")	0.004325	0.001110	3.897917	0.0003

R-squared	0.265744	Mean dependent var	0.005305
Adjusted R-squared	0.238550	S.D. dependent var	0.069120
S.E. of regression	0.060315	Akaike info criterion	-2.727273
Sum squared resid	0.196447	Schwarz criterion	-2.619744
Log likelihood	80.72729	Hannan-Quinn criter.	-2.685484
F-statistic	9.771940	Durbin-Watson stat	1.868069
Prob(F-statistic)	0.000239		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.193610	0.9917
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.69E-06
HAC corrected variance (Bartlett kernel)	3.69E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 04/24/17 Time: 16:31
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.005131	0.026563	-0.193155	0.8476
C	-0.001983	0.002520	-0.786658	0.4349
@TREND("1992M03")	6.30E-05	2.45E-05	2.570954	0.0129

R-squared	0.246006	Mean dependent var	-0.000594
Adjusted R-squared	0.218080	S.D. dependent var	0.002231
S.E. of regression	0.001973	Akaike info criterion	-9.567474
Sum squared resid	0.000210	Schwarz criterion	-9.459945
Log likelihood	275.6730	Hannan-Quinn criter.	-9.525685
F-statistic	8.809287	Durbin-Watson stat	1.961515
Prob(F-statistic)	0.000489		

Null Hypothesis: LINT has a unit root
Exogenous: Constant
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.013612	0.0396
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	4.14E-06
HAC corrected variance (Bartlett kernel)	4.78E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 04/24/17 Time: 16:33
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.057132	0.018076	-3.160671	0.0026
C	0.003588	0.001351	2.655088	0.0104

R-squared	0.153714	Mean dependent var	-0.000594
Adjusted R-squared	0.138327	S.D. dependent var	0.002231
S.E. of regression	0.002071	Akaike info criterion	-9.487089
Sum squared resid	0.000236	Schwarz criterion	-9.415403
Log likelihood	272.3820	Hannan-Quinn criter.	-9.459230
F-statistic	9.989841	Durbin-Watson stat	1.659380
Prob(F-statistic)	0.002560		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.695753	0.2423
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000146
HAC corrected variance (Bartlett kernel)	0.000203

Phillips-Perron Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 04/24/17 Time: 16:34
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.182988	0.078674	-2.325891	0.0238
C	0.854145	0.366107	2.333046	0.0234
@TREND("1992M03")	0.000501	0.000234	2.138656	0.0370

R-squared	0.091157	Mean dependent var	0.002876
Adjusted R-squared	0.057496	S.D. dependent var	0.012769
S.E. of regression	0.012397	Akaike info criterion	-5.891557
Sum squared resid	0.008299	Schwarz criterion	-5.784028
Log likelihood	170.9094	Hannan-Quinn criter.	-5.849768
F-statistic	2.708088	Durbin-Watson stat	1.760526
Prob(F-statistic)	0.075719		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.917269	0.7758
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000158
HAC corrected variance (Bartlett kernel)	0.000166

Phillips-Perron Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 04/24/17 Time: 18:17
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.030741	0.034565	-0.889344	0.3777
C	0.148241	0.163460	0.906894	0.3684

R-squared	0.014177	Mean dependent var	0.002876
Adjusted R-squared	-0.003747	S.D. dependent var	0.012769
S.E. of regression	0.012793	Akaike info criterion	-5.845341
Sum squared resid	0.009002	Schwarz criterion	-5.773655
Log likelihood	168.5922	Hannan-Quinn criter.	-5.817481
F-statistic	0.790933	Durbin-Watson stat	1.887479
Prob(F-statistic)	0.377692		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.060782	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000160
HAC corrected variance (Bartlett kernel)	0.000160

Phillips-Perron Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 04/24/17 Time: 16:35
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.954202	0.135141	-7.060782	0.0000
C	0.002500	0.003426	0.729555	0.4688
@TREND("1992M03")	8.43E-06	0.000105	0.080613	0.9360

R-squared	0.480185	Mean dependent var	-0.000199
Adjusted R-squared	0.460933	S.D. dependent var	0.017691
S.E. of regression	0.012989	Akaike info criterion	-5.798207
Sum squared resid	0.009111	Schwarz criterion	-5.690678
Log likelihood	168.2489	Hannan-Quinn criter.	-5.756418
F-statistic	24.94155	Durbin-Watson stat	2.014779
Prob(F-statistic)	0.000000		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.108463	0.9185
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.57E-05
HAC corrected variance (Bartlett kernel)	1.58E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 04/24/17 Time: 16:35
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.066165	0.060336	-1.096621	0.2777
C	0.310071	0.282449	1.097792	0.2772
@TREND("1992M03")	0.000130	8.53E-05	1.525640	0.1329

R-squared	0.052444	Mean dependent var	0.001559
Adjusted R-squared	0.017349	S.D. dependent var	0.004104
S.E. of regression	0.004068	Akaike info criterion	-8.120160
Sum squared resid	0.000894	Schwarz criterion	-8.012631
Log likelihood	234.4246	Hannan-Quinn criter.	-8.078370
F-statistic	1.494359	Durbin-Watson stat	1.947131
Prob(F-statistic)	0.233524		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.588872	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.60E-05
HAC corrected variance (Bartlett kernel)	1.60E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 04/24/17 Time: 16:35
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-1.036738	0.136613	-7.588872	0.0000
C	0.000339	0.001075	0.315653	0.7535
@TREND("1992M03")	4.56E-05	3.38E-05	1.349773	0.1827

R-squared	0.516221	Mean dependent var	0.000000
Adjusted R-squared	0.498303	S.D. dependent var	0.005803
S.E. of regression	0.004110	Akaike info criterion	-8.099473
Sum squared resid	0.000912	Schwarz criterion	-7.991944
Log likelihood	233.8350	Hannan-Quinn criter.	-8.057683
F-statistic	28.81063	Durbin-Watson stat	1.973944
Prob(F-statistic)	0.000000		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.000251	0.1412
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000284
HAC corrected variance (Bartlett kernel)	0.000260

Phillips-Perron Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 04/24/17 Time: 16:36
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.320097	0.102876	-3.111497	0.0030
C	1.531411	0.488344	3.135925	0.0028
@TREND("1992M03")	0.003383	0.001116	3.030979	0.0037

R-squared	0.154713	Mean dependent var	0.010239
Adjusted R-squared	0.123406	S.D. dependent var	0.018493
S.E. of regression	0.017314	Akaike info criterion	-5.223416
Sum squared resid	0.016188	Schwarz criterion	-5.115887
Log likelihood	151.8674	Hannan-Quinn criter.	-5.181627
F-statistic	4.941829	Durbin-Watson stat	2.294251
Prob(F-statistic)	0.010693		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.850128	0.7968
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000332
HAC corrected variance (Bartlett kernel)	0.000145

Phillips-Perron Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 04/24/17 Time: 16:36
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.010724	0.013770	-0.778805	0.4394
C	0.064377	0.069557	0.925529	0.3587

R-squared	0.010908	Mean dependent var	0.010239
Adjusted R-squared	-0.007076	S.D. dependent var	0.018493
S.E. of regression	0.018558	Akaike info criterion	-5.101392
Sum squared resid	0.018942	Schwarz criterion	-5.029706
Log likelihood	147.3897	Hannan-Quinn criter.	-5.073532
F-statistic	0.606537	Durbin-Watson stat	2.702431
Prob(F-statistic)	0.439433		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant
Bandwidth: 8 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.02488	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000294
HAC corrected variance (Bartlett kernel)	0.000177

Phillips-Perron Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 04/24/17 Time: 16:36
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.353830	0.126104	-10.73580	0.0000
C	0.013795	0.002636	5.232927	0.0000

R-squared	0.676960	Mean dependent var	0.000191
Adjusted R-squared	0.671086	S.D. dependent var	0.030431
S.E. of regression	0.017453	Akaike info criterion	-5.224205
Sum squared resid	0.016753	Schwarz criterion	-5.152519
Log likelihood	150.8898	Hannan-Quinn criter.	-5.196345
F-statistic	115.2573	Durbin-Watson stat	2.200559
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.057732	0.1263
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000204
HAC corrected variance (Bartlett kernel)	0.000201

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 04/24/17 Time: 16:36
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.289253	0.094081	-3.074529	0.0033
C	1.315496	0.427656	3.076060	0.0033
@TREND("1992M03")	0.000700	0.000254	2.757735	0.0079

R-squared	0.149057	Mean dependent var	0.000970
Adjusted R-squared	0.117541	S.D. dependent var	0.015625
S.E. of regression	0.014678	Akaike info criterion	-5.553684
Sum squared resid	0.011635	Schwarz criterion	-5.446155
Log likelihood	161.2800	Hannan-Quinn criter.	-5.511894
F-statistic	4.729505	Durbin-Watson stat	2.008128
Prob(F-statistic)	0.012803		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.063544	0.7242
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000233
HAC corrected variance (Bartlett kernel)	0.000160

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 04/24/17 Time: 16:37
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.059652	0.046367	-1.286522	0.2036
C	0.276101	0.213866	1.290999	0.2021

R-squared	0.029214	Mean dependent var	0.000970
Adjusted R-squared	0.011564	S.D. dependent var	0.015625
S.E. of regression	0.015535	Akaike info criterion	-5.457011
Sum squared resid	0.013273	Schwarz criterion	-5.385325
Log likelihood	157.5248	Hannan-Quinn criter.	-5.429151
F-statistic	1.655140	Durbin-Watson stat	2.217557
Prob(F-statistic)	0.203650		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.679817	0.0000
Test critical values:	1% level	-4.127338	
	5% level	-3.490662	
	10% level	-3.173943	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000235
HAC corrected variance (Bartlett kernel)	0.000183

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Date: 04/24/17 Time: 16:37
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.142932	0.134692	-8.485541	0.0000
C	0.000795	0.004118	0.192964	0.8477
@TREND("1992M03")	1.12E-05	0.000127	0.088456	0.9298

R-squared	0.571446	Mean dependent var	0.000000
Adjusted R-squared	0.555574	S.D. dependent var	0.023622
S.E. of regression	0.015748	Akaike info criterion	-5.413012
Sum squared resid	0.013392	Schwarz criterion	-5.305483
Log likelihood	157.2708	Hannan-Quinn criter.	-5.371222
F-statistic	36.00260	Durbin-Watson stat	2.075609
Prob(F-statistic)	0.000000		

K 1.3 KPSS Unit Root Tests

Null Hypothesis: LM2 is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.180524
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000514
HAC corrected variance (Bartlett kernel)	0.001429

KPSS Test Equation
Dependent Variable: LM2
Method: Least Squares
Date: 05/09/17 Time: 13:23
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.758729	0.006033	788.8138	0.0000
@TREND("1992M03")	0.010703	0.000186	57.61437	0.0000

R-squared	0.983701	Mean dependent var	5.058402
Adjusted R-squared	0.983405	S.D. dependent var	0.179110
S.E. of regression	0.023074	Akaike info criterion	-4.665806
Sum squared resid	0.029281	Schwarz criterion	-4.594120
Log likelihood	134.9755	Hannan-Quinn criter.	-4.637946
F-statistic	3319.415	Durbin-Watson stat	0.653641
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.095240
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000335
HAC corrected variance (Bartlett kernel)	9.96E-05

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 05/09/17 Time: 13:24
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011995	0.004871	2.462438	0.0170
@TREND("1992M03")	-6.27E-05	0.000150	-0.417942	0.6776

R-squared	0.003166	Mean dependent var	0.010239
Adjusted R-squared	-0.014958	S.D. dependent var	0.018493
S.E. of regression	0.018630	Akaike info criterion	-5.093595
Sum squared resid	0.019090	Schwarz criterion	-5.021909
Log likelihood	147.1675	Hannan-Quinn criter.	-5.065735
F-statistic	0.174675	Durbin-Watson stat	2.710372
Prob(F-statistic)	0.677617		

Null Hypothesis: D(LM2) is stationary
Exogenous: Constant
Bandwidth: 8 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.140939
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000336
HAC corrected variance (Bartlett kernel)	0.000107

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010239	0.002449	4.180388	0.0001

R-squared	0.000000	Mean dependent var	0.010239
Adjusted R-squared	0.000000	S.D. dependent var	0.018493
S.E. of regression	0.018493	Akaike info criterion	-5.125512
Sum squared resid	0.019151	Schwarz criterion	-5.089669
Log likelihood	147.0771	Hannan-Quinn criter.	-5.111582
Durbin-Watson stat	2.701781		

K 2 For Meltdown Period

K 2.1 ADF Unit Root Test

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.092797	0.5331
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.159094	0.076020	-2.092797	0.0441
D(LDSEGEN(-1))	0.226413	0.112182	2.018258	0.0518

D(LDSEGEN(-2))	-0.146646	0.116137	-1.262703	0.2155
C	0.914930	0.492222	1.858774	0.0720
@TREND("1996M11")	-0.002853	0.003362	-0.848424	0.4023

R-squared	0.366471	Mean dependent var	-0.047683
Adjusted R-squared	0.289680	S.D. dependent var	0.110861
S.E. of regression	0.093434	Akaike info criterion	-1.781034
Sum squared resid	0.288090	Schwarz criterion	-1.565563
Log likelihood	38.83965	Hannan-Quinn criter.	-1.704371
F-statistic	4.772292	Durbin-Watson stat	2.434122
Prob(F-statistic)	0.003777		

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.386195	0.0178
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.106921	0.031576	-3.386195	0.0018
D(LDSEGEN(-1))	0.252669	0.115484	2.187915	0.0359
D(LDSEGEN(-2))	-0.243025	0.114696	-2.118861	0.0417
D(LDSEGEN(-3))	0.129363	0.109765	1.178550	0.2470
C	0.566751	0.181435	3.123720	0.0037

R-squared	0.378798	Mean dependent var	-0.047683
Adjusted R-squared	0.303501	S.D. dependent var	0.110861
S.E. of regression	0.092521	Akaike info criterion	-1.800685
Sum squared resid	0.282484	Schwarz criterion	-1.585213
Log likelihood	39.21301	Hannan-Quinn criter.	-1.724021
F-statistic	5.030713	Durbin-Watson stat	2.580426
Prob(F-statistic)	0.002810		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.759993	0.0301
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LIPI)
Method: Least Squares
Date: 12/14/16 Time: 20:40
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.805615	0.214260	-3.759993	0.0007
D(LIPI(-1))	0.414400	0.178382	2.323107	0.0265
D(LIPI(-2))	0.097638	0.178873	0.545850	0.5888
C	4.050407	1.076204	3.763607	0.0007
@TREND("1996M11")	0.003759	0.001381	2.722878	0.0103

R-squared	0.364094	Mean dependent var	0.009070
Adjusted R-squared	0.287015	S.D. dependent var	0.081555
S.E. of regression	0.068863	Akaike info criterion	-2.391303
Sum squared resid	0.156492	Schwarz criterion	-2.175831
Log likelihood	50.43476	Hannan-Quinn criter.	-2.314640
F-statistic	4.723624	Durbin-Watson stat	1.904113
Prob(F-statistic)	0.003995		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.107195	0.9929
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 12/14/16 Time: 20:41
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.019679	0.183577	-0.107195	0.9153
D(LINT(-1))	-0.329413	0.240192	-1.371458	0.1795
D(LINT(-2))	-0.044669	0.209598	-0.213118	0.8325
C	0.003153	0.013513	0.233355	0.8169
@TREND("1996M11")	-6.01E-05	0.000116	-0.518699	0.6074

R-squared	0.151577	Mean dependent var	0.000248
Adjusted R-squared	0.048738	S.D. dependent var	0.002712
S.E. of regression	0.002645	Akaike info criterion	-8.910200
Sum squared resid	0.000231	Schwarz criterion	-8.694728
Log likelihood	174.2938	Hannan-Quinn criter.	-8.833537
F-statistic	1.473928	Durbin-Watson stat	1.986685
Prob(F-statistic)	0.232433		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.018634	0.0012
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Date: 12/14/16 Time: 20:42
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-1.404335	0.279824	-5.018634	0.0000
D(LINT(-1),2)	0.057196	0.171451	0.333597	0.7407
C	0.001708	0.000893	1.913389	0.0641
@TREND("1996M11")	-7.17E-05	4.06E-05	-1.766852	0.0862

R-squared	0.664481	Mean dependent var	-7.54E-05
Adjusted R-squared	0.634876	S.D. dependent var	0.004313
S.E. of regression	0.002606	Akaike info criterion	-8.962483
Sum squared resid	0.000231	Schwarz criterion	-8.790106
Log likelihood	174.2872	Hannan-Quinn criter.	-8.901153
F-statistic	22.44518	Durbin-Watson stat	1.988599
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.565554	0.0008
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Date: 12/14/16 Time: 20:42
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-1.249674	0.273718	-4.565554	0.0001
D(LINT(-1),2)	-0.017056	0.171185	-0.099632	0.9212
C	0.000328	0.000445	0.737020	0.4660

R-squared	0.633675	Mean dependent var	-7.54E-05
Adjusted R-squared	0.612742	S.D. dependent var	0.004313
S.E. of regression	0.002684	Akaike info criterion	-8.927272
Sum squared resid	0.000252	Schwarz criterion	-8.797989
Log likelihood	172.6182	Hannan-Quinn criter.	-8.881274
F-statistic	30.27176	Durbin-Watson stat	1.984239
Prob(F-statistic)	0.000000		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.857013	0.1872
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 12/14/16 Time: 20:42
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.356348	0.124727	-2.857013	0.0073
D(LCPI(-1))	0.240983	0.163289	1.475812	0.1495
D(LCPI(-2))	0.199373	0.168020	1.186604	0.2439
C	1.715512	0.598648	2.865644	0.0072
@TREND("1996M11")	0.002162	0.000769	2.811002	0.0082

R-squared	0.206334	Mean dependent var	0.005647
Adjusted R-squared	0.110132	S.D. dependent var	0.008612
S.E. of regression	0.008124	Akaike info criterion	-6.665815
Sum squared resid	0.002178	Schwarz criterion	-6.450343
Log likelihood	131.6505	Hannan-Quinn criter.	-6.589151
F-statistic	2.144798	Durbin-Watson stat	1.988134
Prob(F-statistic)	0.097257		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.464097	0.8873
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 12/14/16 Time: 20:42
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.009745	0.020997	-0.464097	0.6455
D(LCPI(-1))	0.105998	0.167504	0.632809	0.5310
C	0.052977	0.103164	0.513516	0.6108

R-squared	0.015746	Mean dependent var	0.005647
Adjusted R-squared	-0.040497	S.D. dependent var	0.008612
S.E. of regression	0.008785	Akaike info criterion	-6.555856
Sum squared resid	0.002701	Schwarz criterion	-6.426573
Log likelihood	127.5613	Hannan-Quinn criter.	-6.509859
F-statistic	0.279957	Durbin-Watson stat	2.017750
Prob(F-statistic)	0.757493		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.391262	0.0004
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 12/14/16 Time: 20:43
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.901753	0.167262	-5.391262	0.0000
C	0.005245	0.002918	1.797358	0.0809
@TREND("1996M11")	-7.74E-06	0.000131	-0.059313	0.9530

R-squared	0.454563	Mean dependent var	9.79E-05
Adjusted R-squared	0.423395	S.D. dependent var	0.011604
S.E. of regression	0.008812	Akaike info criterion	-6.549822
Sum squared resid	0.002718	Schwarz criterion	-6.420539
Log likelihood	127.4466	Hannan-Quinn criter.	-6.503824
F-statistic	14.58438	Durbin-Watson stat	2.009503
Prob(F-statistic)	0.000025		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.021005	0.1400
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 12/14/16 Time: 20:43
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.515489	0.170635	-3.021005	0.0048
D(LEXR(-1))	0.065228	0.173649	0.375634	0.7095
C	2.463981	0.814006	3.026982	0.0047
@TREND("1996M11")	0.002471	0.000810	3.051593	0.0044

R-squared	0.244497	Mean dependent var	0.004813
Adjusted R-squared	0.177835	S.D. dependent var	0.008377
S.E. of regression	0.007596	Akaike info criterion	-6.823139
Sum squared resid	0.001962	Schwarz criterion	-6.650761
Log likelihood	133.6396	Hannan-Quinn criter.	-6.761808
F-statistic	3.667703	Durbin-Watson stat	1.982006
Prob(F-statistic)	0.021611		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.036049	0.9561
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 04/21/17 Time: 21:09
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	0.000933	0.025874	0.036049	0.9715
D(LEXR(-1))	-0.260091	0.176114	-1.476834	0.1492
D(LEXR(-2))	-0.367505	0.193737	-1.896933	0.0666
D(LEXR(-3))	-0.038969	0.199665	-0.195171	0.8465
C	0.003251	0.125592	0.025884	0.9795

R-squared	0.133118	Mean dependent var	0.004813
Adjusted R-squared	0.028041	S.D. dependent var	0.008377
S.E. of regression	0.008259	Akaike info criterion	-6.632988
Sum squared resid	0.002251	Schwarz criterion	-6.417516
Log likelihood	131.0268	Hannan-Quinn criter.	-6.556325
F-statistic	1.266862	Durbin-Watson stat	2.000567
Prob(F-statistic)	0.302698		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.159961	0.0116
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 12/14/16 Time: 20:43
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-1.663960	0.399994	-4.159961	0.0002
D(LEXR(-1),2)	0.401155	0.305341	1.313794	0.1980
D(LEXR(-2),2)	0.036927	0.199490	0.185107	0.8543
C	0.007097	0.003191	2.224175	0.0331
@TREND("1996M11")	3.66E-05	0.000123	0.297990	0.7676

R-squared	0.637894	Mean dependent var	0.000000
Adjusted R-squared	0.594002	S.D. dependent var	0.012944
S.E. of regression	0.008248	Akaike info criterion	-6.635636
Sum squared resid	0.002245	Schwarz criterion	-6.420164
Log likelihood	131.0771	Hannan-Quinn criter.	-6.558973
F-statistic	14.53338	Durbin-Watson stat	1.998593
Prob(F-statistic)	0.000001		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.865123	0.6527
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 12/14/16 Time: 20:44
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.407649	0.218564	-1.865123	0.0708
D(LM2(-1))	-0.199469	0.195053	-1.022642	0.3137
C	2.175103	1.160812	1.873777	0.0696
@TREND("1996M11")	0.003935	0.001996	1.971146	0.0569

R-squared	0.241799	Mean dependent var	0.010582
Adjusted R-squared	0.174899	S.D. dependent var	0.017280
S.E. of regression	0.015696	Akaike info criterion	-5.371478
Sum squared resid	0.008377	Schwarz criterion	-5.199100
Log likelihood	106.0581	Hannan-Quinn criter.	-5.310147
F-statistic	3.614330	Durbin-Watson stat	1.810326
Prob(F-statistic)	0.022858		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.782295	0.0023
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 12/14/16 Time: 20:44
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-2.620020	0.547858	-4.782295	0.0000
D(LM2(-1),2)	1.039493	0.440081	2.362048	0.0244
D(LM2(-2),2)	0.675244	0.320106	2.109440	0.0428
D(LM2(-3),2)	0.201662	0.182114	1.107339	0.2764
C	0.018554	0.006243	2.972020	0.0056
@TREND("1996M11")	0.000385	0.000239	1.614306	0.1163

R-squared	0.732471	Mean dependent var	0.001120
Adjusted R-squared	0.690670	S.D. dependent var	0.027776
S.E. of regression	0.015448	Akaike info criterion	-5.358719
Sum squared resid	0.007637	Schwarz criterion	-5.100153
Log likelihood	107.8157	Hannan-Quinn criter.	-5.266723
F-statistic	17.52268	Durbin-Watson stat	2.130259
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.272345	0.8797
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 12/14/16 Time: 20:45
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.171306	0.134638	-1.272345	0.2119
D(LGDPRICE(-1))	-0.028463	0.191634	-0.148525	0.8828
C	0.795162	0.629323	1.263519	0.2150
@TREND("1996M11")	-0.000480	0.000638	-0.752227	0.4571

R-squared	0.069727	Mean dependent var	-0.001051
Adjusted R-squared	-0.012356	S.D. dependent var	0.021102
S.E. of regression	0.021232	Akaike info criterion	-4.767287
Sum squared resid	0.015328	Schwarz criterion	-4.594909
Log likelihood	94.57845	Hannan-Quinn criter.	-4.705956
F-statistic	0.849472	Durbin-Watson stat	1.831682
Prob(F-statistic)	0.476573		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.262177	0.6370
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 12/14/16 Time: 20:45
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.083156	0.065883	-1.262177	0.2152
D(LGDPRICE(-1))	-0.073793	0.180780	-0.408191	0.6856
C	0.381005	0.302924	1.257758	0.2168

R-squared	0.054245	Mean dependent var	-0.001051
Adjusted R-squared	0.000202	S.D. dependent var	0.021102
S.E. of regression	0.021100	Akaike info criterion	-4.803413
Sum squared resid	0.015583	Schwarz criterion	-4.674130
Log likelihood	94.26485	Hannan-Quinn criter.	-4.757415
F-statistic	1.003736	Durbin-Watson stat	1.868904
Prob(F-statistic)	0.376813		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.177685	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Date: 12/14/16 Time: 20:45
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.115532	0.180574	-6.177685	0.0000
C	-0.005508	0.006830	-0.806409	0.4255
@TREND("1996M11")	0.000227	0.000317	0.715033	0.4793

R-squared	0.524504	Mean dependent var	0.001247
Adjusted R-squared	0.497332	S.D. dependent var	0.030211
S.E. of regression	0.021419	Akaike info criterion	-4.773404
Sum squared resid	0.016057	Schwarz criterion	-4.644121
Log likelihood	93.69467	Hannan-Quinn criter.	-4.727406
F-statistic	19.30364	Durbin-Watson stat	1.883682
Prob(F-statistic)	0.000002		

K 2.2 PP Unit Root Test

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.646939	0.2631
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.008685
HAC corrected variance (Bartlett kernel)	0.004769

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 05/09/17 Time: 14:44
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.163967	0.065573	-2.500521	0.0172
C	0.937059	0.423006	2.215236	0.0333
@TREND("1996M11")	-0.002775	0.002994	-0.926835	0.3604

R-squared	0.274222	Mean dependent var	-0.047683
Adjusted R-squared	0.232749	S.D. dependent var	0.110861
S.E. of regression	0.097107	Akaike info criterion	-1.750360
Sum squared resid	0.330039	Schwarz criterion	-1.621077
Log likelihood	36.25684	Hannan-Quinn criter.	-1.704362
F-statistic	6.612073	Durbin-Watson stat	2.108789
Prob(F-statistic)	0.003665		

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.271603	0.0001
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.008898
HAC corrected variance (Bartlett kernel)	0.003177

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 05/09/17 Time: 14:46
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.110646	0.031404	-3.523313	0.0012
C	0.582187	0.179462	3.244069	0.0025

R-squared	0.256409	Mean dependent var	-0.047683
Adjusted R-squared	0.235754	S.D. dependent var	0.110861
S.E. of regression	0.096916	Akaike info criterion	-1.778744
Sum squared resid	0.338139	Schwarz criterion	-1.692556
Log likelihood	35.79614	Hannan-Quinn criter.	-1.748079
F-statistic	12.41373	Durbin-Watson stat	2.168356
Prob(F-statistic)	0.001180		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.593618	0.0438
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.004801
HAC corrected variance (Bartlett kernel)	0.005279

Phillips-Perron Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.536605	0.153806	-3.488842	0.0013
C	2.701299	0.773189	3.493711	0.0013
@TREND("1996M11")	0.002546	0.001259	2.023050	0.0508

R-squared	0.258716	Mean dependent var	0.009070
Adjusted R-squared	0.216357	S.D. dependent var	0.081555
S.E. of regression	0.072195	Akaike info criterion	-2.343233
Sum squared resid	0.182424	Schwarz criterion	-2.213950
Log likelihood	47.52144	Hannan-Quinn criter.	-2.297236
F-statistic	6.107702	Durbin-Watson stat	1.580264
Prob(F-statistic)	0.005305		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.998428	0.9323
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.52E-06
HAC corrected variance (Bartlett kernel)	5.45E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.167556	0.129103	-1.297851	0.2028

C	0.013829	0.009754	1.417703	0.1651
@TREND("1996M11")	3.47E-05	7.78E-05	0.445899	0.6584

R-squared	0.089846	Mean dependent var	0.000248
Adjusted R-squared	0.037837	S.D. dependent var	0.002712
S.E. of regression	0.002660	Akaike info criterion	-8.945228
Sum squared resid	0.000248	Schwarz criterion	-8.815945
Log likelihood	172.9593	Hannan-Quinn criter.	-8.899230
F-statistic	1.727519	Durbin-Watson stat	2.341215
Prob(F-statistic)	0.192535		

Null Hypothesis: LINT has a unit root
Exogenous: Constant
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.763503	0.3923
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.55E-06
HAC corrected variance (Bartlett kernel)	4.95E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.117907	0.064609	-1.824919	0.0763
C	0.010256	0.005501	1.864524	0.0704

R-squared	0.084676	Mean dependent var	0.000248
Adjusted R-squared	0.059250	S.D. dependent var	0.002712
S.E. of regression	0.002630	Akaike info criterion	-8.992195
Sum squared resid	0.000249	Schwarz criterion	-8.906006
Log likelihood	172.8517	Hannan-Quinn criter.	-8.961530
F-statistic	3.330328	Durbin-Watson stat	2.448840
Prob(F-statistic)	0.076320		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.330579	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.10E-06
HAC corrected variance (Bartlett kernel)	5.97E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-1.328223	0.159937	-8.304661	0.0000
C	0.001620	0.000842	1.924334	0.0625
@TREND("1996M11")	-6.84E-05	3.89E-05	-1.760601	0.0870

R-squared	0.663383	Mean dependent var	-7.54E-05
Adjusted R-squared	0.644148	S.D. dependent var	0.004313
S.E. of regression	0.002573	Akaike info criterion	-9.011847
Sum squared resid	0.000232	Schwarz criterion	-8.882564
Log likelihood	174.2251	Hannan-Quinn criter.	-8.965849
F-statistic	34.48784	Durbin-Watson stat	2.029967
Prob(F-statistic)	0.000000		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.456726	0.3465
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.34E-05
HAC corrected variance (Bartlett kernel)	8.20E-05

Phillips-Perron Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.244542	0.111153	-2.200047	0.0345
C	1.180481	0.533977	2.210736	0.0337
@TREND("1996M11")	0.001494	0.000692	2.159309	0.0378

R-squared	0.121514	Mean dependent var	0.005647
Adjusted R-squared	0.071315	S.D. dependent var	0.008612
S.E. of regression	0.008300	Akaike info criterion	-6.669541
Sum squared resid	0.002411	Schwarz criterion	-6.540258
Log likelihood	129.7213	Hannan-Quinn criter.	-6.623543
F-statistic	2.420641	Durbin-Watson stat	1.625427
Prob(F-statistic)	0.103600		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.419267	0.8956
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.19E-05
HAC corrected variance (Bartlett kernel)	7.86E-05

Phillips-Perron Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.008338	0.020705	-0.402700	0.6896
C	0.046646	0.101820	0.458126	0.6496

R-squared	0.004484	Mean dependent var	0.005647
Adjusted R-squared	-0.023169	S.D. dependent var	0.008612
S.E. of regression	0.008712	Akaike info criterion	-6.597112
Sum squared resid	0.002732	Schwarz criterion	-6.510923
Log likelihood	127.3451	Hannan-Quinn criter.	-6.566446
F-statistic	0.162168	Durbin-Watson stat	1.804549
Prob(F-statistic)	0.689550		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.391262	0.0004
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.15E-05
HAC corrected variance (Bartlett kernel)	7.15E-05

Phillips-Perron Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.901753	0.167262	-5.391262	0.0000

C	0.005245	0.002918	1.797358	0.0809
@TREND("1996M11")	-7.74E-06	0.000131	-0.059313	0.9530

R-squared	0.454563	Mean dependent var	9.79E-05
Adjusted R-squared	0.423395	S.D. dependent var	0.011604
S.E. of regression	0.008812	Akaike info criterion	-6.549822
Sum squared resid	0.002718	Schwarz criterion	-6.420539
Log likelihood	127.4466	Hannan-Quinn criter.	-6.503824
F-statistic	14.58438	Durbin-Watson stat	2.009503
Prob(F-statistic)	0.000025		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.354448	0.0730
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.18E-05
HAC corrected variance (Bartlett kernel)	5.35E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.483063	0.145371	-3.322966	0.0021
C	2.309460	0.693744	3.328982	0.0021
@TREND("1996M11")	0.002322	0.000698	3.329203	0.0021

R-squared	0.241361	Mean dependent var	0.004813
Adjusted R-squared	0.198011	S.D. dependent var	0.008377
S.E. of regression	0.007502	Akaike info criterion	-6.871629
Sum squared resid	0.001970	Schwarz criterion	-6.742346
Log likelihood	133.5610	Hannan-Quinn criter.	-6.825631
F-statistic	5.567634	Durbin-Watson stat	1.931813
Prob(F-statistic)	0.007954		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.058908	0.9581
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.83E-05
HAC corrected variance (Bartlett kernel)	3.40E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 05/09/17 Time: 14:52
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.005258	0.026167	-0.200924	0.8419
C	0.030365	0.127176	0.238761	0.8126

R-squared	0.001120	Mean dependent var	0.004813
Adjusted R-squared	-0.026627	S.D. dependent var	0.008377
S.E. of regression	0.008488	Akaike info criterion	-6.649152
Sum squared resid	0.002594	Schwarz criterion	-6.562963
Log likelihood	128.3339	Hannan-Quinn criter.	-6.618486
F-statistic	0.040370	Durbin-Watson stat	2.377817
Prob(F-statistic)	0.841889		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.472011	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.55E-05
HAC corrected variance (Bartlett kernel)	4.86E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 05/09/17 Time: 14:52
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-1.200165	0.166270	-7.218166	0.0000
C	0.004877	0.002743	1.777852	0.0841
@TREND("1996M11")	4.87E-05	0.000125	0.388292	0.7002

R-squared	0.598646	Mean dependent var	0.000000
Adjusted R-squared	0.575712	S.D. dependent var	0.012944
S.E. of regression	0.008432	Akaike info criterion	-6.637994
Sum squared resid	0.002488	Schwarz criterion	-6.508711
Log likelihood	129.1219	Hannan-Quinn criter.	-6.591996
F-statistic	26.10246	Durbin-Watson stat	2.112252
Prob(F-statistic)	0.000000		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.876562	0.1810
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000227
HAC corrected variance (Bartlett kernel)	0.000212

Phillips-Perron Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 05/09/17 Time: 14:53
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.536361	0.178804	-2.999718	0.0050
C	2.857621	0.950386	3.006801	0.0049
@TREND("1996M11")	0.005093	0.001645	3.094857	0.0039

R-squared	0.218478	Mean dependent var	0.010582
Adjusted R-squared	0.173819	S.D. dependent var	0.017280
S.E. of regression	0.015707	Akaike info criterion	-5.393814
Sum squared resid	0.008634	Schwarz criterion	-5.264531
Log likelihood	105.4825	Hannan-Quinn criter.	-5.347816
F-statistic	4.892194	Durbin-Watson stat	1.936678
Prob(F-statistic)	0.013381		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.563985	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000243
HAC corrected variance (Bartlett kernel)	0.000140

Phillips-Perron Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 05/09/17 Time: 14:53
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.408966	0.165015	-8.538386	0.0000
C	0.010067	0.005336	1.886721	0.0675
@TREND("1996M11")	0.000237	0.000241	0.984990	0.3314

R-squared	0.676518	Mean dependent var	0.001120
Adjusted R-squared	0.658034	S.D. dependent var	0.027776
S.E. of regression	0.016243	Akaike info criterion	-5.326698
Sum squared resid	0.009234	Schwarz criterion	-5.197414
Log likelihood	104.2073	Hannan-Quinn criter.	-5.280700
F-statistic	36.59890	Durbin-Watson stat	1.987236
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.410125	0.8418
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000404
HAC corrected variance (Bartlett kernel)	0.000396

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.178446	0.123991	-1.439187	0.1590
C	0.828602	0.579403	1.430095	0.1616
@TREND("1996M11")	-0.000510	0.000597	-0.853639	0.3991

R-squared	0.069124	Mean dependent var	-0.001051
Adjusted R-squared	0.015931	S.D. dependent var	0.021102
S.E. of regression	0.020934	Akaike info criterion	-4.819270
Sum squared resid	0.015337	Schwarz criterion	-4.689987
Log likelihood	94.56613	Hannan-Quinn criter.	-4.773272
F-statistic	1.299487	Durbin-Watson stat	1.870552
Prob(F-statistic)	0.285503		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.342444	0.5998
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000412
HAC corrected variance (Bartlett kernel)	0.000387

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.087955	0.064071	-1.372763	0.1783
C	0.403231	0.294521	1.369105	0.1794

R-squared	0.049743	Mean dependent var	-0.001051
Adjusted R-squared	0.023347	S.D. dependent var	0.021102
S.E. of regression	0.020855	Akaike info criterion	-4.851295
Sum squared resid	0.015657	Schwarz criterion	-4.765106
Log likelihood	94.17461	Hannan-Quinn criter.	-4.820630
F-statistic	1.884477	Durbin-Watson stat	1.990277
Prob(F-statistic)	0.178318		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.177685	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000423
HAC corrected variance (Bartlett kernel)	0.000423

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.115532	0.180574	-6.177685	0.0000
C	-0.005508	0.006830	-0.806409	0.4255
@TREND("1996M11")	0.000227	0.000317	0.715033	0.4793

R-squared	0.524504	Mean dependent var	0.001247
Adjusted R-squared	0.497332	S.D. dependent var	0.030211
S.E. of regression	0.021419	Akaike info criterion	-4.773404
Sum squared resid	0.016057	Schwarz criterion	-4.644121
Log likelihood	93.69467	Hannan-Quinn criter.	-4.727406
F-statistic	19.30364	Durbin-Watson stat	1.883682
Prob(F-statistic)	0.000002		

K 3 For Recovery Period

K 3.1 ADF Unit Root

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.443561	0.3556
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.099014	0.040520	-2.443561	0.0162
D(LDSEGEN(-1))	0.132378	0.095876	1.380724	0.1702
D(LDSEGEN(-2))	0.069233	0.098259	0.704594	0.4826
D(LDSEGEN(-3))	0.177551	0.091950	1.930945	0.0561
D(LDSEGEN(-4))	0.095460	0.092540	1.031550	0.3046
D(LDSEGEN(-5))	0.240458	0.093071	2.583611	0.0111
D(LDSEGEN(-6))	0.072753	0.096495	0.753958	0.4525
D(LDSEGEN(-7))	-0.023011	0.097049	-0.237106	0.8130
D(LDSEGEN(-8))	-0.303623	0.096700	-3.139833	0.0022
D(LDSEGEN(-9))	0.211855	0.100067	2.117137	0.0366
D(LDSEGEN(-10))	0.053405	0.101362	0.526877	0.5994
C	0.510355	0.207026	2.465180	0.0153
@TREND("2000M01")	0.001478	0.000575	2.569328	0.0116

R-squared	0.247909	Mean dependent var	0.016206
Adjusted R-squared	0.163563	S.D. dependent var	0.065863
S.E. of regression	0.060236	Akaike info criterion	-2.679087
Sum squared resid	0.388237	Schwarz criterion	-2.377109
Log likelihood	173.7452	Hannan-Quinn criter.	-2.556452
F-statistic	2.939170	Durbin-Watson stat	2.003862
Prob(F-statistic)	0.001454		

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.053125	0.1226
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Date: 06/12/17 Time: 15:54
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.754080	0.246986	-3.053125	0.0029
D(LDSEGEN(-1),2)	-0.158708	0.237194	-0.669104	0.5049
D(LDSEGEN(-2),2)	-0.136491	0.217520	-0.627486	0.5317
D(LDSEGEN(-3),2)	0.010245	0.208053	0.049241	0.9608
D(LDSEGEN(-4),2)	0.073425	0.200661	0.365916	0.7151
D(LDSEGEN(-5),2)	0.277013	0.192822	1.436622	0.1537
D(LDSEGEN(-6),2)	0.292056	0.182491	1.600385	0.1124
D(LDSEGEN(-7),2)	0.206667	0.166647	1.240150	0.2176
D(LDSEGEN(-8),2)	-0.166826	0.136803	-1.219456	0.2253
D(LDSEGEN(-9),2)	0.001193	0.101118	0.011803	0.9906
C	0.005202	0.011337	0.458795	0.6473
@TREND("2000M01")	0.000128	0.000164	0.780907	0.4366

R-squared	0.561678	Mean dependent var	0.000360
Adjusted R-squared	0.517034	S.D. dependent var	0.088648
S.E. of regression	0.061607	Akaike info criterion	-2.641451
Sum squared resid	0.409902	Schwarz criterion	-2.362702
Log likelihood	170.4871	Hannan-Quinn criter.	-2.528250
F-statistic	12.58130	Durbin-Watson stat	1.995022
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: Constant
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.986200	0.0391
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.730886	0.244755	-2.986200	0.0035
D(LDSEGEN(-1),2)	-0.176201	0.235711	-0.747530	0.4564
D(LDSEGEN(-2),2)	-0.149374	0.216505	-0.689932	0.4917
D(LDSEGEN(-3),2)	-0.000645	0.207214	-0.003113	0.9975
D(LDSEGEN(-4),2)	0.063691	0.199914	0.318592	0.7506
D(LDSEGEN(-5),2)	0.268859	0.192194	1.398891	0.1647
D(LDSEGEN(-6),2)	0.286097	0.182005	1.571921	0.1189

D(LDSEGEN(-7),2)	0.200264	0.166147	1.205343	0.2307
D(LDSEGEN(-8),2)	-0.172948	0.136334	-1.268567	0.2073
D(LDSEGEN(-9),2)	-0.002114	0.100848	-0.020958	0.9833
C	0.012523	0.006363	1.967986	0.0516

R-squared	0.559203	Mean dependent var	0.000360
Adjusted R-squared	0.518763	S.D. dependent var	0.088648
S.E. of regression	0.061496	Akaike info criterion	-2.652488
Sum squared resid	0.412217	Schwarz criterion	-2.396968
Log likelihood	170.1493	Hannan-Quinn criter.	-2.548720
F-statistic	13.82795	Durbin-Watson stat	1.995431
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.593964	0.7899
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 06/12/17 Time: 15:55
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.299358	0.187807	-1.593964	0.1139
D(LIPI(-1))	-0.423101	0.198719	-2.129141	0.0356
D(LIPI(-2))	-0.390775	0.191190	-2.043905	0.0435
D(LIPI(-3))	-0.512467	0.181129	-2.829290	0.0056
D(LIPI(-4))	-0.623468	0.174219	-3.578645	0.0005
D(LIPI(-5))	-0.460427	0.168557	-2.731583	0.0074
D(LIPI(-6))	-0.438240	0.158952	-2.757057	0.0069
D(LIPI(-7))	-0.486851	0.152167	-3.199460	0.0018
D(LIPI(-8))	-0.570092	0.142245	-4.007823	0.0001
D(LIPI(-9))	-0.485471	0.128305	-3.783728	0.0003
D(LIPI(-10))	-0.496589	0.112886	-4.399027	0.0000
D(LIPI(-11))	-0.429775	0.105243	-4.083636	0.0001
D(LIPI(-12))	-0.021237	0.090776	-0.233945	0.8155
C	1.578953	0.963980	1.637952	0.1044
@TREND("2000M01")	0.001981	0.001182	1.675733	0.0968

R-squared	0.576931	Mean dependent var	0.005074
Adjusted R-squared	0.520521	S.D. dependent var	0.063696
S.E. of regression	0.044106	Akaike info criterion	-3.287964
Sum squared resid	0.204263	Schwarz criterion	-2.939527
Log likelihood	212.2778	Hannan-Quinn criter.	-3.146462
F-statistic	10.22759	Durbin-Watson stat	1.991620
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.735502	0.9925
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 06/12/17 Time: 15:55
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	0.013807	0.018772	0.735502	0.4637
D(LIPI(-1))	-0.712470	0.099172	-7.184203	0.0000
D(LIPI(-2))	-0.654691	0.109316	-5.988975	0.0000
D(LIPI(-3))	-0.751393	0.112656	-6.669778	0.0000
D(LIPI(-4))	-0.834398	0.121473	-6.869021	0.0000
D(LIPI(-5))	-0.642199	0.130111	-4.935764	0.0000
D(LIPI(-6))	-0.595705	0.129291	-4.607462	0.0000
D(LIPI(-7))	-0.623946	0.129392	-4.822135	0.0000
D(LIPI(-8))	-0.682312	0.126561	-5.391183	0.0000
D(LIPI(-9))	-0.571124	0.118684	-4.812151	0.0000
D(LIPI(-10))	-0.558707	0.107532	-5.195754	0.0000
D(LIPI(-11))	-0.468323	0.103571	-4.521775	0.0000
D(LIPI(-12))	-0.034539	0.091196	-0.378729	0.7056
C	-0.027343	0.102918	-0.265675	0.7910

R-squared	0.565616	Mean dependent var	0.005074
Adjusted R-squared	0.512343	S.D. dependent var	0.063696
S.E. of regression	0.044481	Akaike info criterion	-3.278238
Sum squared resid	0.209725	Schwarz criterion	-2.953031
Log likelihood	210.6943	Hannan-Quinn criter.	-3.146170
F-statistic	10.61722	Durbin-Watson stat	1.983746
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 11 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.479207	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 06/12/17 Time: 15:55
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-8.069611	1.078939	-7.479207	0.0000
D(LIPI(-1),2)	6.368852	1.013486	6.284106	0.0000
D(LIPI(-2),2)	5.724327	0.936950	6.109532	0.0000
D(LIPI(-3),2)	4.981822	0.856472	5.816680	0.0000
D(LIPI(-4),2)	4.154694	0.765558	5.427015	0.0000
D(LIPI(-5),2)	3.518375	0.665709	5.285156	0.0000
D(LIPI(-6),2)	2.927437	0.565783	5.174134	0.0000
D(LIPI(-7),2)	2.307679	0.460707	5.008994	0.0000
D(LIPI(-8),2)	1.628656	0.355539	4.580806	0.0000
D(LIPI(-9),2)	1.059877	0.258717	4.096668	0.0001
D(LIPI(-10),2)	0.502893	0.174046	2.889429	0.0047
D(LIPI(-11),2)	0.035186	0.091008	0.386633	0.6998
C	0.042484	0.009948	4.270583	0.0000
@TREND("2000M01")	0.000106	0.000118	0.897685	0.3714

R-squared	0.820312	Mean dependent var	-0.001021
Adjusted R-squared	0.798275	S.D. dependent var	0.098913
S.E. of regression	0.044426	Akaike info criterion	-3.280721
Sum squared resid	0.209205	Schwarz criterion	-2.955514
Log likelihood	210.8433	Hannan-Quinn criter.	-3.148653
F-statistic	37.22391	Durbin-Watson stat	1.984340
Prob(F-statistic)	0.000000		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.610286	0.7834
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 06/12/17 Time: 15:56
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.029092	0.018067	-1.610286	0.1103
D(LINT(-1))	0.137819	0.094824	1.453419	0.1490
D(LINT(-2))	0.008265	0.095394	0.086640	0.9311

D(LINT(-3))	-0.011295	0.093578	-0.120703	0.9042
D(LINT(-4))	0.027813	0.088966	0.312623	0.7552
D(LINT(-5))	0.047980	0.090110	0.532464	0.5955
D(LINT(-6))	-0.183086	0.091266	-2.006077	0.0473
D(LINT(-7))	0.242734	0.091679	2.647661	0.0093
D(LINT(-8))	0.155116	0.094622	1.639321	0.1041
D(LINT(-9))	0.122151	0.095846	1.274451	0.2052
C	0.002195	0.001542	1.423842	0.1574
@TREND("2000M01")	-3.36E-06	6.64E-06	-0.505749	0.6141

R-squared	0.168324	Mean dependent var	-0.000106
Adjusted R-squared	0.083616	S.D. dependent var	0.001930
S.E. of regression	0.001848	Akaike info criterion	-9.654851
Sum squared resid	0.000369	Schwarz criterion	-9.376102
Log likelihood	591.2911	Hannan-Quinn criter.	-9.541650
F-statistic	1.987112	Durbin-Watson stat	1.981134
Prob(F-statistic)	0.036454		

Null Hypothesis: LINT has a unit root
Exogenous: Constant
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.591735	0.4837
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Date: 06/12/17 Time: 15:56
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.024195	0.015201	-1.591735	0.1143
D(LINT(-1))	0.133681	0.094147	1.419921	0.1585
D(LINT(-2))	0.001511	0.094132	0.016050	0.9872
D(LINT(-3))	-0.020931	0.091304	-0.229249	0.8191
D(LINT(-4))	0.019571	0.087162	0.224533	0.8228
D(LINT(-5))	0.037930	0.087590	0.433034	0.6658
D(LINT(-6))	-0.195148	0.087793	-2.222818	0.0283
D(LINT(-7))	0.232123	0.088940	2.609869	0.0103
D(LINT(-8))	0.143702	0.091577	1.569193	0.1195
D(LINT(-9))	0.110814	0.092869	1.193225	0.2354
C	0.001642	0.001082	1.517512	0.1320

R-squared	0.166354	Mean dependent var	-0.000106
Adjusted R-squared	0.089873	S.D. dependent var	0.001930
S.E. of regression	0.001842	Akaike info criterion	-9.669152
Sum squared resid	0.000370	Schwarz criterion	-9.413632
Log likelihood	591.1491	Hannan-Quinn criter.	-9.565385
F-statistic	2.175096	Durbin-Watson stat	1.979811
Prob(F-statistic)	0.024520		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.375681	0.3903
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-0.629177	0.264841	-2.375681	0.0193
D(LINT(-1),2)	-0.241835	0.257264	-0.940027	0.3493
D(LINT(-2),2)	-0.250227	0.242881	-1.030244	0.3052
D(LINT(-3),2)	-0.284777	0.217501	-1.309314	0.1932
D(LINT(-4),2)	-0.271918	0.199223	-1.364894	0.1751
D(LINT(-5),2)	-0.243921	0.176796	-1.379676	0.1705
D(LINT(-6),2)	-0.449976	0.149943	-3.000982	0.0033
D(LINT(-7),2)	-0.225556	0.128490	-1.755434	0.0820
D(LINT(-8),2)	-0.094439	0.094975	-0.994359	0.3223
C	-0.000207	0.000393	-0.526943	0.5993
@TREND("2000M01")	2.37E-06	5.65E-06	0.420123	0.6752

R-squared	0.508457	Mean dependent var	1.30E-05
Adjusted R-squared	0.463362	S.D. dependent var	0.002541
S.E. of regression	0.001861	Akaike info criterion	-9.647792
Sum squared resid	0.000378	Schwarz criterion	-9.392272
Log likelihood	589.8675	Hannan-Quinn criter.	-9.544024
F-statistic	11.27508	Durbin-Watson stat	1.979610
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant
Lag Length: 8 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.493492	0.1196
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-0.575155	0.230663	-2.493492	0.0141
D(LINT(-1),2)	-0.293230	0.225470	-1.300530	0.1961
D(LINT(-2),2)	-0.297706	0.214181	-1.389974	0.1673

D(LINT(-3),2)	-0.326585	0.192675	-1.695004	0.0929
D(LINT(-4),2)	-0.308052	0.179027	-1.720702	0.0881
D(LINT(-5),2)	-0.273428	0.161639	-1.691600	0.0936
D(LINT(-6),2)	-0.471360	0.140511	-3.354617	0.0011
D(LINT(-7),2)	-0.239478	0.123677	-1.936315	0.0554
D(LINT(-8),2)	-0.101053	0.093310	-1.082982	0.2812
C	-5.87E-05	0.000172	-0.341594	0.7333

R-squared	0.507661	Mean dependent var	1.30E-05
Adjusted R-squared	0.467379	S.D. dependent var	0.002541
S.E. of regression	0.001854	Akaike info criterion	-9.662841
Sum squared resid	0.000378	Schwarz criterion	-9.430550
Log likelihood	589.7705	Hannan-Quinn criter.	-9.568507
F-statistic	12.60260	Durbin-Watson stat	1.980317
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LINT,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.000282	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINT,3)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1),2)	-2.810990	0.401554	-7.000282	0.0000
D(LINT(-1),3)	1.139721	0.347342	3.281261	0.0014
D(LINT(-2),3)	0.633621	0.269939	2.347274	0.0207
D(LINT(-3),3)	0.246519	0.182607	1.349999	0.1797
D(LINT(-4),3)	0.020841	0.093362	0.223231	0.8238
C	0.000186	0.000391	0.475275	0.6355
@TREND("2000M01")	-2.66E-06	5.68E-06	-0.468419	0.6404

R-squared	0.762778	Mean dependent var	7.74E-06
Adjusted R-squared	0.750183	S.D. dependent var	0.004293
S.E. of regression	0.002146	Akaike info criterion	-9.393975
Sum squared resid	0.000520	Schwarz criterion	-9.231371
Log likelihood	570.6385	Hannan-Quinn criter.	-9.327941
F-statistic	60.55797	Durbin-Watson stat	2.001453
Prob(F-statistic)	0.000000		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.934613	0.1556
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.059119	0.020145	-2.934613	0.0041
D(LCPI(-1))	0.323777	0.092797	3.489082	0.0007
D(LCPI(-2))	-0.360140	0.096843	-3.718807	0.0003
D(LCPI(-3))	-0.010832	0.103999	-0.104155	0.9172
D(LCPI(-4))	-0.213082	0.101006	-2.109597	0.0372
D(LCPI(-5))	-0.150501	0.102607	-1.466770	0.1454
D(LCPI(-6))	-0.121238	0.105084	-1.153734	0.2512
D(LCPI(-7))	-0.279063	0.104618	-2.667453	0.0088
D(LCPI(-8))	-0.013808	0.107224	-0.128775	0.8978
D(LCPI(-9))	-0.267860	0.099931	-2.680459	0.0085
D(LCPI(-10))	-0.130164	0.097321	-1.337469	0.1839
C	0.296062	0.099499	2.975510	0.0036
@TREND("2000M01")	0.000405	0.000105	3.845702	0.0002

R-squared	0.433564	Mean dependent var	0.004709
Adjusted R-squared	0.370039	S.D. dependent var	0.008287
S.E. of regression	0.006577	Akaike info criterion	-7.108419
Sum squared resid	0.004629	Schwarz criterion	-6.806441
Log likelihood	439.5051	Hannan-Quinn criter.	-6.985784
F-statistic	6.825041	Durbin-Watson stat	1.970316
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 13 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.730010	0.2267
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-1.228210	0.449892	-2.730010	0.0074
D(LCPI(-1),2)	0.501262	0.439076	1.141629	0.2562
D(LCPI(-2),2)	0.222982	0.423021	0.527118	0.5992
D(LCPI(-3),2)	0.286642	0.396593	0.722760	0.4714
D(LCPI(-4),2)	0.105268	0.367045	0.286799	0.7748
D(LCPI(-5),2)	0.020120	0.333324	0.060362	0.9520
D(LCPI(-6),2)	-0.025008	0.311866	-0.080189	0.9362
D(LCPI(-7),2)	-0.236398	0.277276	-0.852575	0.3959
D(LCPI(-8),2)	-0.164951	0.252412	-0.653501	0.5149
D(LCPI(-9),2)	-0.364263	0.220198	-1.654250	0.1011

D(LCPI(-10),2)	-0.374903	0.192328	-1.949288	0.0540
D(LCPI(-11),2)	-0.367919	0.167960	-2.190508	0.0307
D(LCPI(-12),2)	-0.062387	0.132010	-0.472590	0.6375
D(LCPI(-13),2)	0.103114	0.106393	0.969184	0.3347
C	0.002312	0.001430	1.616903	0.1089
@TREND("2000M01")	5.91E-05	2.61E-05	2.266933	0.0255

R-squared	0.573327	Mean dependent var	-1.31E-05
Adjusted R-squared	0.511788	S.D. dependent var	0.009071
S.E. of regression	0.006338	Akaike info criterion	-7.160952
Sum squared resid	0.004178	Schwarz criterion	-6.789286
Log likelihood	445.6571	Hannan-Quinn criter.	-7.010017
F-statistic	9.316423	Durbin-Watson stat	1.958797
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant
Lag Length: 13 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.516576	0.5220
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.447958	0.295374	-1.516576	0.1324
D(LCPI(-1),2)	-0.242212	0.297635	-0.813789	0.4176
D(LCPI(-2),2)	-0.482668	0.292037	-1.652763	0.1014
D(LCPI(-3),2)	-0.361018	0.280437	-1.287342	0.2008
D(LCPI(-4),2)	-0.484946	0.263770	-1.838518	0.0688
D(LCPI(-5),2)	-0.502197	0.245570	-2.045028	0.0434
D(LCPI(-6),2)	-0.499374	0.235756	-2.118182	0.0365
D(LCPI(-7),2)	-0.644876	0.214859	-3.001397	0.0034
D(LCPI(-8),2)	-0.514265	0.203821	-2.523116	0.0131
D(LCPI(-9),2)	-0.651686	0.183547	-3.550514	0.0006
D(LCPI(-10),2)	-0.597164	0.168691	-3.539986	0.0006
D(LCPI(-11),2)	-0.531096	0.154716	-3.432710	0.0009
D(LCPI(-12),2)	-0.155717	0.127874	-1.217734	0.2261
D(LCPI(-13),2)	0.049131	0.105717	0.464735	0.6431
C	0.002304	0.001458	1.580328	0.1170

R-squared	0.552244	Mean dependent var	-1.31E-05
Adjusted R-squared	0.492543	S.D. dependent var	0.009071
S.E. of regression	0.006462	Akaike info criterion	-7.129387
Sum squared resid	0.004384	Schwarz criterion	-6.780951
Log likelihood	442.7632	Hannan-Quinn criter.	-6.987886
F-statistic	9.250180	Durbin-Watson stat	1.949127
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.971005	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,3)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1),2)	-9.849261	1.097899	-8.971005	0.0000
D(LCPI(-1),3)	8.174862	1.030157	7.935552	0.0000
D(LCPI(-2),3)	7.269018	0.960520	7.567792	0.0000
D(LCPI(-3),3)	6.515525	0.873662	7.457719	0.0000
D(LCPI(-4),3)	5.667897	0.789655	7.177687	0.0000
D(LCPI(-5),3)	4.841673	0.691469	7.002006	0.0000
D(LCPI(-6),3)	4.047741	0.592667	6.829707	0.0000
D(LCPI(-7),3)	3.148696	0.490314	6.421797	0.0000
D(LCPI(-8),3)	2.418149	0.382062	6.329210	0.0000
D(LCPI(-9),3)	1.587247	0.284517	5.578744	0.0000
D(LCPI(-10),3)	0.852471	0.181924	4.685866	0.0000
D(LCPI(-11),3)	0.217129	0.101244	2.144617	0.0343
C	2.11E-05	0.001183	0.017818	0.9858
@TREND("2000M01")	4.44E-06	1.72E-05	0.258159	0.7968

R-squared	0.798026	Mean dependent var	0.000122
Adjusted R-squared	0.773255	S.D. dependent var	0.013653
S.E. of regression	0.006501	Akaike info criterion	-7.124377
Sum squared resid	0.004480	Schwarz criterion	-6.799170
Log likelihood	441.4626	Hannan-Quinn criter.	-6.992309
F-statistic	32.21688	Durbin-Watson stat	1.951574
Prob(F-statistic)	0.000000		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.663670	0.7613
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.059612	0.035832	-1.663670	0.0991
D(LEXR(-1))	-0.033548	0.097913	-0.342628	0.7326
D(LEXR(-2))	0.006562	0.092017	0.071313	0.9433
D(LEXR(-3))	-0.015016	0.092203	-0.162860	0.8709
D(LEXR(-4))	-0.047090	0.091674	-0.513674	0.6085
D(LEXR(-5))	0.091929	0.089576	1.026268	0.3071
D(LEXR(-6))	-0.121743	0.089180	-1.365137	0.1751
D(LEXR(-7))	-0.013900	0.089297	-0.155657	0.8766
D(LEXR(-8))	0.101795	0.088714	1.147454	0.2538
D(LEXR(-9))	0.344469	0.088880	3.875683	0.0002
D(LEXR(-10))	0.069110	0.094027	0.735000	0.4639
C	0.299905	0.177539	1.689236	0.0941
@TREND("2000M01")	0.000146	0.000113	1.290117	0.1998

R-squared	0.206108	Mean dependent var	0.002576
Adjusted R-squared	0.117074	S.D. dependent var	0.010663
S.E. of regression	0.010019	Akaike info criterion	-6.266590
Sum squared resid	0.010741	Schwarz criterion	-5.964611
Log likelihood	388.9954	Hannan-Quinn criter.	-6.143955
F-statistic	2.314924	Durbin-Watson stat	2.006635
Prob(F-statistic)	0.011395		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant
Lag Length: 10 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.587202	0.4860
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.015015	0.009460	-1.587202	0.1154
D(LEXR(-1))	-0.065100	0.095101	-0.684534	0.4951
D(LEXR(-2))	-0.031608	0.087399	-0.361646	0.7183
D(LEXR(-3))	-0.054962	0.087115	-0.630913	0.5294
D(LEXR(-4))	-0.084818	0.087151	-0.973231	0.3326
D(LEXR(-5))	0.060332	0.086428	0.698061	0.4866
D(LEXR(-6))	-0.154700	0.085705	-1.805034	0.0739
D(LEXR(-7))	-0.043173	0.086632	-0.498350	0.6193

D(LEXR(-8))	0.075472	0.086601	0.871500	0.3854
D(LEXR(-9))	0.318484	0.086833	3.667771	0.0004
D(LEXR(-10))	0.040534	0.091662	0.442209	0.6592
C	0.079719	0.049051	1.625232	0.1070

R-squared	0.193759	Mean dependent var	0.002576
Adjusted R-squared	0.111642	S.D. dependent var	0.010663
S.E. of regression	0.010050	Akaike info criterion	-6.267821
Sum squared resid	0.010909	Schwarz criterion	-5.989072
Log likelihood	388.0693	Hannan-Quinn criter.	-6.154620
F-statistic	2.359546	Durbin-Watson stat	2.000761
Prob(F-statistic)	0.011905		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.744167	0.2212
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 06/12/17 Time: 16:01
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-0.974158	0.354992	-2.744167	0.0071
D(LEXR(-1),2)	-0.096533	0.341390	-0.282765	0.7779
D(LEXR(-2),2)	-0.132924	0.315847	-0.420849	0.6747
D(LEXR(-3),2)	-0.192976	0.285703	-0.675443	0.5008
D(LEXR(-4),2)	-0.282374	0.255248	-1.106275	0.2711
D(LEXR(-5),2)	-0.225074	0.229906	-0.978984	0.3298
D(LEXR(-6),2)	-0.382669	0.197087	-1.941621	0.0548
D(LEXR(-7),2)	-0.427444	0.165487	-2.582944	0.0111
D(LEXR(-8),2)	-0.352782	0.133181	-2.648884	0.0093
D(LEXR(-9),2)	-0.035814	0.092622	-0.386675	0.6998
C	0.004570	0.002600	1.757962	0.0816
@TREND("2000M01")	-3.56E-05	3.00E-05	-1.186701	0.2379

R-squared	0.598426	Mean dependent var	2.77E-05
Adjusted R-squared	0.557525	S.D. dependent var	0.015185
S.E. of regression	0.010101	Akaike info criterion	-6.257718
Sum squared resid	0.011019	Schwarz criterion	-5.978969
Log likelihood	387.4631	Hannan-Quinn criter.	-6.144517
F-statistic	14.63107	Durbin-Watson stat	1.999407
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.471364	0.1250
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 06/12/17 Time: 16:01
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-0.779560	0.315437	-2.471364	0.0150
D(LEXR(-1),2)	-0.277867	0.305855	-0.908495	0.3656
D(LEXR(-2),2)	-0.292992	0.286130	-1.023981	0.3081
D(LEXR(-3),2)	-0.331014	0.261440	-1.266115	0.2082
D(LEXR(-4),2)	-0.399002	0.236009	-1.690620	0.0938
D(LEXR(-5),2)	-0.321652	0.215422	-1.493129	0.1383
D(LEXR(-6),2)	-0.457629	0.187040	-2.446695	0.0160
D(LEXR(-7),2)	-0.480649	0.159596	-3.011663	0.0032
D(LEXR(-8),2)	-0.384766	0.130670	-2.944563	0.0040
D(LEXR(-9),2)	-0.048735	0.092152	-0.528858	0.5980
C	0.001892	0.001293	1.463367	0.1462

R-squared	0.593190	Mean dependent var	2.77E-05
Adjusted R-squared	0.555868	S.D. dependent var	0.015185
S.E. of regression	0.010120	Akaike info criterion	-6.261429
Sum squared resid	0.011163	Schwarz criterion	-6.005909
Log likelihood	386.6858	Hannan-Quinn criter.	-6.157662
F-statistic	15.89382	Durbin-Watson stat	2.000098
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEXR,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.786515	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,3)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1),2)	-7.943043	1.170416	-6.786515	0.0000
D(LEXR(-1),3)	5.937621	1.113539	5.332209	0.0000
D(LEXR(-2),3)	4.971453	1.011031	4.917211	0.0000
D(LEXR(-3),3)	4.041647	0.888222	4.550265	0.0000
D(LEXR(-4),3)	3.126157	0.756312	4.133421	0.0001
D(LEXR(-5),3)	2.373640	0.618571	3.837294	0.0002
D(LEXR(-6),3)	1.557014	0.477120	3.263357	0.0015
D(LEXR(-7),3)	0.800957	0.337677	2.371961	0.0195
D(LEXR(-8),3)	0.223974	0.206099	1.086729	0.2796
D(LEXR(-9),3)	0.058846	0.091599	0.642432	0.5220
C	-0.000459	0.001894	-0.242624	0.8088
@TREND("2000M01")	1.86E-06	2.75E-05	0.067594	0.9462

R-squared	0.857538	Mean dependent var	0.000291
Adjusted R-squared	0.843027	S.D. dependent var	0.026319
S.E. of regression	0.010427	Akaike info criterion	-6.194129
Sum squared resid	0.011743	Schwarz criterion	-5.915380
Log likelihood	383.6478	Hannan-Quinn criter.	-6.080928
F-statistic	59.09949	Durbin-Watson stat	2.002981
Prob(F-statistic)	0.000000		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 13 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.727015	0.9683
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.028416	0.039086	-0.727015	0.4689
D(LM2(-1))	-0.208650	0.102351	-2.038579	0.0440
D(LM2(-2))	0.104284	0.087282	1.194791	0.2349
D(LM2(-3))	-0.108711	0.088216	-1.232325	0.2206
D(LM2(-4))	-0.000220	0.084127	-0.002616	0.9979
D(LM2(-5))	-0.087405	0.083195	-1.050605	0.2959
D(LM2(-6))	0.112603	0.078527	1.433937	0.1546
D(LM2(-7))	0.016371	0.079010	0.207206	0.8363
D(LM2(-8))	-0.239999	0.078766	-3.046977	0.0029
D(LM2(-9))	0.037393	0.080397	0.465110	0.6428

D(LM2(-10))	-0.122438	0.080512	-1.520746	0.1314
D(LM2(-11))	0.036521	0.077698	0.470040	0.6393
D(LM2(-12))	0.636192	0.077264	8.234043	0.0000
D(LM2(-13))	-0.010731	0.096254	-0.111490	0.9114
C	0.170883	0.217893	0.784248	0.4347
@TREND("2000M01")	0.000390	0.000491	0.794115	0.4289

R-squared	0.712595	Mean dependent var	0.012997
Adjusted R-squared	0.671142	S.D. dependent var	0.014501
S.E. of regression	0.008316	Akaike info criterion	-6.617822
Sum squared resid	0.007191	Schwarz criterion	-6.246157
Log likelihood	413.0693	Hannan-Quinn criter.	-6.466887
F-statistic	17.19054	Durbin-Watson stat	1.998904
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.251367	0.4567
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.099388	0.488320	-2.251367	0.0264
D(LM2(-1),2)	-0.131602	0.476671	-0.276086	0.7830
D(LM2(-2),2)	-0.056812	0.443717	-0.128037	0.8984
D(LM2(-3),2)	-0.196060	0.406690	-0.482088	0.6307
D(LM2(-4),2)	-0.221964	0.375114	-0.591723	0.5553
D(LM2(-5),2)	-0.334154	0.340217	-0.982180	0.3283
D(LM2(-6),2)	-0.242302	0.311342	-0.778252	0.4382
D(LM2(-7),2)	-0.245330	0.279473	-0.877830	0.3820
D(LM2(-8),2)	-0.505072	0.241189	-2.094091	0.0387
D(LM2(-9),2)	-0.483392	0.208708	-2.316121	0.0225
D(LM2(-10),2)	-0.621846	0.168060	-3.700146	0.0003
D(LM2(-11),2)	-0.598207	0.136982	-4.367047	0.0000
D(LM2(-12),2)	0.024909	0.094046	0.264857	0.7916
C	0.012530	0.005963	2.101340	0.0380
@TREND("2000M01")	3.33E-05	2.37E-05	1.406725	0.1625

R-squared	0.890455	Mean dependent var	-0.000258
Adjusted R-squared	0.875849	S.D. dependent var	0.023547
S.E. of regression	0.008297	Akaike info criterion	-6.629420
Sum squared resid	0.007228	Schwarz criterion	-6.280983
Log likelihood	412.7652	Hannan-Quinn criter.	-6.487918
F-statistic	60.96483	Durbin-Watson stat	2.000221
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant
Lag Length: 12 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.850891	0.3545
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-0.841664	0.454734	-1.850891	0.0670
D(LM2(-1),2)	-0.373383	0.446653	-0.835956	0.4051
D(LM2(-2),2)	-0.273822	0.417953	-0.655150	0.5138
D(LM2(-3),2)	-0.388954	0.384640	-1.011218	0.3142
D(LM2(-4),2)	-0.390359	0.357138	-1.093018	0.2769
D(LM2(-5),2)	-0.481157	0.325262	-1.479290	0.1420
D(LM2(-6),2)	-0.371394	0.298881	-1.242615	0.2168
D(LM2(-7),2)	-0.359151	0.268736	-1.336444	0.1843
D(LM2(-8),2)	-0.601811	0.232242	-2.591304	0.0109
D(LM2(-9),2)	-0.560513	0.202306	-2.770611	0.0066
D(LM2(-10),2)	-0.679907	0.163663	-4.154307	0.0001
D(LM2(-11),2)	-0.633194	0.135326	-4.679032	0.0000
D(LM2(-12),2)	0.014857	0.094206	0.157708	0.8750
C	0.011189	0.005913	1.892136	0.0612

R-squared	0.888390	Mean dependent var	-0.000258
Adjusted R-squared	0.874702	S.D. dependent var	0.023547
S.E. of regression	0.008335	Akaike info criterion	-6.627415
Sum squared resid	0.007364	Schwarz criterion	-6.302208
Log likelihood	411.6449	Hannan-Quinn criter.	-6.495347
F-statistic	64.90286	Durbin-Watson stat	1.995118
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 10 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.04447	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM2,3)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1),2)	-10.94723	0.908901	-12.04447	0.0000
D(LM2(-1),3)	8.782528	0.883445	9.941223	0.0000
D(LM2(-2),3)	7.790533	0.832569	9.357220	0.0000
D(LM2(-3),3)	6.748918	0.763665	8.837533	0.0000
D(LM2(-4),3)	5.773921	0.680641	8.483060	0.0000
D(LM2(-5),3)	4.776238	0.577137	8.275746	0.0000
D(LM2(-6),3)	3.959917	0.455691	8.689912	0.0000
D(LM2(-7),3)	3.228733	0.341507	9.454374	0.0000
D(LM2(-8),3)	2.324836	0.238678	9.740450	0.0000
D(LM2(-9),3)	1.540592	0.145514	10.58724	0.0000
D(LM2(-10),3)	0.710972	0.062355	11.40201	0.0000
C	-0.000460	0.001533	-0.300284	0.7645
@TREND("2000M01")	1.33E-05	2.23E-05	0.594837	0.5532

R-squared	0.964360	Mean dependent var	-0.000472
Adjusted R-squared	0.960363	S.D. dependent var	0.042280
S.E. of regression	0.008418	Akaike info criterion	-6.615002
Sum squared resid	0.007581	Schwarz criterion	-6.313023
Log likelihood	409.9001	Hannan-Quinn criter.	-6.492367
F-statistic	241.2734	Durbin-Watson stat	2.038569
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.782774	0.2066
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.136290	0.048976	-2.782774	0.0063
D(LGDPRICE(-1))	-0.144241	0.094926	-1.519507	0.1315
D(LGDPRICE(-2))	-0.025846	0.095488	-0.270671	0.7871
D(LGDPRICE(-3))	0.169614	0.094955	1.786265	0.0768
D(LGDPRICE(-4))	0.221620	0.097715	2.268034	0.0252
D(LGDPRICE(-5))	-0.116457	0.096802	-1.203043	0.2315
C	0.601510	0.214171	2.808557	0.0059
@TREND("2000M01")	0.002065	0.000698	2.956190	0.0038

R-squared	0.191925	Mean dependent var	0.013407
Adjusted R-squared	0.141420	S.D. dependent var	0.059108
S.E. of regression	0.054769	Akaike info criterion	-2.907049
Sum squared resid	0.335958	Schwarz criterion	-2.721217
Log likelihood	182.4230	Hannan-Quinn criter.	-2.831582
F-statistic	3.800142	Durbin-Watson stat	1.975271
Prob(F-statistic)	0.000974		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.703075	0.0011
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.403433	0.298407	-4.703075	0.0000
D(LGDPRICE(-1),2)	0.170469	0.270619	0.629925	0.5300
D(LGDPRICE(-2),2)	0.115114	0.246131	0.467696	0.6409
D(LGDPRICE(-3),2)	0.253758	0.228131	1.112333	0.2684
D(LGDPRICE(-4),2)	0.398280	0.200078	1.990625	0.0490
D(LGDPRICE(-5),2)	0.179305	0.157249	1.140263	0.2566
D(LGDPRICE(-6),2)	0.013973	0.098901	0.141287	0.8879
C	0.007352	0.010425	0.705207	0.4822
@TREND("2000M01")	0.000188	0.000151	1.249288	0.2142

R-squared	0.639618	Mean dependent var	0.000755
Adjusted R-squared	0.613645	S.D. dependent var	0.090398
S.E. of regression	0.056189	Akaike info criterion	-2.848142
Sum squared resid	0.350453	Schwarz criterion	-2.639080
Log likelihood	179.8885	Hannan-Quinn criter.	-2.763241
F-statistic	24.62584	Durbin-Watson stat	1.951010
Prob(F-statistic)	0.000000		

K 3.2 PP Unit Root Test

Null Hypothesis: LDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.248453	0.4583
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.004175
HAC corrected variance (Bartlett kernel)	0.006926

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.053213	0.033552	-1.585988	0.1154
C	0.279124	0.172798	1.615318	0.1089
@TREND("2000M01")	0.000922	0.000501	1.841059	0.0681

R-squared	0.029534	Mean dependent var	0.016206
Adjusted R-squared	0.012945	S.D. dependent var	0.065863
S.E. of regression	0.065435	Akaike info criterion	-2.590834
Sum squared resid	0.500965	Schwarz criterion	-2.521147
Log likelihood	158.4501	Hannan-Quinn criter.	-2.562534
F-statistic	1.780302	Durbin-Watson stat	1.770300
Prob(F-statistic)	0.173123		

Null Hypothesis: D(LDSEGEN) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.12811	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.004233
HAC corrected variance (Bartlett kernel)	0.005462

Phillips-Perron Test Equation
Dependent Variable: D(LDSEGEN,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.913612	0.092093	-9.920577	0.0000
C	0.005266	0.011964	0.440137	0.6606
@TREND("2000M01")	0.000161	0.000174	0.922269	0.3583

R-squared	0.456870	Mean dependent var	0.000360
Adjusted R-squared	0.447586	S.D. dependent var	0.088648
S.E. of regression	0.065887	Akaike info criterion	-2.577056
Sum squared resid	0.507915	Schwarz criterion	-2.507369
Log likelihood	157.6234	Hannan-Quinn criter.	-2.548756
F-statistic	49.20902	Durbin-Watson stat	2.001024
Prob(F-statistic)	0.000000		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.953945	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002754
HAC corrected variance (Bartlett kernel)	0.001686

Phillips-Perron Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.602812	0.082234	-7.330399	0.0000
C	3.115005	0.424833	7.332304	0.0000
@TREND("2000M01")	0.003866	0.000538	7.185809	0.0000

R-squared	0.315419	Mean dependent var	0.005074
Adjusted R-squared	0.303716	S.D. dependent var	0.063696
S.E. of regression	0.053151	Akaike info criterion	-3.006693
Sum squared resid	0.330523	Schwarz criterion	-2.937005
Log likelihood	183.4016	Hannan-Quinn criter.	-2.978392
F-statistic	26.95369	Durbin-Watson stat	1.824630
Prob(F-statistic)	0.000000		

Null Hypothesis: LINT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.079512	0.9275
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.63E-06
HAC corrected variance (Bartlett kernel)	4.69E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.016078	0.017354	-0.926465	0.3561
C	0.000798	0.001398	0.570689	0.5693

@TREND("2000M01")	3.75E-06	5.58E-06	0.671870	0.5030

R-squared	0.018459	Mean dependent var	-0.000106
Adjusted R-squared	0.001681	S.D. dependent var	0.001930
S.E. of regression	0.001929	Akaike info criterion	-9.639171
Sum squared resid	0.000435	Schwarz criterion	-9.569484
Log likelihood	581.3503	Hannan-Quinn criter.	-9.610871
F-statistic	1.100185	Durbin-Watson stat	1.726105
Prob(F-statistic)	0.336227		

Null Hypothesis: LINT has a unit root
Exogenous: Constant
Bandwidth: 9 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.433459	0.5637
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.64E-06
HAC corrected variance (Bartlett kernel)	5.05E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT(-1)	-0.020898	0.015765	-1.325568	0.1875
C	0.001359	0.001119	1.214622	0.2269

R-squared	0.014672	Mean dependent var	-0.000106
Adjusted R-squared	0.006322	S.D. dependent var	0.001930
S.E. of regression	0.001924	Akaike info criterion	-9.651987
Sum squared resid	0.000437	Schwarz criterion	-9.605529
Log likelihood	581.1192	Hannan-Quinn criter.	-9.633120
F-statistic	1.757130	Durbin-Watson stat	1.711208
Prob(F-statistic)	0.187543		

Null Hypothesis: D(LINT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.513998	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.60E-06
HAC corrected variance (Bartlett kernel)	3.36E-06

Phillips-Perron Test Equation
Dependent Variable: D(LINT,2)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT(-1))	-0.875169	0.091610	-9.553186	0.0000
C	-0.000393	0.000352	-1.119063	0.2654
@TREND("2000M01")	5.08E-06	5.10E-06	0.997614	0.3205

R-squared	0.438244	Mean dependent var	1.30E-05
Adjusted R-squared	0.428641	S.D. dependent var	0.002541
S.E. of regression	0.001921	Akaike info criterion	-9.647607
Sum squared resid	0.000432	Schwarz criterion	-9.577920
Log likelihood	581.8564	Hannan-Quinn criter.	-9.619307
F-statistic	45.63775	Durbin-Watson stat	1.986197
Prob(F-statistic)	0.000000		

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.875468	0.1742
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.08E-05
HAC corrected variance (Bartlett kernel)	3.11E-05

Phillips-Perron Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.063875	0.023373	-2.732878	0.0073
C	0.316913	0.115419	2.745760	0.0070
@TREND("2000M01")	0.000381	0.000122	3.134810	0.0022

R-squared	0.107848	Mean dependent var	0.004709
Adjusted R-squared	0.092598	S.D. dependent var	0.008287
S.E. of regression	0.007894	Akaike info criterion	-6.820813
Sum squared resid	0.007290	Schwarz criterion	-6.751126
Log likelihood	412.2488	Hannan-Quinn criter.	-6.792513
F-statistic	7.071795	Durbin-Watson stat	1.240664
Prob(F-statistic)	0.001261		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.848023	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.59E-05
HAC corrected variance (Bartlett kernel)	1.66E-05

Phillips-Perron Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 06/12/17 Time: 16:10
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.632018	0.086287	-7.324624	0.0000
C	0.001006	0.001379	0.729571	0.4671
@TREND("2000M01")	3.30E-05	2.05E-05	1.607567	0.1106

R-squared	0.314453	Mean dependent var	-1.31E-05
Adjusted R-squared	0.302734	S.D. dependent var	0.009071
S.E. of regression	0.007574	Akaike info criterion	-6.903419
Sum squared resid	0.006712	Schwarz criterion	-6.833732
Log likelihood	417.2051	Hannan-Quinn criter.	-6.875119
F-statistic	26.83329	Durbin-Watson stat	1.785086
Prob(F-statistic)	0.000000		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.499280	0.8247
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000109
HAC corrected variance (Bartlett kernel)	9.98E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 06/12/17 Time: 16:10
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.050845	0.031902	-1.593804	0.1137
C	0.258106	0.159047	1.622828	0.1073
@TREND("2000M01")	0.000108	9.40E-05	1.154037	0.2508

R-squared	0.033717	Mean dependent var	0.002576
Adjusted R-squared	0.017199	S.D. dependent var	0.010663

S.E. of regression	0.010571	Akaike info criterion	-6.236747
Sum squared resid	0.013074	Schwarz criterion	-6.167059
Log likelihood	377.2048	Hannan-Quinn criter.	-6.208446
F-statistic	2.041266	Durbin-Watson stat	1.994813
Prob(F-statistic)	0.134464		

Null Hypothesis: LEXR has a unit root
Exogenous: Constant
Bandwidth: 10 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.766106	0.3957
Test critical values:	1% level	-3.485586	
	5% level	-2.885654	
	10% level	-2.579708	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000110
HAC corrected variance (Bartlett kernel)	7.93E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 06/12/17 Time: 16:10
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.015684	0.009470	-1.656205	0.1003
C	0.083389	0.048804	1.708666	0.0901

R-squared	0.022718	Mean dependent var	0.002576
Adjusted R-squared	0.014436	S.D. dependent var	0.010663
S.E. of regression	0.010586	Akaike info criterion	-6.242095
Sum squared resid	0.013223	Schwarz criterion	-6.195636
Log likelihood	376.5257	Hannan-Quinn criter.	-6.223228
F-statistic	2.743016	Durbin-Watson stat	2.042972
Prob(F-statistic)	0.100337		

Null Hypothesis: D(LEXR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.36210	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000111
HAC corrected variance (Bartlett kernel)	7.51E-05

Phillips-Perron Test Equation
Dependent Variable: D(LEXR,2)
Method: Least Squares
Date: 06/12/17 Time: 16:10
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-1.026597	0.092371	-11.11384	0.0000
C	0.004756	0.001983	2.398012	0.0181
@TREND("2000M01")	-3.55E-05	2.83E-05	-1.253345	0.2126

R-squared	0.513550	Mean dependent var	2.77E-05
Adjusted R-squared	0.505235	S.D. dependent var	0.015185
S.E. of regression	0.010681	Akaike info criterion	-6.215976
Sum squared resid	0.013348	Schwarz criterion	-6.146289
Log likelihood	375.9586	Hannan-Quinn criter.	-6.187676
F-statistic	61.75908	Durbin-Watson stat	2.004029
Prob(F-statistic)	0.000000		

Null Hypothesis: LM2 has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.458029	0.3483
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000195
HAC corrected variance (Bartlett kernel)	0.000172

Phillips-Perron Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 06/12/17 Time: 16:11
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2(-1)	-0.129239	0.048817	-2.647432	0.0092
C	0.745016	0.277430	2.685422	0.0083
@TREND("2000M01")	0.001684	0.000622	2.708269	0.0078

R-squared	0.065548	Mean dependent var	0.012997
Adjusted R-squared	0.049574	S.D. dependent var	0.014501
S.E. of regression	0.014137	Akaike info criterion	-5.655423
Sum squared resid	0.023382	Schwarz criterion	-5.585735
Log likelihood	342.3254	Hannan-Quinn criter.	-5.627122
F-statistic	4.103524	Durbin-Watson stat	2.398039
Prob(F-statistic)	0.018949		

Null Hypothesis: D(LM2) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-21.35232	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000188
HAC corrected variance (Bartlett kernel)	5.29E-05

Phillips-Perron Test Equation
Dependent Variable: D(LM2,2)
Method: Least Squares
Date: 06/12/17 Time: 16:11
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LM2(-1))	-1.289657	0.086077	-14.98265	0.0000
C	0.013971	0.002716	5.143250	0.0000
@TREND("2000M01")	4.82E-05	3.67E-05	1.312820	0.1918

R-squared	0.657548	Mean dependent var	-0.000258
Adjusted R-squared	0.651694	S.D. dependent var	0.023547
S.E. of regression	0.013897	Akaike info criterion	-5.689627
Sum squared resid	0.022595	Schwarz criterion	-5.619940
Log likelihood	344.3776	Hannan-Quinn criter.	-5.661327
F-statistic	112.3270	Durbin-Watson stat	2.100852
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.062778	0.1201
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003171
HAC corrected variance (Bartlett kernel)	0.002945

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE)
Method: Least Squares
Date: 06/12/17 Time: 16:12
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPRICE(-1)	-0.144413	0.045910	-3.145606	0.0021
C	0.638095	0.201613	3.164947	0.0020
@TREND("2000M01")	0.002185	0.000665	3.283361	0.0014

R-squared	0.084760	Mean dependent var	0.013407
Adjusted R-squared	0.069115	S.D. dependent var	0.059108
S.E. of regression	0.057028	Akaike info criterion	-2.865852
Sum squared resid	0.380512	Schwarz criterion	-2.796164
Log likelihood	174.9511	Hannan-Quinn criter.	-2.837551
F-statistic	5.417689	Durbin-Watson stat	2.209291
Prob(F-statistic)	0.005621		

Null Hypothesis: D(LGDPRICE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.17689	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003308
HAC corrected variance (Bartlett kernel)	0.002913

Phillips-Perron Test Equation
Dependent Variable: D(LGDPRICE,2)
Method: Least Squares
Date: 06/12/17 Time: 16:12
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPRICE(-1))	-1.198193	0.092052	-13.01652	0.0000
C	0.006307	0.010594	0.595363	0.5528
@TREND("2000M01")	0.000161	0.000154	1.050774	0.2955

R-squared	0.591790	Mean dependent var	0.000755
Adjusted R-squared	0.584812	S.D. dependent var	0.090398
S.E. of regression	0.058248	Akaike info criterion	-2.823523
Sum squared resid	0.396964	Schwarz criterion	-2.753836
Log likelihood	172.4114	Hannan-Quinn criter.	-2.795223
F-statistic	84.80845	Durbin-Watson stat	2.021568
Prob(F-statistic)	0.000000		

K 3.3 KPSS Unit Root Test

Null Hypothesis: INT is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.294041
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000119
HAC corrected variance (Bartlett kernel)	0.001079

KPSS Test Equation
Dependent Variable: INT
Method: Least Squares
Date: 06/12/17 Time: 22:03
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.080692	0.001992	542.4772	0.0000
@TREND("2000M01")	-0.000137	2.89E-05	-4.739148	0.0000

R-squared	0.159900	Mean dependent var	1.072533
Adjusted R-squared	0.152781	S.D. dependent var	0.011929
S.E. of regression	0.010980	Akaike info criterion	-6.169015
Sum squared resid	0.014225	Schwarz criterion	-6.122557
Log likelihood	372.1409	Hannan-Quinn criter.	-6.150148
F-statistic	22.45952	Durbin-Watson stat	0.036024
Prob(F-statistic)	0.000006		

Null Hypothesis: D(INT) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.119305
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	4.23E-06
HAC corrected variance (Bartlett kernel)	4.91E-06

KPSS Test Equation
Dependent Variable: D(INT)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000489	0.000376	-1.299910	0.1962
@TREND("2000M01")	6.30E-06	5.46E-06	1.153027	0.2512

R-squared	0.011141	Mean dependent var	-0.000114
Adjusted R-squared	0.002761	S.D. dependent var	0.002076
S.E. of regression	0.002074	Akaike info criterion	-9.502552
Sum squared resid	0.000507	Schwarz criterion	-9.456094
Log likelihood	572.1531	Hannan-Quinn criter.	-9.483685
F-statistic	1.329472	Durbin-Watson stat	1.737872
Prob(F-statistic)	0.251229		

Null Hypothesis: D(INT) is stationary
Exogenous: Constant
Bandwidth: 8 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.269009
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	4.28E-06
HAC corrected variance (Bartlett kernel)	5.46E-06

KPSS Test Equation
Dependent Variable: D(INT)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000114	0.000190	-0.602294	0.5481

R-squared	0.000000	Mean dependent var	-0.000114
Adjusted R-squared	0.000000	S.D. dependent var	0.002076
S.E. of regression	0.002076	Akaike info criterion	-9.508015
Sum squared resid	0.000513	Schwarz criterion	-9.484786
Log likelihood	571.4809	Hannan-Quinn criter.	-9.498582
Durbin-Watson stat	1.718484		

Null Hypothesis: LCPI is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.280539
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000894
HAC corrected variance (Bartlett kernel)	0.007207

KPSS Test Equation
Dependent Variable: LCPI
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.939297	0.005470	902.9940	0.0000
@TREND("2000M01")	0.005176	7.94E-05	65.15230	0.0000

R-squared	0.972953	Mean dependent var	5.247282
Adjusted R-squared	0.972724	S.D. dependent var	0.182541
S.E. of regression	0.030147	Akaike info criterion	-4.148911
Sum squared resid	0.107246	Schwarz criterion	-4.102453
Log likelihood	250.9347	Hannan-Quinn criter.	-4.130044
F-statistic	4244.822	Durbin-Watson stat	0.074340
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.122504
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	6.46E-05
HAC corrected variance (Bartlett kernel)	3.28E-05

KPSS Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001511	0.001471	1.027318	0.3064
@TREND("2000M01")	5.37E-05	2.14E-05	2.515566	0.0132

R-squared	0.050898	Mean dependent var	0.004709
Adjusted R-squared	0.042855	S.D. dependent var	0.008287
S.E. of regression	0.008107	Akaike info criterion	-6.775600
Sum squared resid	0.007756	Schwarz criterion	-6.729142
Log likelihood	408.5360	Hannan-Quinn criter.	-6.756733
F-statistic	6.328070	Durbin-Watson stat	1.242973
Prob(F-statistic)	0.013229		

Null Hypothesis: D(LCPI) is stationary
Exogenous: Constant
Bandwidth: 13 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.633786
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	6.81E-05
HAC corrected variance (Bartlett kernel)	6.99E-05

KPSS Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004709	0.000756	6.224958	0.0000

R-squared	0.000000	Mean dependent var	0.004709
Adjusted R-squared	0.000000	S.D. dependent var	0.008287
S.E. of regression	0.008287	Akaike info criterion	-6.740028
Sum squared resid	0.008172	Schwarz criterion	-6.716798
Log likelihood	405.4017	Hannan-Quinn criter.	-6.730594
Durbin-Watson stat	1.179806		

Null Hypothesis: LEXR is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.152887
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000933
HAC corrected variance (Bartlett kernel)	0.007732

KPSS Test Equation
Dependent Variable: LEXR
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.989804	0.005590	892.6967	0.0000
@TREND("2000M01")	0.002779	8.12E-05	34.22818	0.0000

R-squared	0.908496	Mean dependent var	5.155147
Adjusted R-squared	0.907721	S.D. dependent var	0.101414

S.E. of regression	0.030807	Akaike info criterion	-4.105625
Sum squared resid	0.111990	Schwarz criterion	-4.059167
Log likelihood	248.3375	Hannan-Quinn criter.	-4.086759
F-statistic	1171.568	Durbin-Watson stat	0.120791
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEXR) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.084600
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000111
HAC corrected variance (Bartlett kernel)	7.18E-05

KPSS Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Date: 06/12/17 Time: 22:06
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004635	0.001930	2.400787	0.0179
@TREND("2000M01")	-3.46E-05	2.80E-05	-1.233875	0.2197

R-squared	0.012738	Mean dependent var	0.002576
Adjusted R-squared	0.004371	S.D. dependent var	0.010663
S.E. of regression	0.010640	Akaike info criterion	-6.231934
Sum squared resid	0.013358	Schwarz criterion	-6.185476
Log likelihood	375.9161	Hannan-Quinn criter.	-6.213067
F-statistic	1.522447	Durbin-Watson stat	2.054290
Prob(F-statistic)	0.219701		

Null Hypothesis: D(LEXR) is stationary
Exogenous: Constant
Bandwidth: 9 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.258570
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000113
HAC corrected variance (Bartlett kernel)	8.72E-05

KPSS Test Equation
Dependent Variable: D(LEXR)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002576	0.000973	2.646519	0.0092

R-squared	0.000000	Mean dependent var	0.002576
Adjusted R-squared	0.000000	S.D. dependent var	0.010663
S.E. of regression	0.010663	Akaike info criterion	-6.235781
Sum squared resid	0.013530	Schwarz criterion	-6.212552
Log likelihood	375.1469	Hannan-Quinn criter.	-6.226348
Durbin-Watson stat	2.028095		

Null Hypothesis: LM2 is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.236053
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000725
HAC corrected variance (Bartlett kernel)	0.006740

KPSS Test Equation
Dependent Variable: LM2
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.693433	0.004926	1155.873	0.0000
@TREND("2000M01")	0.012753	7.15E-05	178.2556	0.0000

R-squared	0.996300	Mean dependent var	6.452233
Adjusted R-squared	0.996269	S.D. dependent var	0.444435
S.E. of regression	0.027148	Akaike info criterion	-4.358520
Sum squared resid	0.086966	Schwarz criterion	-4.312062
Log likelihood	263.5112	Hannan-Quinn criter.	-4.339653
F-statistic	31775.05	Durbin-Watson stat	0.286368
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LM2) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.071243
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000207
HAC corrected variance (Bartlett kernel)	3.70E-05

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 06/12/17 Time: 22:07
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010571	0.002629	4.020184	0.0001
@TREND("2000M01")	4.08E-05	3.82E-05	1.067752	0.2878

R-squared	0.009569	Mean dependent var	0.012997
Adjusted R-squared	0.001176	S.D. dependent var	0.014501
S.E. of regression	0.014492	Akaike info criterion	-5.613910
Sum squared resid	0.024782	Schwarz criterion	-5.567452
Log likelihood	338.8346	Hannan-Quinn criter.	-5.595043
F-statistic	1.140094	Durbin-Watson stat	2.579638
Prob(F-statistic)	0.287812		

Null Hypothesis: D(LM2) is stationary
Exogenous: Constant
Bandwidth: 13 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.440325
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000209
HAC corrected variance (Bartlett kernel)	6.04E-05

KPSS Test Equation
Dependent Variable: D(LM2)
Method: Least Squares
Date: 06/12/17 Time: 22:08
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012997	0.001324	9.818651	0.0000

R-squared	0.000000	Mean dependent var	0.012997
Adjusted R-squared	0.000000	S.D. dependent var	0.014501
S.E. of regression	0.014501	Akaike info criterion	-5.620961
Sum squared resid	0.025022	Schwarz criterion	-5.597732
Log likelihood	338.2577	Hannan-Quinn criter.	-5.611528
Durbin-Watson stat	2.554991		

Appendix L: ARDL Tests for Different Periods

L 1 For Bubble Period

L 1.1 ARDL Specification

Dependent Variable: LDSEGEN
Method: ARDL
Date: 04/24/17 Time: 22:36
Sample: 1992M03 1996M11
Included observations: 57
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (5 lags, automatic): LIPI LINT LCPI LEXR LM2 LGDPRICE
Fixed regressors: C @TREND
Number of models evaluated: 186624
Selected Model: ARDL(1, 4, 0, 2, 5, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	0.730505	0.088582	8.246630	0.0000
LIPI	0.227893	0.294494	0.773844	0.4439
LIPI(-1)	-0.095029	0.275821	-0.344532	0.7324
LIPI(-2)	0.754673	0.301916	2.499610	0.0170
LIPI(-3)	-0.348939	0.310636	-1.123306	0.2685
LIPI(-4)	0.728259	0.295502	2.464479	0.0185
LINT	-2.427507	1.967113	-1.234046	0.2250
LCPI	2.504805	1.412037	1.773895	0.0843
LCPI(-1)	-3.327115	2.036059	-1.634095	0.1107
LCPI(-2)	2.022857	1.443487	1.401368	0.1694
LEXR	6.424166	4.329441	1.483833	0.1463
LEXR(-1)	2.740642	5.127979	0.534449	0.5962
LEXR(-2)	-2.808476	4.746368	-0.591710	0.5576
LEXR(-3)	7.519722	4.641612	1.620067	0.1137
LEXR(-4)	-7.750304	4.563389	-1.698366	0.0978
LEXR(-5)	12.61658	3.690717	3.418465	0.0015
LM2	0.604901	1.140262	0.530493	0.5989
LGDPRICE	-2.000434	0.805619	-2.483103	0.0177
C	-91.12349	20.15130	-4.521966	0.0001
@TREND	-0.030249	0.014210	-2.128652	0.0400

R-squared	0.984064	Mean dependent var	5.384880
Adjusted R-squared	0.975880	S.D. dependent var	0.606639
S.E. of regression	0.094214	Akaike info criterion	-1.616873
Sum squared resid	0.328423	Schwarz criterion	-0.900013
Log likelihood	66.08089	Hannan-Quinn criter.	-1.338277
F-statistic	120.2506	Durbin-Watson stat	2.083659
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

L 1.2 Bound Test

ARDL Bounds Test
Date: 04/24/17 Time: 22:37
Sample: 1992M03 1996M11
Included observations: 57
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	**3.963162**	**6**

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.33	3.25
5%	2.63	3.62
2.5%	2.9	3.94
1%	3.27	4.39

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 04/24/17 Time: 22:37
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI)	0.288372	0.313918	0.918620	0.3642
D(LIPI(-1))	-0.908279	0.461527	-1.967987	0.0566
D(LIPI(-2))	-0.403653	0.398482	-1.012978	0.3176
D(LIPI(-3))	-0.764019	0.323497	-2.361751	0.0236
D(LCPI)	2.300926	1.460061	1.575911	0.1236
D(LCPI(-1))	-1.758072	1.506494	-1.166996	0.2507
D(LEXR)	4.947807	4.593005	1.077248	0.2883
D(LEXR(-1))	-8.278757	4.763788	-1.737852	0.0906
D(LEXR(-2))	-12.34567	4.258267	-2.899224	0.0063
D(LEXR(-3))	-5.640530	3.873974	-1.456006	0.1538
D(LEXR(-4))	-13.41595	3.771929	-3.556789	0.0010
C	-81.00451	24.39265	-3.320858	0.0020
@TREND	-0.018506	0.017228	-1.074205	0.2897
LIPI(-1)	1.286632	0.677422	1.899305	0.0653
LINT(-1)	-0.979993	2.110913	-0.464251	0.6452
LCPI(-1)	1.386856	1.040805	1.332484	0.1908
LEXR(-1)	16.48791	4.522200	3.645992	0.0008
LM2(-1)	-0.525486	1.254330	-0.418938	0.6777
LGDPRICE(-1)	-1.036704	0.966504	-1.072632	0.2904
LDSEGEN(-1)	-0.230341	0.095650	-2.408165	0.0211

R-squared	0.526781	Mean dependent var	0.045328
Adjusted R-squared	0.283777	S.D. dependent var	0.117710
S.E. of regression	0.099618	Akaike info criterion	-1.505322
Sum squared resid	0.367180	Schwarz criterion	-0.788462
Log likelihood	62.90169	Hannan-Quinn criter.	-1.226726
F-statistic	2.167787	Durbin-Watson stat	2.188297
Prob(F-statistic)	0.021595		

L 1.3 Short- and Long-run Coefficients

ARDL Cointegrating And Long Run Form
Dependent Variable: LDSEGEN
Selected Model: ARDL(1, 4, 0, 2, 5, 0, 0)
Sample: 1992M03 1996M11
Included observations: 57

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI)	0.184394	0.231365	0.796981	0.4305
D(LIPI(-1))	-1.151429	0.267043	-4.311767	0.0001
D(LIPI(-2))	-0.316018	0.262300	-1.204795	0.2359
D(LIPI(-3))	-0.709270	0.252067	-2.813819	0.0078
D(LINT)	-2.913802	6.406871	-0.454793	0.6519
D(LCPI)	2.415683	1.173452	2.058613	0.0466
D(LCPI(-1))	-2.144393	1.244572	-1.722996	0.0932
D(LEXR)	6.513466	3.424108	1.902237	0.0649
D(LEXR(-1))	-9.215305	4.191567	-2.198534	0.0342
D(LEXR(-2))	-12.194122	3.948725	-3.088117	0.0038
D(LEXR(-3))	-4.275752	3.386559	-1.262565	0.2146
D(LEXR(-4))	-12.286713	3.347147	-3.670802	0.0008
D(LM2)	0.998090	0.791166	1.261543	0.2150
D(LGDPRICE)	-2.443402	0.951549	-2.567815	0.0144
C	-88.160887	14.494429	-6.082398	0.0000
CointEq(-1)	-0.260639	0.042842	-6.083670	0.0000

Cointeq = LDSEGEN - (4.7009*LIPI -9.0076*LINT + 4.4548*LCPI + 69.5462 *LEXR + 2.2446*LM2 -7.4229*LGDPRICE -0.1122*@TREND)

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	4.700861	2.572031	1.827684	0.0757
LINT	-9.007625	7.023343	-1.282527	0.2076
LCPI	4.454809	3.655598	1.218626	0.2307
LEXR	69.546221	19.347355	3.594611	0.0009
LM2	2.244574	4.104784	0.546819	0.5878
LGDPRICE	-7.422907	3.704952	-2.003510	0.0525
@TREND	-0.112243	0.057107	-1.965486	0.0569

L 1.4 VECM and Significance Test of the Coefficients

Estimation Command:
=========================
LS DLDSEGEN DLIPI DLIPI(-1) DLIPI(-2) DLIPI(-3) DLCPI DLCPI(-1) DLEXR DLEXR(-1) DLEXR(-2) DLEXR(-3) DLEXR(-4) C @TREND LIPI(-1) LINT(-1) LCPI(-1) LEXR(-1) LM2(-1) LGDPRICE(-1) LDSEGEN(-1)

Estimation Equation:
=========================
DLDSEGEN = C(1)*DLIPI + C(2)*DLIPI(-1) + C(3)*DLIPI(-2) + C(4)*DLIPI(-3) + C(5)*DLCPI + C(6)*DLCPI(-1) + C(7)*DLEXR + C(8)*DLEXR(-1) + C(9)*DLEXR(-2) + C(10)*DLEXR(-3) + C(11)*DLEXR(-4) + C(12) + C(13)*@TREND + C(14)*LIPI(-1) + C(15)*LINT(-1) + C(16)*LCPI(-1) + C(17)*LEXR(-1) + C(18)*LM2(-1) + C(19)*LGDPRICE(-1) + C(20)*LDSEGEN(-1)

Substituted Coefficients:
=========================
DLDSEGEN = 0.288371849926*DLIPI - 0.908278876222*DLIPI(-1) - 0.403653397024*DLIPI(-2) - 0.764018909884*DLIPI(-3) + 2.30092619918*DLCPI - 1.75807243676*DLCPI(-1) + 4.94780689569*DLEXR - 8.27875670273*DLEXR(-1) - 12.345670906*DLEXR(-2) - 5.64052962371*DLEXR(-3) - 13.4159520442*DLEXR(-4) - 81.0045118756 - 0.0185060214746*@TREND + 1.28663150214*LIPI(-1) - 0.97999310276*LINT(-1) + 1.38685621325*LCPI(-1) + 16.4879068585*LEXR(-1) - 0.525485976367*LM2(-1) - 1.03670370519*LGDPRICE(-1) - 0.230341072067*LDSEGEN(-1)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.718183	(4, 37)	0.1667
Chi-square	6.872732	4	0.1428

Null Hypothesis: C(1)=C(2)=C(3)=C(4)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.288372	0.313918
C(2)	-0.908279	0.461527
C(3)	-0.403653	0.398482
C(4)	-0.764019	0.323497

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	1.698200	37	0.0979
F-statistic	2.883884	(1, 37)	0.0979
Chi-square	2.883884	1	0.0895

Null Hypothesis: C(5)=C(6)
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5) - C(6)	4.058999	2.390177

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.605326	(5, 37)	0.0093
Chi-square	18.02663	5	0.0029

Null Hypothesis: C(7)=C(8)=C(9)=C(10)=C(11)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(7)	4.947807	4.593005
C(8)	-8.278757	4.763788
C(9)	-12.34567	4.258267
C(10)	-5.640530	3.873974
C(11)	-13.41595	3.771929

Restrictions are linear in coefficients.

L 2 For Meltdown Period

L 2.1 ARDL Specification

Dependent Variable: LDSEGEN
Method: ARDL
Sample: 1996M11 1999M12
Included observations: 38
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LIPI LINT LCPI LEXR LM2 LGDPRICE
Fixed regressors: C @TREND
Number of models evalulated: 12288
Selected Model: ARDL(2, 0, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	0.964652	0.120255	8.021735	0.0000
LDSEGEN(-2)	-0.241105	0.126039	-1.912940	0.0660
LIPI	0.050458	0.251365	0.200734	0.8424
LINT	-6.989847	5.933278	-1.178075	0.2487
LCPI	0.757885	1.748161	0.433532	0.6679
LEXR	-4.312731	2.193952	-1.965736	0.0593
LM2	-0.780655	1.556325	-0.501601	0.6199
LGDPRICE	-0.117665	0.738003	-0.159437	0.8745
C	22.33589	12.70935	1.757438	0.0898
@TREND	0.018236	0.019953	0.913940	0.3686

R-squared	0.968344	Mean dependent var	5.644976
Adjusted R-squared	0.958169	S.D. dependent var	0.461233
S.E. of regression	0.094335	Akaike info criterion	-1.662999
Sum squared resid	0.249174	Schwarz criterion	-1.232055
Log likelihood	41.59698	Hannan-Quinn criter.	-1.509672
F-statistic	95.16679	Durbin-Watson stat	2.316925
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

L 2.2 Bound Test

ARDL Bounds Test
Sample: 1996M11 1999M12
Included observations: 38
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	1.867293	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.33	3.25
5%	2.63	3.62
2.5%	2.9	3.94
1%	3.27	4.39

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.254430	0.141653	1.796143	0.0833
C	2.842622	16.26848	0.174732	0.8625
@TREND	-0.011455	0.022111	-0.518074	0.6085

LIPI(-1)	-0.015300	0.248608	-0.061543	0.9514
LINT(-1)	-3.718599	6.311002	-0.589225	0.5604
LCPI(-1)	-0.763796	1.921948	-0.397407	0.6941
LEXR(-1)	0.440633	2.453128	0.179621	0.8587
LM2(-1)	0.722219	1.709680	0.422429	0.6759
LGDPRICE(-1)	-0.492889	0.873261	-0.564424	0.5770
LDSEGEN(-1)	-0.273164	0.115432	-2.366440	0.0251

R-squared	0.361423	Mean dependent var	-0.047683
Adjusted R-squared	0.156166	S.D. dependent var	0.110861
S.E. of regression	0.101838	Akaike info criterion	-1.509940
Sum squared resid	0.290385	Schwarz criterion	-1.078996
Log likelihood	38.68885	Hannan-Quinn criter.	-1.356613
F-statistic	1.760830	Durbin-Watson stat	2.355889
Prob(F-statistic)	0.121482		

L 2.3 Short- and Long-run Coefficients

ARDL Cointegrating And Long Run Form
Dependent Variable: LDSEGEN
Selected Model: ARDL(2, 0, 0, 0, 0, 0, 0)
Sample: 1996M11 1999M12
Included observations: 38

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.263962	0.109886	2.402143	0.0232
D(LIPI)	0.082254	0.219114	0.375393	0.7102
D(LINT)	-6.310143	5.829688	-1.082415	0.2883
D(LCPI)	0.708963	1.804624	0.392859	0.6974
D(LEXR)	-5.765962	1.941353	-2.970074	0.0060
D(LM2)	-1.489971	1.097725	-1.357326	0.1855
D(LGDPRICE)	0.105356	0.787136	0.133847	0.8945
C	21.247676	4.868901	4.363957	0.0002
CointEq(-1)	-0.262589	0.060127	-4.367214	0.0002

Cointeq = LDSEGEN - (0.1825*LIPI -25.2840*LINT + 2.7415*LCPI -15.6002*LEXR -2.8238*LM2 -0.4256*LGDPRICE + 0.0660*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	0.182518	0.950284	0.192067	0.8491
LINT	-25.284048	20.663638	-1.223601	0.2313
LCPI	2.741461	6.532604	0.419658	0.6779
LEXR	-15.600240	9.019769	-1.729561	0.0947
LM2	-2.823826	6.411021	-0.440464	0.6630
LGDPRICE	-0.425624	2.590790	-0.164283	0.8707
@TREND	0.065963	0.089348	0.738273	0.4665

L 3 For Recovery Period

L 3.1 ARDL Specification

Dependent Variable: LDSEGEN
Method: ARDL
Sample: 2000M01 2009M12
Included observations: 120
Maximum dependent lags: 10 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (12 lags, automatic): LIPI LINT LCPI LEXR LM2 LGDPRICE
Fixed regressors: C @TREND

Number of models evalulated: 48268090
Selected Model: ARDL(7, 1, 0, 3, 6, 10, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	0.790463	0.098576	8.018839	0.0000
LDSEGEN(-2)	-0.143579	0.129449	-1.109153	0.2705
LDSEGEN(-3)	0.255950	0.127792	2.002872	0.0484
LDSEGEN(-4)	-0.009304	0.125136	-0.074350	0.9409
LDSEGEN(-5)	0.117200	0.124935	0.938092	0.3509
LDSEGEN(-6)	0.165175	0.127514	1.295354	0.1987
LDSEGEN(-7)	-0.371073	0.096112	-3.860830	0.0002
LIPI	-0.021795	0.117983	-0.184734	0.8539
LIPI(-1)	0.177692	0.113231	1.569287	0.1203
LINT	-6.132059	1.877861	-3.265449	0.0016
LCPI	0.402231	0.783164	0.513598	0.6089
LCPI(-1)	-0.579336	1.259820	-0.459856	0.6468
LCPI(-2)	-0.008868	1.248104	-0.007105	0.9943
LCPI(-3)	1.862338	0.829569	2.244947	0.0274
LEXR	0.083692	0.509374	0.164303	0.8699
LEXR(-1)	-0.853529	0.665692	-1.282167	0.2033
LEXR(-2)	-0.255131	0.647450	-0.394055	0.6945
LEXR(-3)	0.645583	0.623614	1.035229	0.3035
LEXR(-4)	-0.728181	0.634453	-1.147729	0.2543
LEXR(-5)	1.750072	0.658740	2.656697	0.0094
LEXR(-6)	-0.877420	0.486806	-1.802403	0.0750
LM2	2.269722	0.521207	4.354738	0.0000
LM2(-1)	-2.657880	0.582130	-4.565787	0.0000
LM2(-2)	0.751057	0.605429	1.240537	0.2182
LM2(-3)	0.007384	0.601953	0.012267	0.9902
LM2(-4)	-1.011078	0.532625	-1.898293	0.0611
LM2(-5)	1.033450	0.497782	2.076110	0.0409
LM2(-6)	-1.565857	0.566680	-2.763214	0.0070
LM2(-7)	1.788537	0.571675	3.128594	0.0024
LM2(-8)	-0.222790	0.597497	-0.372872	0.7102
LM2(-9)	0.847974	0.616535	1.375386	0.1726
LM2(-10)	0.926854	0.548421	1.690041	0.0947
LGDPRICE	-0.207368	0.064257	-3.227165	0.0018
C	-14.27882	3.917878	-3.644529	0.0005
@TREND	-0.031045	0.010842	-2.863425	0.0053

R-squared	0.993662	Mean dependent var	5.987846
Adjusted R-squared	0.991127	S.D. dependent var	0.525751
S.E. of regression	0.049524	Akaike info criterion	-2.934215
Sum squared resid	0.208476	Schwarz criterion	-2.121196
Log likelihood	211.0529	Hannan-Quinn criter.	-2.604044
F-statistic	391.9497	Durbin-Watson stat	1.971750
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

L 3.2 Bound Test

ARDL Bounds Test

Sample: 2000M01 2009M12
Included observations: 120
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.879556	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.33	3.25
5%	2.63	3.62
2.5%	2.9	3.94
1%	3.27	4.39

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.004502	0.101507	-0.044356	0.9647
D(LDSEGEN(-2))	-0.154596	0.098752	-1.565499	0.1212
D(LDSEGEN(-3))	0.094255	0.099758	0.944835	0.3474
D(LDSEGEN(-4))	0.075784	0.094777	0.799605	0.4262
D(LDSEGEN(-5))	0.158024	0.092393	1.710340	0.0909
D(LDSEGEN(-6))	0.307716	0.099700	3.086422	0.0027
D(LIPI)	0.002770	0.125147	0.022133	0.9824
D(LCPI)	0.192477	0.824902	0.233333	0.8161
D(LCPI(-1))	-1.293241	0.833662	-1.551278	0.1246
D(LCPI(-2))	-1.651698	0.869009	-1.900669	0.0607
D(LEXR)	-0.097252	0.539442	-0.180283	0.8574
D(LEXR(-1))	-0.458226	0.532902	-0.859868	0.3923
D(LEXR(-2))	-0.716765	0.512749	-1.397886	0.1658
D(LEXR(-3))	-0.649964	0.518398	-1.253794	0.2134
D(LEXR(-4))	-0.722895	0.509646	-1.418426	0.1597
D(LEXR(-5))	0.728024	0.517205	1.407612	0.1629
D(LM2)	1.983125	0.544702	3.640754	0.0005
D(LM2(-1))	-2.882960	0.896936	-3.214231	0.0018
D(LM2(-2))	-1.953081	0.800354	-2.440271	0.0168
D(LM2(-3))	-1.770112	0.792740	-2.232903	0.0282
D(LM2(-4))	-2.894104	0.850545	-3.402645	0.0010
D(LM2(-5))	-1.887845	0.821523	-2.297981	0.0240
D(LM2(-6))	-3.228082	0.740494	-4.359361	0.0000
D(LM2(-7))	-1.530561	0.734970	-2.082481	0.0403
D(LM2(-8))	-2.019957	0.686620	-2.941883	0.0042
D(LM2(-9))	-1.240815	0.602568	-2.059211	0.0425
C	-13.30089	3.901038	-3.409576	0.0010
@TREND	-0.032154	0.011195	-2.872253	0.0051
LIPI(-1)	0.171627	0.154452	1.111194	0.2696
LINT(-1)	-6.317013	1.962368	-3.219077	0.0018
LCPI(-1)	1.366491	0.406902	3.358284	0.0012
LEXR(-1)	-0.326185	0.226854	-1.437863	0.1541
LM2(-1)	2.291416	0.846050	2.708369	0.0082
LGDPRICE(-1)	-0.139069	0.067080	-2.073178	0.0412
LDSEGEN(-1)	-0.180373	0.046516	-3.877702	0.0002

R-squared	0.557041	Mean dependent var	0.016206
Adjusted R-squared	0.379858	S.D. dependent var	0.065863
S.E. of regression	0.051866	Akaike info criterion	-2.841801
Sum squared resid	0.228660	Schwarz criterion	-2.028782
Log likelihood	205.5080	Hannan-Quinn criter.	-2.511630
F-statistic	3.143866	Durbin-Watson stat	1.985193
Prob(F-statistic)	0.000011		

L 3.3 Short- and Long-run Coefficients

ARDL Cointegrating And Long Run Form
Dependent Variable: LDSEGEN
Selected Model: ARDL(7, 1, 0, 3, 6, 10, 0)
Date: 06/12/17 Time: 16:15
Sample: 2000M01 2009M12
Included observations: 120

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	-0.013139	0.085908	-0.152939	0.8788
D(LDSEGEN(-2))	-0.157679	0.083492	-1.888558	0.0624
D(LDSEGEN(-3))	0.098928	0.084756	1.167212	0.2464
D(LDSEGEN(-4))	0.087737	0.081443	1.077288	0.2844
D(LDSEGEN(-5))	0.207562	0.083059	2.498962	0.0144
D(LDSEGEN(-6))	0.371014	0.088614	4.186858	0.0001
D(LIPI)	-0.022826	0.089648	-0.254612	0.7996
D(LINT)	-5.937682	2.777133	-2.138061	0.0354
D(LCPI)	0.382045	0.724498	0.527324	0.5993
D(LCPI(-1))	-1.833417	0.779856	-2.350968	0.0210
D(LCPI(-2))	-1.855280	0.774189	-2.396417	0.0187
D(LEXR)	0.089513	0.461269	0.194059	0.8466
D(LEXR(-1))	-0.542448	0.456194	-1.189074	0.2377
D(LEXR(-2))	-0.803061	0.440230	-1.824186	0.0716
D(LEXR(-3))	-0.135437	0.472011	-0.286937	0.7749
D(LEXR(-4))	-0.880064	0.455476	-1.932186	0.0567
D(LEXR(-5))	0.868098	0.470542	1.844887	0.0685
D(LM2)	2.277371	0.471631	4.828710	0.0000
D(LM2(-1))	-2.551160	0.560607	-4.550710	0.0000
D(LM2(-2))	-1.798217	0.533187	-3.372582	0.0011
D(LM2(-3))	-1.786534	0.521565	-3.425335	0.0009
D(LM2(-4))	-2.804726	0.517811	-5.416503	0.0000
D(LM2(-5))	-1.772610	0.548388	-3.232401	0.0017
D(LM2(-6))	-3.334180	0.558270	-5.972340	0.0000
D(LM2(-7))	-1.539691	0.562033	-2.739502	0.0075
D(LM2(-8))	-1.768751	0.535728	-3.301585	0.0014
D(LM2(-9))	-0.927631	0.518634	-1.788604	0.0772
D(LGDPRICE)	-0.218275	0.085612	-2.549577	0.0126
C	-14.246812	2.038885	-6.987552	0.0000
CointEq(-1)	-0.194312	0.027780	-6.994579	0.0000

Cointeq = LDSEGEN - (0.7988*LIPI -31.4197*LINT + 8.5894*LCPI -1.2037 *LEXR + 11.1053*LM2 -1.0625*LGDPRICE -0.1591*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	0.798789	0.770422	1.036820	0.3028
LINT	-31.419687	13.186846	-2.382654	0.0194
LCPI	8.589429	1.963493	4.374566	0.0000
LEXR	-1.203660	1.149669	-1.046962	0.2981
LM2	11.105277	5.430646	2.044928	0.0440
LGDPRICE	-1.062523	0.363037	-2.926763	0.0044
@TREND	-0.159071	0.073702	-2.158299	0.0337

L 3.4 VECM Results for Significance Test of the Coefficients

Estimation Command:
=========================
LS DLDSEGEN DLDSEGEN(-1) DLDSEGEN(-2) DLDSEGEN(-3) DLDSEGEN(-4) DLDSEGEN(-5) DLDSEGEN(-6) DLIPI DLCPI DLCPI(-1) DLCPI(-2) DLEXR DLEXR(-1) DLEXR(-2) DLEXR(-3) DLEXR(-4) DLEXR(-5) DLM2 DLM2(-1) DLM2(-2) DLM2(-3) DLM2(-4) DLM2(-5) DLM2(-6) DLM2(-7) DLM2(-8) DLM2(-9) C @TREND LIPI(-1) LINT(-1) LCPI(-1) LEXR(-1) LM2(-1) LGDPRICE(-1) LDSEGEN(-1)

Estimation Equation:
=========================
DLDSEGEN = C(1)*DLDSEGEN(-1) + C(2)*DLDSEGEN(-2) + C(3)*DLDSEGEN(-3) + C(4)*DLDSEGEN(-4) + C(5)*DLDSEGEN(-5) + C(6)*DLDSEGEN(-6) + C(7)*DLIPI + C(8)*DLCPI + C(9)*DLCPI(-1) + C(10)*DLCPI(-2) + C(11)*DLEXR + C(12)*DLEXR(-1) + C(13)*DLEXR(-2) + C(14)*DLEXR(-3) + C(15)*DLEXR(-4) + C(16)*DLEXR(-5) + C(17)*DLM2 + C(18)*DLM2(-1) + C(19)*DLM2(-2) + C(20)*DLM2(-3) + C(21)*DLM2(-4) + C(22)*DLM2(-5) + C(23)*DLM2(-6) + C(24)*DLM2(-7) + C(25)*DLM2(-8) + C(26)*DLM2(-9) + C(27) + C(28)*@TREND + C(29)*LIPI(-1) + C(30)*LINT(-1) + C(31)*LCPI(-1) + C(32)*LEXR(-1) + C(33)*LM2(-1) + C(34)*LGDPRICE(-1) + C(35)*LDSEGEN(-1)

Substituted Coefficients:
=========================
DLDSEGEN = -0.00450245633882*DLDSEGEN(-1) - 0.154595957557*DLDSEGEN(-2) + 0.0942546600057*DLDSEGEN(-3) + 0.075784367071*DLDSEGEN(-4) + 0.158024178525*DLDSEGEN(-5) + 0.307716164144*DLDSEGEN(-6) + 0.00276991139801*DLIPI + 0.192476936745*DLCPI - 1.29324123244*DLCPI(-1) - 1.65169790128*DLCPI(-2) - 0.0972520775654*DLEXR - 0.45822598621*DLEXR(-1) - 0.716764509838*DLEXR(-2) - 0.649964064344*DLEXR(-3) - 0.722895195207*DLEXR(-4) + 0.728023920266*DLEXR(-5) + 1.98312513656*DLM2 - 2.88295954138*DLM2(-1) - 1.95308115168*DLM2(-2) - 1.77011198142*DLM2(-3) - 2.89410430761*DLM2(-4) - 1.88784496947*DLM2(-5) - 3.22808151864*DLM2(-6) - 1.53056149652*DLM2(-7) - 2.01995730342*DLM2(-8) - 1.24081540016*DLM2(-9) - 13.3008865961 - 0.0321544914927*@TREND + 0.171626658246*LIPI(-1) - 6.31701298302*LINT(-1) + 1.3664907124*LCPI(-1) - 0.326184946103*LEXR(-1) + 2.29141628363*LM2(-1) - 0.139068878537*LGDPRICE(-1) - 0.180373271671*LDSEGEN(-1)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.518679	(3, 85)	0.0635
Chi-square	7.556038	3	0.0561

Null Hypothesis: C(8)=C(9)=C(10)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	0.192477	0.824902
C(9)	-1.293241	0.833662
C(10)	-1.651698	0.869009

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.427246	(6, 85)	0.2137
Chi-square	8.563479	6	0.1997

Null Hypothesis: C(11)=C(12)=C(13)=C(14)=C(15)=C(16)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(11)	-0.097252	0.539442
C(12)	-0.458226	0.532902
C(13)	-0.716765	0.512749
C(14)	-0.649964	0.518398
C(15)	-0.722895	0.509646
C(16)	0.728024	0.517205

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.304306	(10, 85)	0.0001
Chi-square	43.04306	10	0.0000

Null Hypothesis: C(17)=C(18)=C(19)=C(20)=C(21)=C(22)=
C(23)=C(24)=C(25)=C(26)=0
Null Hypothesis Summary:

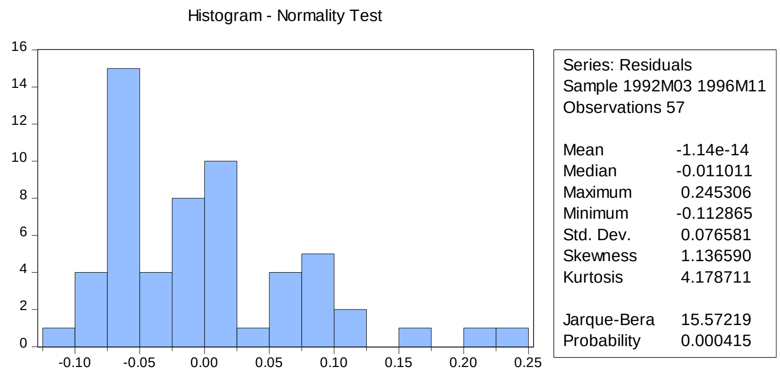
Normalized Restriction (= 0)	Value	Std. Err.
C(17)	1.983125	0.544702
C(18)	-2.882960	0.896936
C(19)	-1.953081	0.800354
C(20)	-1.770112	0.792740
C(21)	-2.894104	0.850545
C(22)	-1.887845	0.821523
C(23)	-3.228082	0.740494
C(24)	-1.530561	0.734970
C(25)	-2.019957	0.686620
C(26)	-1.240815	0.602568

Restrictions are linear in coefficients.

Appendix M: Residual Diagnostic Tests for Different Periods

M 1 For Bubble Period

M 1.1 Normality Test of Residuals



M 1.2 Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.830237	Prob. F(2,35)	0.4443
Obs*R-squared	2.581717	Prob. Chi-Square(2)	0.2750

Test Equation:
Dependent Variable: RESID
Method: ARDL
Sample: 1992M03 1996M11
Included observations: 57
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	-0.007172	0.129509	-0.055381	0.9562
LIPI	-0.057619	0.304029	-0.189517	0.8508
LIPI(-1)	0.134218	0.296151	0.453210	0.6532
LIPI(-2)	-0.129315	0.320178	-0.403885	0.6888
LIPI(-3)	0.080382	0.326089	0.246503	0.8067
LIPI(-4)	-0.021410	0.299094	-0.071582	0.9433
LINT	0.267845	2.034361	0.131660	0.8960
LCPI	-0.220950	1.439986	-0.153439	0.8789
LCPI(-1)	0.424888	2.139337	0.198607	0.8437
LCPI(-2)	-0.063298	1.467867	-0.043123	0.9658
LEXR	-1.561497	4.910829	-0.317970	0.7524
LEXR(-1)	-1.224242	5.518487	-0.221844	0.8257
LEXR(-2)	1.748663	4.999763	0.349749	0.7286
LEXR(-3)	0.406506	4.733225	0.085884	0.9320
LEXR(-4)	0.210974	4.590677	0.045957	0.9636
LEXR(-5)	0.117132	3.750535	0.031231	0.9753
LM2	-0.467428	1.213201	-0.385285	0.7024
LGDPRICE	0.097057	0.817120	0.118779	0.9061
C	2.446630	22.69068	0.107825	0.9148
@TREND	0.005478	0.015070	0.363532	0.7184
RESID(-1)	-0.069688	0.252927	-0.275527	0.7845
RESID(-2)	0.286986	0.243132	1.180373	0.2458

R-squared	0.045293	Mean dependent var	-1.14E-14
Adjusted R-squared	-0.527531	S.D. dependent var	0.076581
S.E. of regression	0.094649	Akaike info criterion	-1.593049
Sum squared resid	0.313547	Schwarz criterion	-0.804503
Log likelihood	67.40189	Hannan-Quinn criter.	-1.286593
F-statistic	0.079070	Durbin-Watson stat	1.931812
Prob(F-statistic)	1.000000		

M 1.3 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.022347	Prob. F(19,37)	0.4610
Obs*R-squared	19.62268	Prob. Chi-Square(19)	0.4176
Scaled explained SS	13.14114	Prob. Chi-Square(19)	0.8313

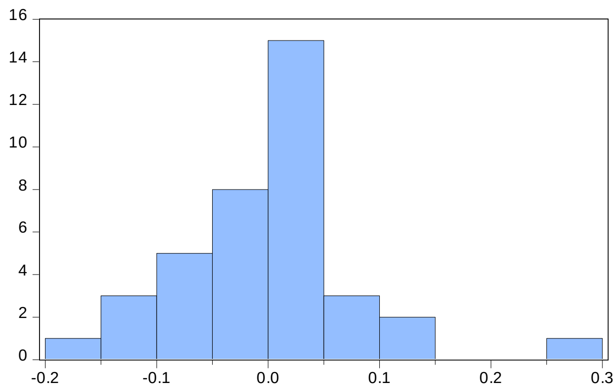
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.249984	2.208384	-1.471657	0.1496
LDSEGEN(-1)	-0.002053	0.009708	-0.211516	0.8336
LIPI	0.012720	0.032274	0.394124	0.6958
LIPI(-1)	-0.023156	0.030227	-0.766051	0.4485
LIPI(-2)	0.044829	0.033087	1.354880	0.1837
LIPI(-3)	-0.010160	0.034043	-0.298462	0.7670
LIPI(-4)	0.054202	0.032384	1.673729	0.1026
LINT	-0.134191	0.215576	-0.622475	0.5374
LCPI	0.014969	0.154745	0.096732	0.9235
LCPI(-1)	-0.084304	0.223132	-0.377821	0.7077
LCPI(-2)	0.073761	0.158192	0.466273	0.6438
LEXR	-0.009316	0.474464	-0.019635	0.9844
LEXR(-1)	0.825653	0.561976	1.469196	0.1502
LEXR(-2)	-0.727341	0.520155	-1.398315	0.1703
LEXR(-3)	0.503918	0.508675	0.990648	0.3283
LEXR(-4)	-0.704507	0.500102	-1.408726	0.1673
LEXR(-5)	0.854616	0.404466	2.112948	0.0414
LM2	-0.082942	0.124961	-0.663745	0.5110
LGDPRICE	-0.040341	0.088288	-0.456924	0.6504
@TREND	-0.000562	0.001557	-0.360630	0.7204

R-squared	0.344258	Mean dependent var	0.005762
Adjusted R-squared	0.007525	S.D. dependent var	0.010364
S.E. of regression	0.010325	Akaike info criterion	-6.038889
Sum squared resid	0.003944	Schwarz criterion	-5.322029
Log likelihood	192.1083	Hannan-Quinn criter.	-5.760293
F-statistic	1.022347	Durbin-Watson stat	2.544808
Prob(F-statistic)	0.460999		

M 2 For Meltdown Period

M 2.1 Normality Test of Residuals



Series: Residuals
Sample 1996M11 1999M12
Observations 38

Mean	6.29e-15
Median	0.007907
Maximum	0.271626
Minimum	-0.187674
Std. Dev.	0.082064
Skewness	0.599925
Kurtosis	4.979176
Jarque-Bera	8.481562
Probability	0.014396

M 2.2 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.069472	Prob. F(1,27)	0.1618
Obs*R-squared	2.705241	Prob. Chi-Square(1)	0.1000

Test Equation:
Dependent Variable: RESID
Method: ARDL
Sample: 1996M11 1999M12
Included observations: 38
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	0.102795	0.137968	0.745062	0.4627
LDSEGEN(-2)	-0.103222	0.143003	-0.721814	0.4766
LIPI	-0.060526	0.250260	-0.241853	0.8107
LINT	2.251775	6.029824	0.373440	0.7117
LCPI	0.170416	1.719787	0.099091	0.9218
LEXR	-0.101242	2.154366	-0.046994	0.9629
LM2	0.726664	1.608786	0.451685	0.6551
LGDPRICE	0.015845	0.724384	0.021874	0.9827
C	-3.557020	12.71608	-0.279726	0.7818
@TREND	-0.008267	0.020408	-0.405099	0.6886
RESID(-1)	-0.353330	0.245613	-1.438566	0.1618

R-squared	0.071191	Mean dependent var	6.29E-15
Adjusted R-squared	-0.272813	S.D. dependent var	0.082064
S.E. of regression	0.092583	Akaike info criterion	-1.684219
Sum squared resid	0.231435	Schwarz criterion	-1.210181
Log likelihood	43.00016	Hannan-Quinn criter.	-1.515560
F-statistic	0.206947	Durbin-Watson stat	2.193027
Prob(F-statistic)	0.993731		

M 2.3 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.434836	Prob. F(9,28)	0.2210
Obs*R-squared	11.99393	Prob. Chi-Square(9)	0.2137
Scaled explained SS	12.95607	Prob. Chi-Square(9)	0.1646

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

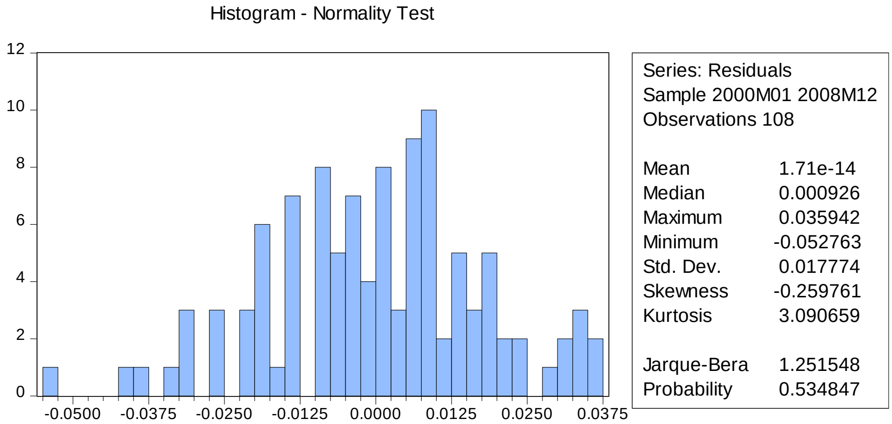
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.538035	1.698340	0.905611	0.3729
LDSEGEN(-1)	-0.014425	0.016070	-0.897634	0.3770
LDSEGEN(-2)	-0.007231	0.016842	-0.429316	0.6710
LIPI	-0.032474	0.033590	-0.966783	0.3419
LINT	-1.579990	0.792859	-1.992775	0.0561
LCPI	0.111202	0.233605	0.476023	0.6378
LEXR	-0.210854	0.293176	-0.719205	0.4780
LM2	-0.057308	0.207970	-0.275557	0.7849
LGDPRICE	-0.070168	0.098619	-0.711505	0.4827
@TREND	9.29E-05	0.002666	0.034843	0.9725

R-squared	0.315630	Mean dependent var	0.006557
Adjusted R-squared	0.095653	S.D. dependent var	0.013256

S.E. of regression	0.012606	Akaike info criterion	-5.688372
Sum squared resid	0.004449	Schwarz criterion	-5.257428
Log likelihood	118.0791	Hannan-Quinn criter.	-5.535045
F-statistic	1.434836	Durbin-Watson stat	2.641469
Prob(F-statistic)	0.220974		

M 3 For Recovery Period

M 3.1 Normality Test of Residuals



M 3.2 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.067365	Prob. F(1,22)	0.7976
Obs*R-squared	0.329693	Prob. Chi-Square(1)	0.5658

Test Equation:
Dependent Variable: RESID
Method: ARDL
Sample: 2000M01 2008M12
Included observations: 108
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDSEGEN(-1)	0.047509	0.249506	0.190411	0.8507
LDSEGEN(-2)	-0.033267	0.222602	-0.149449	0.8826
LDSEGEN(-3)	-0.001259	0.179981	-0.006998	0.9945
LDSEGEN(-4)	-0.008153	0.182151	-0.044758	0.9647
LDSEGEN(-5)	0.009599	0.187356	0.051233	0.9596
LDSEGEN(-6)	-0.003312	0.181719	-0.018228	0.9856
LDSEGEN(-7)	-0.010649	0.203330	-0.052371	0.9587
LDSEGEN(-8)	-0.002188	0.187838	-0.011650	0.9908
LDSEGEN(-9)	0.010340	0.169795	0.060898	0.9520
LDSEGEN(-10)	-0.008067	0.144692	-0.055754	0.9560
LIPI	-0.012975	0.222520	-0.058310	0.9540
LIPI(-1)	0.013362	0.203580	0.065637	0.9483
LIPI(-2)	-0.003792	0.183275	-0.020688	0.9837
LIPI(-3)	-0.021639	0.233249	-0.092770	0.9269
LIPI(-4)	-0.008777	0.216868	-0.040472	0.9681
LIPI(-5)	0.013803	0.204776	0.067407	0.9469
LIPI(-6)	-0.011623	0.212792	-0.054620	0.9569
LIPI(-7)	0.001989	0.181790	0.010942	0.9914
LIPI(-8)	-0.015555	0.208271	-0.074684	0.9411
LIPI(-9)	0.010223	0.196508	0.052025	0.9590
LIPI(-10)	-0.002018	0.176639	-0.011425	0.9910
LIPI(-11)	-0.002312	0.190558	-0.012131	0.9904

LIPI(-12)	-0.003329	0.188732	-0.017636	0.9861
LINT	0.248432	5.229347	0.047507	0.9625
LINT(-1)	0.139345	7.766876	0.017941	0.9858
LINT(-2)	0.062703	8.638126	0.007259	0.9943
LINT(-3)	0.449614	7.503321	0.059922	0.9528
LINT(-4)	-0.917341	7.714886	-0.118905	0.9064
LINT(-5)	0.232596	5.902537	0.039406	0.9689
LINT(-6)	0.630697	7.092489	0.088925	0.9299
LINT(-7)	0.410164	6.487137	0.063227	0.9502
LINT(-8)	-0.499207	6.526646	-0.076487	0.9397
LINT(-9)	-0.484640	6.495882	-0.074607	0.9412
LINT(-10)	0.506848	5.461804	0.092799	0.9269
LCPI	-0.134131	1.481643	-0.090529	0.9287
LCPI(-1)	0.193292	2.134363	0.090562	0.9287
LCPI(-2)	-0.049601	2.030180	-0.024432	0.9807
LCPI(-3)	-0.004103	1.790805	-0.002291	0.9982
LCPI(-4)	-0.112203	1.770518	-0.063373	0.9500
LCPI(-5)	0.200890	1.987101	0.101097	0.9204
LCPI(-6)	-0.188917	2.095022	-0.090174	0.9290
LCPI(-7)	0.014557	2.288837	0.006360	0.9950
LCPI(-8)	0.304947	2.775026	0.109890	0.9135
LCPI(-9)	-0.335092	2.623578	-0.127723	0.8995
LCPI(-10)	0.135949	2.267058	0.059967	0.9527
LCPI(-11)	-0.069232	1.872578	-0.036971	0.9708
LEXR	0.021099	0.970654	0.021737	0.9829
LEXR(-1)	-0.019297	0.884973	-0.021806	0.9828
LEXR(-2)	-0.020540	0.891942	-0.023029	0.9818
LEXR(-3)	0.122254	1.201420	0.101758	0.9199
LEXR(-4)	0.026487	1.175541	0.022532	0.9822
LEXR(-5)	-0.093993	1.110370	-0.084650	0.9333
LEXR(-6)	0.016978	1.065188	0.015939	0.9874
LEXR(-7)	-0.005949	1.031769	-0.005766	0.9955
LEXR(-8)	-0.042560	1.001559	-0.042494	0.9665
LEXR(-9)	-0.001139	0.993886	-0.001146	0.9991
LEXR(-10)	-0.036396	0.793808	-0.045849	0.9638
LM2	0.081898	1.110925	0.073720	0.9419
LM2(-1)	0.020143	1.047074	0.019238	0.9848
LM2(-2)	0.041752	0.924420	0.045166	0.9644
LM2(-3)	0.018213	0.883708	0.020609	0.9837
LM2(-4)	-0.096388	1.052840	-0.091550	0.9279
LM2(-5)	0.024303	1.018741	0.023856	0.9812
LM2(-6)	0.029634	1.056274	0.028055	0.9779
LM2(-7)	0.004294	0.825276	0.005204	0.9959
LM2(-8)	-0.016297	0.846748	-0.019246	0.9848
LM2(-9)	-0.030080	0.847376	-0.035498	0.9720
LM2(-10)	0.003493	0.842787	0.004144	0.9967
LM2(-11)	-0.118082	1.055188	-0.111906	0.9119
LM2(-12)	-0.107556	1.092268	-0.098470	0.9225
LGDPRICE	-0.024657	0.215721	-0.114298	0.9100
LGDPRICE(-1)	-0.001850	0.208431	-0.008875	0.9930
LGDPRICE(-2)	0.020763	0.220276	0.094258	0.9258
LGDPRICE(-3)	-0.005304	0.204543	-0.025929	0.9795
LGDPRICE(-4)	0.009767	0.194278	0.050273	0.9604
LGDPRICE(-5)	-0.014586	0.227636	-0.064078	0.9495
LGDPRICE(-6)	-0.007812	0.204106	-0.038277	0.9698
LGDPRICE(-7)	0.002482	0.168159	0.014757	0.9884
LGDPRICE(-8)	-0.002060	0.162487	-0.012680	0.9900
LGDPRICE(-9)	0.002281	0.189659	0.012027	0.9905
LGDPRICE(-10)	0.004399	0.176191	0.024965	0.9803
LGDPRICE(-11)	-0.007732	0.204515	-0.037805	0.9702
LGDPRICE(-12)	-0.017552	0.215739	-0.081358	0.9359
C	1.171296	9.555754	0.122575	0.9036
@TREND	0.003058	0.027127	0.112742	0.9113
RESID(-1)	-0.091436	0.352290	-0.259548	0.7976

R-squared	0.003053	Mean dependent var	1.37E-14
Adjusted R-squared	-3.848789	S.D. dependent var	0.017774
S.E. of regression	0.039139	Akaike info criterion	-3.641895
Sum squared resid	0.033701	Schwarz criterion	-1.506124
Log likelihood	282.6623	Hannan-Quinn criter.	-2.775917
F-statistic	0.000793	Durbin-Watson stat	2.019840
Prob(F-statistic)	1.000000		

M 3.3 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.579193	Prob. F(84,23)	0.1072
Obs*R-squared	92.04135	Prob. Chi-Square(84)	0.2570
Scaled explained SS	4.363595	Prob. Chi-Square(84)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 2000M01 2008M12
Included observations: 108

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000845	0.081129	0.010419	0.9918
LDSEGEN(-1)	-0.000232	0.001633	-0.142303	0.8881
LDSEGEN(-2)	9.37E-05	0.001753	0.053466	0.9578
LDSEGEN(-3)	-0.001097	0.001733	-0.633296	0.5328
LDSEGEN(-4)	0.001245	0.001728	0.720215	0.4786
LDSEGEN(-5)	0.000591	0.001769	0.333831	0.7415
LDSEGEN(-6)	-0.000756	0.001746	-0.433181	0.6689
LDSEGEN(-7)	4.28E-05	0.001918	0.022297	0.9824
LDSEGEN(-8)	0.001572	0.001807	0.869974	0.3933
LDSEGEN(-9)	-0.002664	0.001590	-1.675652	0.1073
LDSEGEN(-10)	0.002354	0.001361	1.729424	0.0971
LIPI	0.001688	0.002089	0.808016	0.4274
LIPI(-1)	-0.001097	0.001897	-0.578348	0.5686
LIPI(-2)	0.004216	0.001760	2.395944	0.0251
LIPI(-3)	-0.001660	0.002098	-0.791059	0.4370
LIPI(-4)	0.000512	0.002063	0.247944	0.8064
LIPI(-5)	0.000240	0.001905	0.125812	0.9010
LIPI(-6)	-0.001595	0.002004	-0.795894	0.4342
LIPI(-7)	0.001149	0.001749	0.656767	0.5178
LIPI(-8)	-0.001731	0.001921	-0.901185	0.3768
LIPI(-9)	3.94E-05	0.001854	0.021242	0.9832
LIPI(-10)	-0.000298	0.001700	-0.175238	0.8624
LIPI(-11)	0.004003	0.001833	2.183090	0.0395
LIPI(-12)	-0.003346	0.001814	-1.844947	0.0780
LINT	-0.019359	0.049518	-0.390952	0.6994
LINT(-1)	0.066585	0.074631	0.892199	0.3815
LINT(-2)	-0.181177	0.083169	-2.178420	0.0399
LINT(-3)	0.190222	0.070319	2.705134	0.0126
LINT(-4)	-0.154885	0.066052	-2.344886	0.0280
LINT(-5)	0.051819	0.056194	0.922155	0.3660
LINT(-6)	0.013923	0.064179	0.216938	0.8302
LINT(-7)	0.011782	0.060601	0.194419	0.8476
LINT(-8)	0.019326	0.060072	0.321716	0.7506
LINT(-9)	-0.004326	0.059927	-0.072190	0.9431
LINT(-10)	-0.036959	0.049130	-0.752263	0.4595
LCPI	-0.007661	0.013375	-0.572777	0.5724
LCPI(-1)	-0.002841	0.019266	-0.147462	0.8841
LCPI(-2)	0.009641	0.019468	0.495226	0.6251
LCPI(-3)	-0.027319	0.017248	-1.583858	0.1269
LCPI(-4)	0.016423	0.016537	0.993071	0.3310
LCPI(-5)	0.007143	0.017628	0.405224	0.6891

LCPI(-6)	0.019525	0.018922	1.031867	0.3129
LCPI(-7)	-0.026550	0.022039	-1.204685	0.2406
LCPI(-8)	-0.002726	0.024215	-0.112595	0.9113
LCPI(-9)	0.000991	0.021999	0.045048	0.9645
LCPI(-10)	-0.012412	0.021245	-0.584242	0.5647
LCPI(-11)	0.013082	0.017853	0.732774	0.4711
LEXR	-0.009306	0.009316	-0.998905	0.3282
LEXR(-1)	-0.006972	0.008494	-0.820841	0.4202
LEXR(-2)	-0.000611	0.008557	-0.071359	0.9437
LEXR(-3)	-0.001637	0.010646	-0.153763	0.8791
LEXR(-4)	0.012265	0.011280	1.087368	0.2881
LEXR(-5)	-0.005761	0.010110	-0.569802	0.5743
LEXR(-6)	0.002067	0.010240	0.201864	0.8418
LEXR(-7)	-0.013010	0.009935	-1.309500	0.2033
LEXR(-8)	0.006140	0.009517	0.645174	0.5252
LEXR(-9)	0.004923	0.009573	0.514246	0.6120
LEXR(-10)	-0.002000	0.007526	-0.265715	0.7928
LM2	0.013256	0.010260	1.292013	0.2092
LM2(-1)	0.013929	0.010058	1.384974	0.1793
LM2(-2)	-0.016331	0.008768	-1.862602	0.0753
LM2(-3)	0.003167	0.008485	0.373207	0.7124
LM2(-4)	-0.014934	0.009489	-1.573865	0.1292
LM2(-5)	-0.004230	0.009771	-0.432903	0.6691
LM2(-6)	0.023064	0.010114	2.280341	0.0322
LM2(-7)	-0.001869	0.007947	-0.235206	0.8161
LM2(-8)	0.013146	0.008133	1.616298	0.1197
LM2(-9)	-0.001025	0.008085	-0.126802	0.9002
LM2(-10)	0.000595	0.008117	0.073246	0.9422
LM2(-11)	0.000563	0.009170	0.061379	0.9516
LM2(-12)	-0.002633	0.009734	-0.270529	0.7892
LGDPRICE	-3.40E-05	0.001865	-0.018251	0.9856
LGDPRICE(-1)	-0.000361	0.002006	-0.180003	0.8587
LGDPRICE(-2)	0.002041	0.001977	1.032688	0.3125
LGDPRICE(-3)	-0.001871	0.001960	-0.954242	0.3499
LGDPRICE(-4)	0.002500	0.001836	1.361985	0.1864
LGDPRICE(-5)	-0.004300	0.002125	-2.023904	0.0547
LGDPRICE(-6)	-0.000287	0.001944	-0.147747	0.8838
LGDPRICE(-7)	0.001086	0.001617	0.671478	0.5086
LGDPRICE(-8)	-0.000948	0.001563	-0.606257	0.5503
LGDPRICE(-9)	0.002134	0.001825	1.169530	0.2542
LGDPRICE(-10)	-0.002902	0.001689	-1.717747	0.0993
LGDPRICE(-11)	0.003183	0.001949	1.633497	0.1160
LGDPRICE(-12)	-0.001467	0.001973	-0.743403	0.4648
@TREND	-0.000252	0.000235	-1.070921	0.2953

R-squared	0.852235	Mean dependent var	0.000313
Adjusted R-squared	0.312570	S.D. dependent var	0.000455
S.E. of regression	0.000377	Akaike info criterion	-12.90131
Sum squared resid	3.27E-06	Schwarz criterion	-10.79038
Log likelihood	781.6709	Hannan-Quinn criter.	-12.04541
F-statistic	1.579193	Durbin-Watson stat	2.113284
Prob(F-statistic)	0.107183		

Appendix N: Ordinary Least Squares Estimation

N 1 OLS Estimation

Dependent Variable: DLDSEGEN
Method: Least Squares
Date: 03/05/17 Time: 20:02
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLIPI	-0.059165	0.079937	-0.740142	0.4598
DLINT	-1.205957	1.683445	-0.716363	0.4743
DLCPI	-0.456110	0.568582	-0.802190	0.4231
DLEXR	-0.818278	0.565252	-1.447635	0.1488
DLM2	0.771890	0.377767	2.043297	0.0419
DLGDPRICE	-0.016780	0.116407	-0.144150	0.8855
C	0.004190	0.007420	0.564680	0.5727

R-squared	0.027962	Mean dependent var	0.008816
Adjusted R-squared	0.007988	S.D. dependent var	0.090990
S.E. of regression	0.090626	Akaike info criterion	-1.941021
Sum squared resid	2.398210	Schwarz criterion	-1.854389
Log likelihood	297.1827	Hannan-Quinn criter.	-1.906347
F-statistic	1.399948	Durbin-Watson stat	1.704021
Prob(F-statistic)	0.214398		

N 2 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	6.602612	Prob. F(1,291)	0.0107
Obs*R-squared	6.633615	Prob. Chi-Square(1)	0.0100

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/05/17 Time: 20:02
Sample: 1991M02 2015M12
Included observations: 299
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLIPI	0.010468	0.079286	0.132028	0.8951
DLINT	0.343090	1.672860	0.205092	0.8376
DLCPI	-0.052060	0.563568	-0.092376	0.9265
DLEXR	-0.022087	0.559972	-0.039442	0.9686
DLM2	-0.048367	0.374667	-0.129094	0.8974
DLGDPRICE	-0.012415	0.115407	-0.107572	0.9144
C	0.000954	0.007359	0.129610	0.8970
RESID(-1)	0.149952	0.058357	2.569555	0.0107

R-squared	0.022186	Mean dependent var	2.31E-18
Adjusted R-squared	-0.001335	S.D. dependent var	0.089709
S.E. of regression	0.089769	Akaike info criterion	-1.956768
Sum squared resid	2.345003	Schwarz criterion	-1.857760
Log likelihood	300.5368	Hannan-Quinn criter.	-1.917140
F-statistic	0.943230	Durbin-Watson stat	2.003162
Prob(F-statistic)	0.473365		

N 3 Heteroskedasticity Test: ARCH

F-statistic	16.70739	Prob. F(1,296)	0.0001
Obs*R-squared	15.92160	Prob. Chi-Square(1)	0.0001

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/05/17 Time: 20:03
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006187	0.001488	4.158362	0.0000
RESID^2(-1)	0.231147	0.056550	4.087468	0.0001

R-squared	0.053428	Mean dependent var	0.008047
Adjusted R-squared	0.050230	S.D. dependent var	0.025091
S.E. of regression	0.024453	Akaike info criterion	-4.577437
Sum squared resid	0.176993	Schwarz criterion	-4.552624
Log likelihood	684.0381	Hannan-Quinn criter.	-4.567504
F-statistic	16.70739	Durbin-Watson stat	2.111140
Prob(F-statistic)	0.000056		

Appendix O: Volatility Modeling with EGARCH(1,1,1) Model

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 22:03
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Failure to improve likelihood (non-zero gradients) after 100 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(8) + C(9)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(10)
*RESID(-1)/@SQRT(GARCH(-1)) + C(11)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
DLIPI	-0.036937	0.060272	-0.612844	0.5400
DLINT	-0.260559	1.148395	-0.226890	0.8205
DLCPI	1.127699	0.344249	3.275823	0.0011
DLEXR	-0.704919	0.324902	-2.169640	0.0300
DLM2	1.403796	0.229948	6.104851	0.0000
DLGDPRICE	0.101400	0.059572	1.702133	0.0887
C	-0.007716	0.004303	-1.793109	0.0730
		Variance Equation		
C(8)	1.82E-05	0.013724	0.001330	0.9989
C(9)	-0.066535	0.013069	-5.091257	0.0000
C(10)	0.151251	0.017060	8.865750	0.0000
C(11)	0.988912	3.70E-05	26729.38	0.0000

R-squared	-0.023136	Mean dependent var	0.008816
Adjusted R-squared	-0.044160	S.D. dependent var	0.090990
S.E. of regression	0.092977	Akaike info criterion	-2.258027
Sum squared resid	2.524278	Schwarz criterion	-2.121891
Log likelihood	348.5751	Hannan-Quinn criter.	-2.203539
Durbin-Watson stat	1.724543		

Heteroskedasticity Test: ARCH

F-statistic	0.202596	Prob. F(1,296)	0.6530
Obs*R-squared	0.203825	Prob. Chi-Square(1)	0.6517

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.135407	0.138789	8.180816	0.0000
WGT_RESID^2(-1)	-0.026153	0.058104	-0.450107	0.6530

R-squared	0.000684	Mean dependent var	1.106470
Adjusted R-squared	-0.002692	S.D. dependent var	2.120462
S.E. of regression	2.123315	Akaike info criterion	4.350523
Sum squared resid	1334.506	Schwarz criterion	4.375335
Log likelihood	-646.2279	Hannan-Quinn criter.	4.360455
F-statistic	0.202596	Durbin-Watson stat	1.996028
Prob (F-statistic)	0.652963		

Appendix P: Model Selection for Conditional Variance Estimation

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:13
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.005630	0.004967	1.133614	0.2570
		Variance Equation		
C	0.002148	0.000504	4.265811	0.0000
RESID(-1)^2	0.310408	0.066232	4.686706	0.0000
GARCH(-1)	0.424754	0.107220	3.961525	0.0001

R-squared	-0.001230	Mean dependent var	0.008816
Adjusted R-squared	-0.001230	S.D. dependent var	0.090990
S.E. of regression	0.091046	Akaike info criterion	-2.189928
Sum squared resid	2.470231	Schwarz criterion	-2.140424
Log likelihood	331.3943	Hannan-Quinn criter.	-2.170114
Durbin-Watson stat	1.679790		

Heteroskedasticity Test: ARCH

F-statistic	0.030474	Prob. F(1,296)	0.8615
Obs*R-squared	0.030677	Prob. Chi-Square(1)	0.8610

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:14
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.012559	0.152969	6.619381	0.0000
WGT_RESID^2(-1)	-0.010146	0.058123	-0.174569	0.8615

R-squared	0.000103	Mean dependent var	1.002386
Adjusted R-squared	-0.003275	S.D. dependent var	2.437522
S.E. of regression	2.441510	Akaike info criterion	4.629799
Sum squared resid	1764.448	Schwarz criterion	4.654612
Log likelihood	-687.8401	Hannan-Quinn criter.	4.639732
F-statistic	0.030474	Durbin-Watson stat	1.999339
Prob(F-statistic)	0.861538		

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:14
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 19 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006783	0.005708	1.188201	0.2348
AR(1)	0.121436	0.087089	1.394386	0.1632
		Variance Equation		
C	0.002130	0.000511	4.171213	0.0000
RESID(-1)^2	0.278864	0.067259	4.146138	0.0000
GARCH(-1)	0.445405	0.110431	4.033337	0.0001

R-squared	0.023513	Mean dependent var	0.008775
Adjusted R-squared	0.020214	S.D. dependent var	0.091140
S.E. of regression	0.090214	Akaike info criterion	-2.186461
Sum squared resid	2.409038	Schwarz criterion	-2.124430
Log likelihood	330.7828	Hannan-Quinn criter.	-2.161631
Durbin-Watson stat	1.927784		
Inverted AR Roots	.12		

Heteroskedasticity Test: ARCH

F-statistic	0.003060	Prob. F(1,295)	0.9559
Obs*R-squared	0.003081	Prob. Chi-Square(1)	0.9557

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:15
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.998840	0.154014	6.485387	0.0000
WGT_RESID^2(-1)	0.003221	0.058226	0.055315	0.9559

R-squared	0.000010	Mean dependent var	1.002069
Adjusted R-squared	-0.003379	S.D. dependent var	2.452047
S.E. of regression	2.456186	Akaike info criterion	4.641808
Sum squared resid	1779.691	Schwarz criterion	4.666682
Log likelihood	-687.3085	Hannan-Quinn criter.	4.651766
F-statistic	0.003060	Durbin-Watson stat	2.000079
Prob(F-statistic)	0.955925		

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:15
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 27 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.005573	0.005073	1.098436	0.2720
Variance Equation				
C(2)	-1.173400	0.288812	-4.062857	0.0000
C(3)	0.354890	0.088236	4.022049	0.0001
C(4)	0.114646	0.041571	2.757830	0.0058
C(5)	0.817780	0.046511	17.58255	0.0000

R-squared	-0.001275	Mean dependent var	0.008816
Adjusted R-squared	-0.001275	S.D. dependent var	0.090990
S.E. of regression	0.091048	Akaike info criterion	-2.190322
Sum squared resid	2.470342	Schwarz criterion	-2.128442
Log likelihood	332.4531	Hannan-Quinn criter.	-2.165555
Durbin-Watson stat	1.679715		

Heteroskedasticity Test: ARCH

F-statistic	0.070095	Prob. F(1,296)	0.7914
Obs*R-squared	0.070552	Prob. Chi-Square(1)	0.7905

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:15
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.983056	0.147606	6.660005	0.0000
WGT_RESID^2(-1)	0.015388	0.058122	0.264754	0.7914

R-squared	0.000237	Mean dependent var	0.998428
Adjusted R-squared	-0.003141	S.D. dependent var	2.338993
S.E. of regression	2.342664	Akaike info criterion	4.547143
Sum squared resid	1624.470	Schwarz criterion	4.571956
Log likelihood	-675.5243	Hannan-Quinn criter.	4.557075
F-statistic	0.070095	Durbin-Watson stat	2.000211
Prob(F-statistic)	0.791383		

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:16
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 35 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.008228	0.005211	1.579013	0.1143
AR(1)	0.111136	0.067190	1.654049	0.0981
		Variance Equation		
C(3)	-1.479373	0.372908	-3.967131	0.0001
C(4)	0.425017	0.087967	4.831543	0.0000
C(5)	0.090131	0.044836	2.010260	0.0444
C(6)	0.766640	0.064045	11.97039	0.0000

R-squared	0.022972	Mean dependent var	0.008775
Adjusted R-squared	0.019672	S.D. dependent var	0.091140
S.E. of regression	0.090239	Akaike info criterion	-2.181275
Sum squared resid	2.410372	Schwarz criterion	-2.106837
Log likelihood	331.0100	Hannan-Quinn criter.	-2.151478
Durbin-Watson stat	1.907339		
Inverted AR Roots	.11		

Heteroskedasticity Test: ARCH

F-statistic	0.044744	Prob. F(1,295)	0.8326
Obs*R-squared	0.045040	Prob. Chi-Square(1)	0.8319

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:16
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.986983	0.148023	6.667775	0.0000
WGT_RESID^2(-1)	0.012316	0.058225	0.211528	0.8326

R-squared	0.000152	Mean dependent var	0.999299
Adjusted R-squared	-0.003238	S.D. dependent var	2.341556
S.E. of regression	2.345344	Akaike info criterion	4.549452
Sum squared resid	1622.688	Schwarz criterion	4.574326
Log likelihood	-673.5937	Hannan-Quinn criter.	4.559410
F-statistic	0.044744	Durbin-Watson stat	2.000262
Prob(F-statistic)	0.832622		

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:16
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006532	0.005004	1.305240	0.1918
Variance Equation				
C	0.001677	0.000482	3.477642	0.0005
RESID(-1)^2	0.324348	0.078948	4.108363	0.0000
RESID(-1)^2*(RESID(-1)<0)	-0.164156	0.081551	-2.012923	0.0441
GARCH(-1)	0.538376	0.109429	4.919863	0.0000

R-squared	-0.000632	Mean dependent var	0.008816
Adjusted R-squared	-0.000632	S.D. dependent var	0.090990
S.E. of regression	0.091019	Akaike info criterion	-2.187739
Sum squared resid	2.468757	Schwarz criterion	-2.125859
Log likelihood	332.0670	Hannan-Quinn criter.	-2.162972
Durbin-Watson stat	1.680794		

Heteroskedasticity Test: ARCH

F-statistic	0.006947	Prob. F(1,296)	0.9336
Obs*R-squared	0.006994	Prob. Chi-Square(1)	0.9334

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:16
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.006804	0.152936	6.583164	0.0000
WGT_RESID^2(-1)	-0.004845	0.058126	-0.083347	0.9336

R-squared	0.000023	Mean dependent var	1.001949
Adjusted R-squared	-0.003355	S.D. dependent var	2.436978
S.E. of regression	2.441062	Akaike info criterion	4.629432
Sum squared resid	1763.800	Schwarz criterion	4.654245
Log likelihood	-687.7854	Hannan-Quinn criter.	4.639365
F-statistic	0.006947	Durbin-Watson stat	1.999876
Prob(F-statistic)	0.933632		

Dependent Variable: DLDSEGEN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:17
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.007205	0.005583	1.290525	0.1969
AR(1)	0.104534	0.082442	1.267969	0.2048
		Variance Equation		
C	0.001945	0.000494	3.935530	0.0001
RESID(-1)^2	0.308384	0.080955	3.809310	0.0001
RESID(-1)^2*(RESID(-1)<0)	-0.096964	0.087138	-1.112772	0.2658
GARCH(-1)	0.484455	0.109405	4.428087	0.0000

R-squared	0.022087	Mean dependent var	0.008775
Adjusted R-squared	0.018783	S.D. dependent var	0.091140
S.E. of regression	0.090280	Akaike info criterion	-2.181368
Sum squared resid	2.412557	Schwarz criterion	-2.106930
Log likelihood	331.0239	Hannan-Quinn criter.	-2.151571
Durbin-Watson stat	1.893393		
Inverted AR Roots	.10		

Heteroskedasticity Test: ARCH

F-statistic	0.000815	Prob. F(1,295)	0.9772
Obs*R-squared	0.000820	Prob. Chi-Square(1)	0.9772

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:17
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.000245	0.153517	6.515516	0.0000
WGT_RESID^2(-1)	0.001662	0.058227	0.028544	0.9772

R-squared	0.000003	Mean dependent var	1.001911
Adjusted R-squared	-0.003387	S.D. dependent var	2.442862
S.E. of regression	2.446996	Akaike info criterion	4.634310
Sum squared resid	1766.398	Schwarz criterion	4.659184
Log likelihood	-686.1951	Hannan-Quinn criter.	4.644268
F-statistic	0.000815	Durbin-Watson stat	1.999907
Prob(F-statistic)	0.977248		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:17
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 23 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006443	0.004066	1.584618	0.1131
		Variance Equation		
C	0.003108	0.006211	0.500393	0.6168
RESID(-1)^2	0.042930	0.070300	0.610660	0.5414
GARCH(-1)	0.335181	1.255225	0.267029	0.7894

R-squared	-0.000019	Mean dependent var	0.006747
Adjusted R-squared	-0.000019	S.D. dependent var	0.070792
S.E. of regression	0.070793	Akaike info criterion	-2.437856
Sum squared resid	1.493468	Schwarz criterion	-2.388352
Log likelihood	368.4595	Hannan-Quinn criter.	-2.418042
Durbin-Watson stat	2.316541		

Heteroskedasticity Test: ARCH

F-statistic	0.027110	Prob. F(1,296)	0.8693
Obs*R-squared	0.027291	Prob. Chi-Square(1)	0.8688

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:18
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.991977	0.103615	9.573703	0.0000
WGT_RESID^2(-1)	0.009587	0.058226	0.164651	0.8693

R-squared	0.000092	Mean dependent var	1.001502
Adjusted R-squared	-0.003286	S.D. dependent var	1.481542
S.E. of regression	1.483974	Akaike info criterion	3.634014
Sum squared resid	651.8453	Schwarz criterion	3.658826
Log likelihood	-539.4680	Hannan-Quinn criter.	3.643946
F-statistic	0.027110	Durbin-Watson stat	1.996805
Prob(F-statistic)	0.869331		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:18
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 35 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006867	0.003513	1.954479	0.0506
AR(1)	-0.166740	0.058891	-2.831351	0.0046
		Variance Equation		
C	0.001133	0.005748	0.197104	0.8437
RESID(-1)^2	-0.003196	0.043152	-0.074070	0.9410
GARCH(-1)	0.769597	1.174819	0.655077	0.5124

R-squared	0.026888	Mean dependent var	0.006872
Adjusted R-squared	0.023601	S.D. dependent var	0.070878
S.E. of regression	0.070037	Akaike info criterion	-2.453219
Sum squared resid	1.451918	Schwarz criterion	-2.391187
Log likelihood	370.5296	Hannan-Quinn criter.	-2.428388
Durbin-Watson stat	2.055331		

Inverted AR Roots	-.17

Heteroskedasticity Test: ARCH

F-statistic	0.251521	Prob. F(1,295)	0.6164
Obs*R-squared	0.253010	Prob. Chi-Square(1)	0.6150

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:18
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.033987	0.102454	10.09218	0.0000
WGT_RESID^2(-1)	-0.029287	0.058397	-0.501518	0.6164

R-squared	0.000852	Mean dependent var	1.004882
Adjusted R-squared	-0.002535	S.D. dependent var	1.453246
S.E. of regression	1.455087	Akaike info criterion	3.594719
Sum squared resid	624.5968	Schwarz criterion	3.619593
Log likelihood	-531.8158	Hannan-Quinn criter.	3.604677
F-statistic	0.251521	Durbin-Watson stat	1.982874
Prob(F-statistic)	0.616380		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:18
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 30 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.007083	0.004379	1.617557	0.1058
		Variance Equation		
C(2)	-5.704582	10.19459	-0.559569	0.5758
C(3)	0.032391	0.130582	0.248050	0.8041
C(4)	0.045579	0.090846	0.501721	0.6159
C(5)	-0.071385	1.918072	-0.037217	0.9703

R-squared	-0.000023	Mean dependent var	0.006747
Adjusted R-squared	-0.000023	S.D. dependent var	0.070792
S.E. of regression	0.070793	Akaike info criterion	-2.429285
Sum squared resid	1.493474	Schwarz criterion	-2.367404
Log likelihood	368.1781	Hannan-Quinn criter.	-2.404517
Durbin-Watson stat	2.316531		

Heteroskedasticity Test: ARCH

F-statistic	0.749422	Prob. F(1,296)	0.3874
Obs*R-squared	0.752580	Prob. Chi-Square(1)	0.3857

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:18
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.952513	0.103046	9.243525	0.0000
WGT_RESID^2(-1)	0.050323	0.058130	0.865691	0.3874

R-squared	0.002525	Mean dependent var	1.002590
Adjusted R-squared	-0.000844	S.D. dependent var	1.471505
S.E. of regression	1.472126	Akaike info criterion	3.617982
Sum squared resid	641.4782	Schwarz criterion	3.642794
Log likelihood	-537.0793	Hannan-Quinn criter.	3.627914
F-statistic	0.749422	Durbin-Watson stat	2.000498
Prob(F-statistic)	0.387361		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 34 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.007988	0.003254	2.454533	0.0141
AR(1)	-0.221800	0.052556	-4.220251	0.0000
		Variance Equation		
C(3)	-10.22024	0.467408	-21.86576	0.0000
C(4)	-0.135529	0.098104	-1.381482	0.1671
C(5)	-0.018098	0.054308	-0.333237	0.7390
C(6)	-0.936506	0.075717	-12.36843	0.0000

R-squared	0.023218	Mean dependent var	0.006872
Adjusted R-squared	0.019918	S.D. dependent var	0.070878
S.E. of regression	0.070169	Akaike info criterion	-2.465746
Sum squared resid	1.457394	Schwarz criterion	-2.391308
Log likelihood	373.3962	Hannan-Quinn criter.	-2.435949
Durbin-Watson stat	1.969294		
Inverted AR Roots	-.22		

Heteroskedasticity Test: ARCH

F-statistic	0.049191	Prob. F(1,295)	0.8246
Obs*R-squared	0.049516	Prob. Chi-Square(1)	0.8239

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.980297	0.097733	10.03039	0.0000
WGT_RESID^2(-1)	0.012989	0.058565	0.221790	0.8246

R-squared	0.000167	Mean dependent var	0.993033
Adjusted R-squared	-0.003223	S.D. dependent var	1.360704
S.E. of regression	1.362895	Akaike info criterion	3.463810
Sum squared resid	547.9573	Schwarz criterion	3.488684
Log likelihood	-512.3758	Hannan-Quinn criter.	3.473768
F-statistic	0.049191	Durbin-Watson stat	1.983600
Prob(F-statistic)	0.824631		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 25 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.005266	0.004628	1.137742	0.2552
		Variance Equation		
C	0.001932	0.004236	0.456185	0.6483
RESID(-1)^2	0.005641	0.064631	0.087283	0.9304
RESID(-1)^2*(RESID(-1)<0)	0.058827	0.113972	0.516151	0.6057
GARCH(-1)	0.578250	0.887359	0.651653	0.5146

R-squared	-0.000439	Mean dependent var	0.006747
Adjusted R-squared	-0.000439	S.D. dependent var	0.070792
S.E. of regression	0.070808	Akaike info criterion	-2.431716
Sum squared resid	1.494097	Schwarz criterion	-2.369836
Log likelihood	368.5415	Hannan-Quinn criter.	-2.406949
Durbin-Watson stat	2.315567		

Heteroskedasticity Test: ARCH

F-statistic	0.125025	Prob. F(1,296)	0.7239
Obs*R-squared	0.125817	Prob. Chi-Square(1)	0.7228

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.980671	0.103756	9.451719	0.0000
WGT_RESID^2(-1)	0.020586	0.058220	0.353589	0.7239

R-squared	0.000422	Mean dependent var	1.001113
Adjusted R-squared	-0.002955	S.D. dependent var	1.485097
S.E. of regression	1.487290	Akaike info criterion	3.638477
Sum squared resid	654.7609	Schwarz criterion	3.663289
Log likelihood	-540.1330	Hannan-Quinn criter.	3.648409
F-statistic	0.125025	Durbin-Watson stat	1.996754
Prob(F-statistic)	0.723898		

Dependent Variable: DLIPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 45 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006143	0.004021	1.527724	0.1266
AR(1)	-0.162873	0.059996	-2.714739	0.0066
		Variance Equation		
C	0.000973	0.004193	0.232019	0.8165
RESID(-1)^2	-0.017110	0.054418	-0.314420	0.7532
RESID(-1)^2*(RESID(-1)<0)	0.034213	0.097314	0.351569	0.7252
GARCH(-1)	0.798779	0.876404	0.911427	0.3621

R-squared	0.026774	Mean dependent var	0.006872
Adjusted R-squared	0.023486	S.D. dependent var	0.070878
S.E. of regression	0.070041	Akaike info criterion	-2.447112
Sum squared resid	1.452089	Schwarz criterion	-2.372674
Log likelihood	370.6197	Hannan-Quinn criter.	-2.417315
Durbin-Watson stat	2.061152		

Inverted AR Roots	-.16

Heteroskedasticity Test: ARCH

F-statistic	0.224014	Prob. F(1,295)	0.6363
Obs*R-squared	0.225362	Prob. Chi-Square(1)	0.6350

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:19
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.031566	0.102473	10.06670	0.0000
WGT_RESID^2(-1)	-0.027639	0.058395	-0.473302	0.6363

R-squared	0.000759	Mean dependent var	1.004119
Adjusted R-squared	-0.002628	S.D. dependent var	1.454068
S.E. of regression	1.455978	Akaike info criterion	3.595944
Sum squared resid	625.3621	Schwarz criterion	3.620817
Log likelihood	-531.9977	Hannan-Quinn criter.	3.605902
F-statistic	0.224014	Durbin-Watson stat	1.983760
Prob(F-statistic)	0.636348		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:20
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 19 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000311	0.000137	-2.272366	0.0231
Variance Equation				
C	6.29E-07	1.54E-07	4.072861	0.0000
RESID(-1)^2	0.201196	0.055965	3.595006	0.0003
GARCH(-1)	0.771870	0.050735	15.21380	0.0000

R-squared	-0.002689	Mean dependent var	-0.000148
Adjusted R-squared	-0.002689	S.D. dependent var	0.003148
S.E. of regression	0.003153	Akaike info criterion	-9.026880
Sum squared resid	0.002962	Schwarz criterion	-8.977375
Log likelihood	1353.518	Hannan-Quinn criter.	-9.007066
Durbin-Watson stat	1.841325		

Heteroskedasticity Test: ARCH

F-statistic	0.665253	Prob. F(1,296)	0.4154
Obs*R-squared	0.668246	Prob. Chi-Square(1)	0.4137

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:20
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.048217	0.220290	4.758342	0.0000
WGT_RESID^2(-1)	-0.047350	0.058053	-0.815631	0.4154

R-squared	0.002242	Mean dependent var	1.000938
Adjusted R-squared	-0.001128	S.D. dependent var	3.666720
S.E. of regression	3.668788	Akaike info criterion	5.444289
Sum squared resid	3984.162	Schwarz criterion	5.469102
Log likelihood	-809.1990	Hannan-Quinn criter.	5.454221
F-statistic	0.665253	Durbin-Watson stat	2.005647
Prob(F-statistic)	0.415367		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:20
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000332	0.000205	-1.613324	0.1067
AR(1)	0.273541	0.069699	3.924588	0.0001
		Variance Equation		
C	6.73E-07	1.37E-07	4.927033	0.0000
RESID(-1)^2	0.223655	0.055648	4.019141	0.0001
GARCH(-1)	0.749432	0.046520	16.10992	0.0000

R-squared	-0.034824	Mean dependent var	-0.000148
Adjusted R-squared	-0.038320	S.D. dependent var	0.003154
S.E. of regression	0.003214	Akaike info criterion	-9.042686
Sum squared resid	0.003057	Schwarz criterion	-8.980654
Log likelihood	1352.360	Hannan-Quinn criter.	-9.017855
Durbin-Watson stat	2.392010		
Inverted AR Roots	.27		

Heteroskedasticity Test: ARCH

F-statistic	0.499623	Prob. F(1,295)	0.4802
Obs*R-squared	0.502160	Prob. Chi-Square(1)	0.4786

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:21
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.042017	0.219403	4.749325	0.0000
WGT_RESID^2(-1)	-0.041116	0.058168	-0.706840	0.4802

R-squared	0.001691	Mean dependent var	1.000920
Adjusted R-squared	-0.001693	S.D. dependent var	3.642862
S.E. of regression	3.645945	Akaike info criterion	5.431819
Sum squared resid	3921.409	Schwarz criterion	5.456693
Log likelihood	-804.6252	Hannan-Quinn criter.	5.441777
F-statistic	0.499623	Durbin-Watson stat	2.004999
Prob(F-statistic)	0.480224		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:21
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 42 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000687	9.03E-05	-7.609827	0.0000
		Variance Equation		
C(2)	-13.34643	0.390930	-34.14024	0.0000
C(3)	1.011822	0.082823	12.21664	0.0000
C(4)	0.823484	0.094507	8.713491	0.0000
C(5)	-0.076582	0.036238	-2.113320	0.0346

R-squared	-0.029446	Mean dependent var	-0.000148
Adjusted R-squared	-0.029446	S.D. dependent var	0.003148
S.E. of regression	0.003194	Akaike info criterion	-8.820213
Sum squared resid	0.003041	Schwarz criterion	-8.758332
Log likelihood	1323.622	Hannan-Quinn criter.	-8.795445
Durbin-Watson stat	1.793466		

Heteroskedasticity Test: ARCH

F-statistic	0.366970	Prob. F(1,296)	0.5451
Obs*R-squared	0.368992	Prob. Chi-Square(1)	0.5436

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:21
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.039735	0.230247	4.515742	0.0000
WGT_RESID^2(-1)	-0.035186	0.058083	-0.605780	0.5451

R-squared	0.001238	Mean dependent var	1.004453
Adjusted R-squared	-0.002136	S.D. dependent var	3.841309
S.E. of regression	3.845410	Akaike info criterion	5.538326
Sum squared resid	4377.004	Schwarz criterion	5.563139
Log likelihood	-823.2106	Hannan-Quinn criter.	5.548258
F-statistic	0.366970	Durbin-Watson stat	2.002301
Prob(F-statistic)	0.545125		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:21
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 49 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000662	0.000116	-5.686812	0.0000
AR(1)	0.180987	0.077125	2.346666	0.0189
		Variance Equation		
C(3)	-12.70279	0.433878	-29.27733	0.0000
C(4)	1.051636	0.098985	10.62421	0.0000
C(5)	0.777407	0.105946	7.337740	0.0000
C(6)	-0.021519	0.038682	-0.556317	0.5780

R-squared	-0.022880	Mean dependent var	-0.000148
Adjusted R-squared	-0.026336	S.D. dependent var	0.003154
S.E. of regression	0.003195	Akaike info criterion	-8.818397
Sum squared resid	0.003022	Schwarz criterion	-8.743959
Log likelihood	1319.941	Hannan-Quinn criter.	-8.788600
Durbin-Watson stat	2.181636		
Inverted AR Roots	.18		

Heteroskedasticity Test: ARCH

F-statistic	0.258790	Prob. F(1,295)	0.6113
Obs*R-squared	0.260316	Prob. Chi-Square(1)	0.6099

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:21
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.034203	0.237721	4.350496	0.0000
WGT_RESID^2(-1)	-0.029604	0.058193	-0.508714	0.6113

R-squared	0.000876	Mean dependent var	1.004498
Adjusted R-squared	-0.002510	S.D. dependent var	3.966314
S.E. of regression	3.971290	Akaike info criterion	5.602770
Sum squared resid	4652.487	Schwarz criterion	5.627644
Log likelihood	-830.0114	Hannan-Quinn criter.	5.612728
F-statistic	0.258790	Durbin-Watson stat	2.002148
Prob(F-statistic)	0.611333		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:22
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 21 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000319	0.000161	-1.973201	0.0485
		Variance Equation		
C	6.56E-07	1.65E-07	3.984097	0.0001
RESID(-1)^2	0.179048	0.050988	3.511554	0.0004
RESID(-1)^2*(RESID(-1)<0)	0.043232	0.032288	1.338936	0.1806
GARCH(-1)	0.769373	0.052982	14.52143	0.0000

R-squared	-0.002946	Mean dependent var	-0.000148
Adjusted R-squared	-0.002946	S.D. dependent var	0.003148
S.E. of regression	0.003153	Akaike info criterion	-9.021461
Sum squared resid	0.002963	Schwarz criterion	-8.959581
Log likelihood	1353.708	Hannan-Quinn criter.	-8.996694
Durbin-Watson stat	1.840854		

Heteroskedasticity Test: ARCH

F-statistic	0.652638	Prob. F(1,296)	0.4198
Obs*R-squared	0.655602	Prob. Chi-Square(1)	0.4181

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:22
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.047813	0.220939	4.742545	0.0000
WGT_RESID^2(-1)	-0.046900	0.058054	-0.807860	0.4198

R-squared	0.002200	Mean dependent var	1.000973
Adjusted R-squared	-0.001171	S.D. dependent var	3.678172
S.E. of regression	3.680324	Akaike info criterion	5.450568
Sum squared resid	4009.257	Schwarz criterion	5.475380
Log likelihood	-810.1346	Hannan-Quinn criter.	5.460500
F-statistic	0.652638	Durbin-Watson stat	2.005483
Prob(F-statistic)	0.419820		

Dependent Variable: DLINT
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:22
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 21 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000334	0.000215	-1.552293	0.1206
AR(1)	0.271252	0.079288	3.421111	0.0006
		Variance Equation		
C	6.76E-07	1.53E-07	4.419544	0.0000
RESID(-1)^2	0.218073	0.055038	3.962208	0.0001
RESID(-1)^2*(RESID(-1)<0)	0.010455	0.041640	0.251079	0.8018
GARCH(-1)	0.749415	0.051949	14.42609	0.0000

R-squared	-0.033981	Mean dependent var	-0.000148
Adjusted R-squared	-0.037474	S.D. dependent var	0.003154
S.E. of regression	0.003212	Akaike info criterion	-9.036015
Sum squared resid	0.003054	Schwarz criterion	-8.961577
Log likelihood	1352.366	Hannan-Quinn criter.	-9.006218
Durbin-Watson stat	2.387763		
Inverted AR Roots	.27		

Heteroskedasticity Test: ARCH

F-statistic	0.495323	Prob. F(1,295)	0.4821
Obs*R-squared	0.497845	Prob. Chi-Square(1)	0.4804

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:22
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.041840	0.219751	4.741006	0.0000
WGT_RESID^2(-1)	-0.040939	0.058169	-0.703792	0.4821

R-squared	0.001676	Mean dependent var	1.000920
Adjusted R-squared	-0.001708	S.D. dependent var	3.649039
S.E. of regression	3.652154	Akaike info criterion	5.435223
Sum squared resid	3934.778	Schwarz criterion	5.460096
Log likelihood	-805.1306	Hannan-Quinn criter.	5.445180
F-statistic	0.495323	Durbin-Watson stat	2.004953
Prob(F-statistic)	0.482118		

Dependent Variable: DLCPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:23
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 30 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004672	0.000520	8.979843	0.0000
		Variance Equation		
C	1.51E-06	6.59E-07	2.297133	0.0216
RESID(-1)^2	0.050218	0.014167	3.544802	0.0004
GARCH(-1)	0.931155	0.016391	56.80851	0.0000

R-squared	-0.000250	Mean dependent var	0.004821
Adjusted R-squared	-0.000250	S.D. dependent var	0.009440
S.E. of regression	0.009442	Akaike info criterion	-6.545427
Sum squared resid	0.026564	Schwarz criterion	-6.495923
Log likelihood	982.5414	Hannan-Quinn criter.	-6.525614
Durbin-Watson stat	1.520041		

Heteroskedasticity Test: ARCH

F-statistic	0.001618	Prob. F(1,296)	0.9679
Obs*R-squared	0.001629	Prob. Chi-Square(1)	0.9678

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:23
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.028917	0.134726	7.637106	0.0000
WGT_RESID^2(-1)	-0.002338	0.058127	-0.040220	0.9679

R-squared	0.000005	Mean dependent var	1.026517
Adjusted R-squared	-0.003373	S.D. dependent var	2.081561
S.E. of regression	2.085068	Akaike info criterion	4.314169
Sum squared resid	1286.863	Schwarz criterion	4.338982
Log likelihood	-640.8112	Hannan-Quinn criter.	4.324101
F-statistic	0.001618	Durbin-Watson stat	1.999786
Prob(F-statistic)	0.967945		

Dependent Variable: DLCPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:23
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 30 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004722	0.000713	6.621468	0.0000
AR(1)	0.299492	0.060397	4.958706	0.0000
		Variance Equation		
C	1.40E-06	5.04E-07	2.771120	0.0056
RESID(-1)^2	0.048672	0.012762	3.813774	0.0001
GARCH(-1)	0.931129	0.014213	65.51413	0.0000

R-squared	0.053834	Mean dependent var	0.004813
Adjusted R-squared	0.050638	S.D. dependent var	0.009455
S.E. of regression	0.009213	Akaike info criterion	-6.627842
Sum squared resid	0.025122	Schwarz criterion	-6.565810
Log likelihood	992.5485	Hannan-Quinn criter.	-6.603011
Durbin-Watson stat	2.076767		
Inverted AR Roots	.30		

Heteroskedasticity Test: ARCH

F-statistic	0.006224	Prob. F(1,296)	0.9372
Obs*R-squared	0.006266	Prob. Chi-Square(1)	0.9369

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:23
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.028805	0.136782	7.521483	0.0000
WGT_RESID^2(-1)	-0.004586	0.058127	-0.078895	0.9372

R-squared	0.000021	Mean dependent var	1.024107
Adjusted R-squared	-0.003357	S.D. dependent var	2.122183
S.E. of regression	2.125742	Akaike info criterion	4.352808
Sum squared resid	1337.559	Schwarz criterion	4.377621
Log likelihood	-646.5684	Hannan-Quinn criter.	4.362740
F-statistic	0.006224	Durbin-Watson stat	1.999757
Prob(F-statistic)	0.937170		

Dependent Variable: DLCPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:24
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 63 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004703	0.000750	6.266560	0.0000
AR(1)	0.303659	0.051059	5.947163	0.0000
		Variance Equation		
C(3)	-0.296136	0.080893	-3.660843	0.0003
C(4)	0.095335	0.030732	3.102140	0.0019
C(5)	0.102276	0.031687	3.227690	0.0012
C(6)	0.976712	0.006790	143.8416	0.0000

R-squared	0.053298	Mean dependent var	0.004813
Adjusted R-squared	0.050100	S.D. dependent var	0.009455
S.E. of regression	0.009215	Akaike info criterion	-6.656059
Sum squared resid	0.025136	Schwarz criterion	-6.581621
Log likelihood	997.7528	Hannan-Quinn criter.	-6.626262
Durbin-Watson stat	2.084150		
Inverted AR Roots	.30		

Heteroskedasticity Test: ARCH

F-statistic	0.798982	Prob. F(1,295)	0.3721
Obs*R-squared	0.802226	Prob. Chi-Square(1)	0.3704

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:24
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.965154	0.143082	6.745477	0.0000
WGT_RESID^2(-1)	0.051973	0.058145	0.893858	0.3721

R-squared	0.002701	Mean dependent var	1.018074
Adjusted R-squared	-0.000680	S.D. dependent var	2.244073
S.E. of regression	2.244836	Akaike info criterion	4.461853
Sum squared resid	1486.590	Schwarz criterion	4.486727
Log likelihood	-660.5852	Hannan-Quinn criter.	4.471811
F-statistic	0.798982	Durbin-Watson stat	2.002363
Prob(F-statistic)	0.372126		

Dependent Variable: DLCPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:24
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 30 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004759	0.000523	9.090927	0.0000
		Variance Equation		
C	1.02E-06	3.81E-07	2.675825	0.0075
RESID(-1)^2	0.106927	0.028974	3.690459	0.0002
RESID(-1)^2*(RESID(-1)<0)	-0.115155	0.033312	-3.456866	0.0005
GARCH(-1)	0.938275	0.017691	53.03775	0.0000

R-squared	-0.000044	Mean dependent var	0.004821
Adjusted R-squared	-0.000044	S.D. dependent var	0.009440
S.E. of regression	0.009441	Akaike info criterion	-6.565626
Sum squared resid	0.026559	Schwarz criterion	-6.503746
Log likelihood	986.5611	Hannan-Quinn criter.	-6.540859
Durbin-Watson stat	1.520355		

Heteroskedasticity Test: ARCH

F-statistic	0.015157	Prob. F(1,296)	0.9021
Obs*R-squared	0.015259	Prob. Chi-Square(1)	0.9017

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:24
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.031903	0.136995	7.532418	0.0000
WGT_RESID^2(-1)	-0.007156	0.058125	-0.123114	0.9021

R-squared	0.000051	Mean dependent var	1.024569
Adjusted R-squared	-0.003327	S.D. dependent var	2.126106
S.E. of regression	2.129640	Akaike info criterion	4.356472
Sum squared resid	1342.469	Schwarz criterion	4.381285
Log likelihood	-647.1143	Hannan-Quinn criter.	4.366404
F-statistic	0.015157	Durbin-Watson stat	1.999729
Prob(F-statistic)	0.902100		

Dependent Variable: DLCPI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:24
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 45 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004919	0.000701	7.016948	0.0000
AR(1)	0.270665	0.055856	4.845738	0.0000
		Variance Equation		
C	1.02E-06	3.30E-07	3.080881	0.0021
RESID(-1)^2	0.104763	0.026790	3.910543	0.0001
RESID(-1)^2*(RESID(-1)<0)	-0.103721	0.032431	-3.198249	0.0014
GARCH(-1)	0.934551	0.015574	60.00612	0.0000

R-squared	0.056422	Mean dependent var	0.004813
Adjusted R-squared	0.053234	S.D. dependent var	0.009455
S.E. of regression	0.009200	Akaike info criterion	-6.638259
Sum squared resid	0.025053	Schwarz criterion	-6.563820
Log likelihood	995.1005	Hannan-Quinn criter.	-6.608462
Durbin-Watson stat	2.024582		
Inverted AR Roots	.27		

Heteroskedasticity Test: ARCH

F-statistic	0.338428	Prob. F(1,295)	0.5612
Obs*R-squared	0.340332	Prob. Chi-Square(1)	0.5596

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:25
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.982302	0.142181	6.908830	0.0000
WGT_RESID^2(-1)	0.033852	0.058190	0.581746	0.5612

R-squared	0.001146	Mean dependent var	1.016725
Adjusted R-squared	-0.002240	S.D. dependent var	2.225527
S.E. of regression	2.228018	Akaike info criterion	4.446813
Sum squared resid	1464.399	Schwarz criterion	4.471687
Log likelihood	-658.3518	Hannan-Quinn criter.	4.456771
F-statistic	0.338428	Durbin-Watson stat	2.001091
Prob(F-statistic)	0.561182		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:25
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.001741	0.000612	2.844734	0.0044
		Variance Equation		
C	2.94E-06	8.42E-07	3.485184	0.0005
RESID(-1)^2	0.245447	0.036287	6.764032	0.0000
GARCH(-1)	0.809528	0.014331	56.48854	0.0000

R-squared	-0.008864	Mean dependent var	0.002632
Adjusted R-squared	-0.008864	S.D. dependent var	0.009479
S.E. of regression	0.009521	Akaike info criterion	-6.659471
Sum squared resid	0.027013	Schwarz criterion	-6.609967
Log likelihood	999.5910	Hannan-Quinn criter.	-6.639658
Durbin-Watson stat	1.859369		

Heteroskedasticity Test: ARCH

F-statistic	0.154127	Prob. F(1,296)	0.6949
Obs*R-squared	0.155088	Prob. Chi-Square(1)	0.6937

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:25
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.029070	0.232195	4.431922	0.0000
WGT_RESID^2(-1)	-0.022811	0.058103	-0.392591	0.6949

R-squared	0.000520	Mean dependent var	1.006197
Adjusted R-squared	-0.002856	S.D. dependent var	3.874543
S.E. of regression	3.880073	Akaike info criterion	5.556274
Sum squared resid	4456.269	Schwarz criterion	5.581086
Log likelihood	-825.8848	Hannan-Quinn criter.	5.566206
F-statistic	0.154127	Durbin-Watson stat	2.001675
Prob(F-statistic)	0.694904		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:25
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.001943	0.000809	2.400574	0.0164
AR(1)	0.238410	0.089161	2.673926	0.0075
	Variance Equation			
C	2.74E-06	8.32E-07	3.292271	0.0010
RESID(-1)^2	0.261796	0.040770	6.421206	0.0000
GARCH(-1)	0.802038	0.014298	56.09566	0.0000

R-squared	-0.030845	Mean dependent var	0.002640
Adjusted R-squared	-0.034328	S.D. dependent var	0.009494
S.E. of regression	0.009655	Akaike info criterion	-6.674265
Sum squared resid	0.027594	Schwarz criterion	-6.612234
Log likelihood	999.4655	Hannan-Quinn criter.	-6.649435
Durbin-Watson stat	2.304501		
Inverted AR Roots	.24		

Heteroskedasticity Test: ARCH

F-statistic	0.037987	Prob. F(1,295)	0.8456
Obs*R-squared	0.038239	Prob. Chi-Square(1)	0.8450

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:26
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.020487	0.228308	4.469779	0.0000
WGT_RESID^2(-1)	-0.011348	0.058222	-0.194901	0.8456

R-squared	0.000129	Mean dependent var	1.009118
Adjusted R-squared	-0.003261	S.D. dependent var	3.797804
S.E. of regression	3.803990	Akaike info criterion	5.516689
Sum squared resid	4268.751	Schwarz criterion	5.541563
Log likelihood	-817.2284	Hannan-Quinn criter.	5.526647
F-statistic	0.037987	Durbin-Watson stat	2.000670
Prob(F-statistic)	0.845604		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:26
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Failure to improve likelihood (singular hessian) after 64 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000196	0.000275	0.713246	0.4757
		Variance Equation		
C(2)	-0.635847	0.089113	-7.135325	0.0000
C(3)	-0.054303	0.015122	-3.590929	0.0003
C(4)	0.354362	0.017390	20.37692	0.0000
C(5)	0.941608	0.010590	88.91638	0.0000

R-squared	-0.066251	Mean dependent var	0.002632
Adjusted R-squared	-0.066251	S.D. dependent var	0.009479
S.E. of regression	0.009788	Akaike info criterion	-6.909655
Sum squared resid	0.028549	Schwarz criterion	-6.847775
Log likelihood	1037.993	Hannan-Quinn criter.	-6.884888
Durbin-Watson stat	1.759296		

Heteroskedasticity Test: ARCH

F-statistic	0.039582	Prob. F(1,296)	0.8424
Obs*R-squared	0.039844	Prob. Chi-Square(1)	0.8418

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:48
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.025117	0.204874	5.003656	0.0000
WGT_RESID^2(-1)	-0.011561	0.058111	-0.198952	0.8424

R-squared	0.000134	Mean dependent var	1.013439
Adjusted R-squared	-0.003244	S.D. dependent var	3.382923
S.E. of regression	3.388406	Akaike info criterion	5.285285
Sum squared resid	3398.464	Schwarz criterion	5.310098
Log likelihood	-785.5075	Hannan-Quinn criter.	5.295217
F-statistic	0.039582	Durbin-Watson stat	2.000734
Prob(F-statistic)	0.842437		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:26
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Failure to improve likelihood (non-zero gradients) after 87 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.45E-08	0.000263	9.32E-05	0.9999
AR(1)	0.180667	0.033329	5.420722	0.0000
		Variance Equation		
C(3)	-0.568453	0.088811	-6.400700	0.0000
C(4)	-0.100627	0.017289	-5.820248	0.0000
C(5)	0.454247	0.026648	17.04594	0.0000
C(6)	0.949290	0.010697	88.74597	0.0000

R-squared	-0.062564	Mean dependent var	0.002640
Adjusted R-squared	-0.066153	S.D. dependent var	0.009494
S.E. of regression	0.009803	Akaike info criterion	-6.936002
Sum squared resid	0.028443	Schwarz criterion	-6.861564
Log likelihood	1039.464	Hannan-Quinn criter.	-6.906205
Durbin-Watson stat	2.103607		
Inverted AR Roots	.18		

Heteroskedasticity Test: ARCH

F-statistic	0.036418	Prob. F(1,295)	0.8488
Obs*R-squared	0.036661	Prob. Chi-Square(1)	0.8482

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:26
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.023090	0.202862	5.043275	0.0000
WGT_RESID^2(-1)	-0.011109	0.058212	-0.190836	0.8488

R-squared	0.000123	Mean dependent var	1.011907
Adjusted R-squared	-0.003266	S.D. dependent var	3.341567
S.E. of regression	3.347019	Akaike info criterion	5.260729
Sum squared resid	3304.749	Schwarz criterion	5.285602
Log likelihood	-779.2182	Hannan-Quinn criter.	5.270687
F-statistic	0.036418	Durbin-Watson stat	2.000828
Prob(F-statistic)	0.848785		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:27
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Failure to improve likelihood (singular hessian) after 62 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000922	0.000240	3.849185	0.0001
Variance Equation				
C	1.01E-06	1.35E-07	7.506407	0.0000
RESID(-1)^2	0.314779	0.020545	15.32162	0.0000
RESID(-1)^2*(RESID(-1)<0)	-0.596132	0.030570	-19.50028	0.0000
GARCH(-1)	0.866674	0.004814	180.0414	0.0000

R-squared	-0.032633	Mean dependent var	0.002632
Adjusted R-squared	-0.032633	S.D. dependent var	0.009479
S.E. of regression	0.009632	Akaike info criterion	-6.913022
Sum squared resid	0.027649	Schwarz criterion	-6.851141
Log likelihood	1038.497	Hannan-Quinn criter.	-6.888254
Durbin-Watson stat	1.816571		

Heteroskedasticity Test: ARCH

F-statistic	0.178079	Prob. F(1,296)	0.6733
Obs*R-squared	0.179174	Prob. Chi-Square(1)	0.6721

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:27
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.041662	0.188655	5.521519	0.0000
WGT_RESID^2(-1)	-0.024516	0.058096	-0.421994	0.6733

R-squared	0.000601	Mean dependent var	1.016802
Adjusted R-squared	-0.002775	S.D. dependent var	3.089553
S.E. of regression	3.093837	Akaike info criterion	5.103390
Sum squared resid	2833.261	Schwarz criterion	5.128203
Log likelihood	-758.4051	Hannan-Quinn criter.	5.113322
F-statistic	0.178079	Durbin-Watson stat	2.001956
Prob(F-statistic)	0.673336		

Dependent Variable: DLEXR
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:27
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Failure to improve likelihood (non-zero gradients) after 138 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000883	0.000255	3.461232	0.0005
AR(1)	0.003334	0.032370	0.103012	0.9180
		Variance Equation		
C	9.68E-07	1.34E-07	7.240506	0.0000
RESID(-1)^2	0.317246	0.026041	12.18245	0.0000
RESID(-1)^2*(RESID(-1)<0)	-0.597484	0.031789	-18.79513	0.0000
GARCH(-1)	0.865242	0.005497	157.4048	0.0000

R-squared	-0.033766	Mean dependent var	0.002640
Adjusted R-squared	-0.037259	S.D. dependent var	0.009494
S.E. of regression	0.009669	Akaike info criterion	-6.909210
Sum squared resid	0.027672	Schwarz criterion	-6.834772
Log likelihood	1035.472	Hannan-Quinn criter.	-6.879413
Durbin-Watson stat	1.820392		
Inverted AR Roots	.00		

Heteroskedasticity Test: ARCH

F-statistic	0.171333	Prob. F(1,295)	0.6792
Obs*R-squared	0.172394	Prob. Chi-Square(1)	0.6780

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:27
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.035024	0.188209	5.499333	0.0000
WGT_RESID^2(-1)	-0.024088	0.058195	-0.413923	0.6792

R-squared	0.000580	Mean dependent var	1.010744
Adjusted R-squared	-0.002807	S.D. dependent var	3.077668
S.E. of regression	3.081985	Akaike info criterion	5.095736
Sum squared resid	2802.096	Schwarz criterion	5.120609
Log likelihood	-754.7168	Hannan-Quinn criter.	5.105694
F-statistic	0.171333	Durbin-Watson stat	2.002159
Prob(F-statistic)	0.679231		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:28
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Failure to improve likelihood (non-zero gradients) after 420 iterations
Coefficient covariance computed using outer product of gradients
WARNING: Singular covariance - coefficients are not unique
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.012296	NA	NA	NA
		Variance Equation		
C	-4.14E-06	NA	NA	NA
RESID(-1)^2	-0.017611	NA	NA	NA
GARCH(-1)	1.040755	NA	NA	NA

R-squared	-0.000236	Mean dependent var	0.012063
Adjusted R-squared	-0.000236	S.D. dependent var	0.015189
S.E. of regression	0.015191	Akaike info criterion	-5.622736
Sum squared resid	0.068767	Schwarz criterion	-5.573232
Log likelihood	844.5990	Hannan-Quinn criter.	-5.602922
Durbin-Watson stat	2.643122		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:28
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 25 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.011710	0.000796	14.71694	0.0000
AR(1)	-0.338227	0.053648	-6.304605	0.0000
		Variance Equation		
C	0.000118	0.000135	0.872612	0.3829
RESID(-1)^2	-0.039764	0.053577	-0.742178	0.4580
GARCH(-1)	0.471024	0.629337	0.748445	0.4542

R-squared	0.102534	Mean dependent var	0.012078
Adjusted R-squared	0.099502	S.D. dependent var	0.015212
S.E. of regression	0.014436	Akaike info criterion	-5.615572
Sum squared resid	0.061683	Schwarz criterion	-5.553540
Log likelihood	841.7203	Hannan-Quinn criter.	-5.590741
Durbin-Watson stat	2.071444		
Inverted AR Roots	-.34		

Heteroskedasticity Test: ARCH

F-statistic	0.002997	Prob. F(1,295)	0.9564
Obs*R-squared	0.003018	Prob. Chi-Square(1)	0.9562

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:28
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.005038	0.110973	9.056641	0.0000
WGT_RESID^2(-1)	-0.003189	0.058242	-0.054747	0.9564

R-squared	0.000010	Mean dependent var	1.001841
Adjusted R-squared	-0.003380	S.D. dependent var	1.623354
S.E. of regression	1.626095	Akaike info criterion	3.816951
Sum squared resid	780.0341	Schwarz criterion	3.841824
Log likelihood	-564.8172	Hannan-Quinn criter.	3.826908
F-statistic	0.002997	Durbin-Watson stat	1.999239
Prob(F-statistic)	0.956377		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:29
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 24 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.013188	0.001051	12.54439	0.0000
Variance Equation				
C(2)	-10.71386	1.759358	-6.089641	0.0000
C(3)	-0.041417	0.134528	-0.307873	0.7582
C(4)	0.363567	0.101745	3.573305	0.0004
C(5)	-0.271975	0.204637	-1.329062	0.1838

R-squared	-0.005507	Mean dependent var	0.012063
Adjusted R-squared	-0.005507	S.D. dependent var	0.015189
S.E. of regression	0.015231	Akaike info criterion	-5.585381
Sum squared resid	0.069130	Schwarz criterion	-5.523501
Log likelihood	840.0144	Hannan-Quinn criter.	-5.560614
Durbin-Watson stat	2.629268		

Heteroskedasticity Test: ARCH

F-statistic	0.025362	Prob. F(1,296)	0.8736
Obs*R-squared	0.025531	Prob. Chi-Square(1)	0.8731

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:29
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.994142	0.114405	8.689686	0.0000
WGT_RESID^2(-1)	0.009257	0.058130	0.159253	0.8736

R-squared	0.000086	Mean dependent var	1.003435
Adjusted R-squared	-0.003292	S.D. dependent var	1.695902
S.E. of regression	1.698691	Akaike info criterion	3.904282
Sum squared resid	854.1236	Schwarz criterion	3.929095
Log likelihood	-579.7381	Hannan-Quinn criter.	3.914215
F-statistic	0.025362	Durbin-Watson stat	1.998792
Prob(F-statistic)	0.873578		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:29
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Failure to improve likelihood (singular hessian) after 87 iterations
Coefficient covariance computed using outer product of gradients
WARNING: Singular covariance - coefficients are not unique
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.011159	NA	NA	NA
AR(1)	-0.345844	NA	NA	NA
		Variance Equation		
C(3)	-17.44231	NA	NA	NA
C(4)	0.092093	NA	NA	NA
C(5)	-0.022887	NA	NA	NA
C(6)	-0.992774	NA	NA	NA

R-squared	0.096705	Mean dependent var	0.012078
Adjusted R-squared	0.093654	S.D. dependent var	0.015212
S.E. of regression	0.014482	Akaike info criterion	-5.776681
Sum squared resid	0.062084	Schwarz criterion	-5.702243
Log likelihood	866.7254	Hannan-Quinn criter.	-5.746884
Durbin-Watson stat	2.046207		
Inverted AR Roots	-.35		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:29
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 31 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.013132	0.001100	11.94073	0.0000
Variance Equation				
C	0.000224	4.49E-05	4.991956	0.0000
RESID(-1)^2	0.285351	0.203979	1.398926	0.1618
RESID(-1)^2*(RESID(-1)<0)	-0.371643	0.205239	-1.810787	0.0702
GARCH(-1)	-0.095020	0.170341	-0.557822	0.5770

R-squared	-0.004970	Mean dependent var	0.012063
Adjusted R-squared	-0.004970	S.D. dependent var	0.015189
S.E. of regression	0.015227	Akaike info criterion	-5.582455
Sum squared resid	0.069093	Schwarz criterion	-5.520574
Log likelihood	839.5770	Hannan-Quinn criter.	-5.557687
Durbin-Watson stat	2.630671		

Heteroskedasticity Test: ARCH

F-statistic	0.053406	Prob. F(1,296)	0.8174
Obs*R-squared	0.053757	Prob. Chi-Square(1)	0.8166

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:55
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.016729	0.111952	9.081810	0.0000
WGT_RESID^2(-1)	-0.013432	0.058124	-0.231097	0.8174

R-squared	0.000180	Mean dependent var	1.003249
Adjusted R-squared	-0.003197	S.D. dependent var	1.646923
S.E. of regression	1.649553	Akaike info criterion	3.845575
Sum squared resid	805.4239	Schwarz criterion	3.870388
Log likelihood	-570.9907	Hannan-Quinn criter.	3.855507
F-statistic	0.053406	Durbin-Watson stat	2.000212
Prob(F-statistic)	0.817399		

Dependent Variable: DLM2
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:30
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Failure to improve likelihood (non-zero gradients) after 205 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) +
C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.012329	0.000599	20.56848	0.0000
AR(1)	-0.318699	0.055742	-5.717357	0.0000
		Variance Equation		
C	-1.99E-07	1.01E-06	-0.196945	0.8439
RESID(-1)^2	-0.024716	0.011832	-2.088950	0.0367
RESID(-1)^2*(RESID(-1)<0)	0.028084	0.023535	1.193329	0.2327
GARCH(-1)	1.012243	0.000199	5085.009	0.0000

R-squared	0.103296	Mean dependent var	0.012078
Adjusted R-squared	0.100266	S.D. dependent var	0.015212
S.E. of regression	0.014430	Akaike info criterion	-5.741237
Sum squared resid	0.061631	Schwarz criterion	-5.666799
Log likelihood	861.4443	Hannan-Quinn criter.	-5.711440
Durbin-Watson stat	2.105419		

Inverted AR Roots	-.32

Heteroskedasticity Test: ARCH

F-statistic	2.648286	Prob. F(1,295)	0.1047
Obs*R-squared	2.642518	Prob. Chi-Square(1)	0.1040

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:30
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.194325	0.106165	11.24968	0.0000
WGT_RESID^2(-1)	-0.094365	0.057987	-1.627356	0.1047

R-squared	0.008897	Mean dependent var	1.091257
Adjusted R-squared	0.005538	S.D. dependent var	1.472466
S.E. of regression	1.468383	Akaike info criterion	3.612912
Sum squared resid	636.0637	Schwarz criterion	3.637785
Log likelihood	-534.5174	Hannan-Quinn criter.	3.622869
F-statistic	2.648286	Durbin-Watson stat	2.021610
Prob(F-statistic)	0.104729		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:30
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 17 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.002509	0.002110	1.189236	0.2343
Variance Equation				
C	0.000263	3.56E-05	7.368141	0.0000
RESID(-1)^2	0.461178	0.086645	5.322621	0.0000
GARCH(-1)	0.528707	0.049159	10.75500	0.0000

R-squared	-0.008397	Mean dependent var	0.006672
Adjusted R-squared	-0.008397	S.D. dependent var	0.045503
S.E. of regression	0.045694	Akaike info criterion	-3.730519
Sum squared resid	0.622202	Schwarz criterion	-3.681015
Log likelihood	561.7126	Hannan-Quinn criter.	-3.710705
Durbin-Watson stat	2.232050		

Heteroskedasticity Test: ARCH

F-statistic	0.628510	Prob. F(1,296)	0.4285
Obs*R-squared	0.631416	Prob. Chi-Square(1)	0.4268

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:30
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.047544	0.177812	5.891300	0.0000
WGT_RESID^2(-1)	-0.046031	0.058062	-0.792786	0.4285

R-squared	0.002119	Mean dependent var	1.001444
Adjusted R-squared	-0.001252	S.D. dependent var	2.898923
S.E. of regression	2.900738	Akaike info criterion	4.974496
Sum squared resid	2490.626	Schwarz criterion	4.999309
Log likelihood	-739.1999	Hannan-Quinn criter.	4.984428
F-statistic	0.628510	Durbin-Watson stat	2.002827
Prob(F-statistic)	0.428537		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:31
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 18 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.002565	0.002121	1.209142	0.2266
AR(1)	-0.011836	0.087431	-0.135374	0.8923
		Variance Equation		
C	0.000262	3.62E-05	7.255502	0.0000
RESID(-1)^2	0.458596	0.087187	5.259902	0.0000
GARCH(-1)	0.530101	0.049578	10.69216	0.0000

R-squared	-0.005621	Mean dependent var	0.006699
Adjusted R-squared	-0.009018	S.D. dependent var	0.045577
S.E. of regression	0.045782	Akaike info criterion	-3.718477
Sum squared resid	0.620426	Schwarz criterion	-3.656445
Log likelihood	559.0531	Hannan-Quinn criter.	-3.693646
Durbin-Watson stat	2.210921		
Inverted AR Roots	-.01		

Heteroskedasticity Test: ARCH

F-statistic	0.642070	Prob. F(1,295)	0.4236
Obs*R-squared	0.645019	Prob. Chi-Square(1)	0.4219

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:58
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.048768	0.178362	5.880011	0.0000
WGT_RESID^2(-1)	-0.046603	0.058159	-0.801293	0.4236

R-squared	0.002172	Mean dependent var	1.002067
Adjusted R-squared	-0.001211	S.D. dependent var	2.903338
S.E. of regression	2.905095	Akaike info criterion	4.977521
Sum squared resid	2489.675	Schwarz criterion	5.002394
Log likelihood	-737.1618	Hannan-Quinn criter.	4.987478
F-statistic	0.642070	Durbin-Watson stat	2.002388
Prob(F-statistic)	0.423607		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:31
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Convergence achieved after 36 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006429	0.002689	2.390753	0.0168
		Variance Equation		
C(2)	-7.992552	0.443583	-18.01818	0.0000
C(3)	-0.105325	0.083181	-1.266216	0.2054
C(4)	0.367901	0.077664	4.737102	0.0000
C(5)	-0.277291	0.065804	-4.213893	0.0000

R-squared	-0.000029	Mean dependent var	0.006672
Adjusted R-squared	-0.000029	S.D. dependent var	0.045503
S.E. of regression	0.045504	Akaike info criterion	-3.426438
Sum squared resid	0.617038	Schwarz criterion	-3.364558
Log likelihood	517.2525	Hannan-Quinn criter.	-3.401671
Durbin-Watson stat	2.250729		

Heteroskedasticity Test: ARCH

F-statistic	0.337133	Prob. F(1,296)	0.5619
Obs*R-squared	0.339025	Prob. Chi-Square(1)	0.5604

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:31
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.969999	0.230757	4.203551	0.0000
WGT_RESID^2(-1)	0.033729	0.058091	0.580632	0.5619

R-squared	0.001138	Mean dependent var	1.003861
Adjusted R-squared	-0.002237	S.D. dependent var	3.849864
S.E. of regression	3.854167	Akaike info criterion	5.542876
Sum squared resid	4396.963	Schwarz criterion	5.567689
Log likelihood	-823.8885	Hannan-Quinn criter.	5.552808
F-statistic	0.337133	Durbin-Watson stat	2.005274
Prob(F-statistic)	0.561930		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:31
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Convergence achieved after 32 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*RESID(-1)/@SQRT(GARCH(-1)) + C(6)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006686	0.002800	2.388024	0.0169
AR(1)	0.014306	0.057446	0.249031	0.8033
		Variance Equation		
C(3)	-7.910525	0.543368	-14.55831	0.0000
C(4)	-0.109529	0.091434	-1.197902	0.2310
C(5)	0.375611	0.076880	4.885688	0.0000
C(6)	-0.265408	0.085388	-3.108270	0.0019

R-squared	-0.003795	Mean dependent var	0.006699
Adjusted R-squared	-0.007186	S.D. dependent var	0.045577
S.E. of regression	0.045741	Akaike info criterion	-3.416838
Sum squared resid	0.619299	Schwarz criterion	-3.342400
Log likelihood	515.1088	Hannan-Quinn criter.	-3.387041
Durbin-Watson stat	2.276671		
Inverted AR Roots	.01		

Heteroskedasticity Test: ARCH

F-statistic	0.344308	Prob. F(1,295)	0.5578
Obs*R-squared	0.346238	Prob. Chi-Square(1)	0.5563

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 22:00
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.969664	0.229533	4.224507	0.0000
WGT_RESID^2(-1)	0.034144	0.058189	0.586778	0.5578

R-squared	0.001166	Mean dependent var	1.003946
Adjusted R-squared	-0.002220	S.D. dependent var	3.821178
S.E. of regression	3.825417	Akaike info criterion	5.527923
Sum squared resid	4316.976	Schwarz criterion	5.552797
Log likelihood	-818.8966	Hannan-Quinn criter.	5.537881
F-statistic	0.344308	Durbin-Watson stat	2.005291
Prob(F-statistic)	0.557802		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:32
Sample (adjusted): 1991M02 2015M12
Included observations: 299 after adjustments
Failure to improve likelihood (non-zero gradients) after 9 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +
C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006672	0.005760	1.158277	0.2468
		Variance Equation		
C	0.001341	0.000375	3.574960	0.0004
RESID(-1)^2	0.150000	0.083954	1.786693	0.0740
RESID(-1)^2*(RESID(-1)<0)	-0.283882	0.085152	-3.333818	0.0009
GARCH(-1)	0.600000	0.123168	4.871380	0.0000

R-squared	0.000000	Mean dependent var	0.006672
Adjusted R-squared	0.000000	S.D. dependent var	0.045503
S.E. of regression	0.045503	Akaike info criterion	-3.296590
Sum squared resid	0.617021	Schwarz criterion	-3.234710
Log likelihood	497.8403	Hannan-Quinn criter.	-3.271823
Durbin-Watson stat	2.250793		

Heteroskedasticity Test: ARCH

F-statistic	0.712319	Prob. F(1,296)	0.3994
Obs*R-squared	0.715410	Prob. Chi-Square(1)	0.3977

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:32
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.492728	0.113620	4.336629	0.0000
WGT_RESID^2(-1)	0.048998	0.058055	0.843990	0.3994

R-squared	0.002401	Mean dependent var	0.518119
Adjusted R-squared	-0.000970	S.D. dependent var	1.890465
S.E. of regression	1.891381	Akaike info criterion	4.119180
Sum squared resid	1058.887	Schwarz criterion	4.143993
Log likelihood	-611.7579	Hannan-Quinn criter.	4.129113
F-statistic	0.712319	Durbin-Watson stat	2.004601
Prob(F-statistic)	0.399357		

Dependent Variable: DLGDPRICE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 06/15/17 Time: 21:32
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Failure to improve likelihood (non-zero gradients) after 39 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-1)^2*(RESID(-1)<0) + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.006544	0.004475	1.462332	0.1437
AR(1)	0.037693	0.106892	0.352625	0.7244
Variance Equation				
C	0.001233	0.000323	3.814680	0.0001
RESID(-1)^2	0.144285	0.070262	2.053545	0.0400
RESID(-1)^2*(RESID(-1)<0)	-0.268416	0.099668	-2.693090	0.0071
GARCH(-1)	0.590592	0.102070	5.786161	0.0000

R-squared	-0.010890	Mean dependent var	0.006699
Adjusted R-squared	-0.014305	S.D. dependent var	0.045577
S.E. of regression	0.045902	Akaike info criterion	-3.357549
Sum squared resid	0.623677	Schwarz criterion	-3.283111
Log likelihood	506.2748	Hannan-Quinn criter.	-3.327752
Durbin-Watson stat	2.318095		
Inverted AR Roots	.04		

Heteroskedasticity Test: ARCH

F-statistic	0.762722	Prob. F(1,295)	0.3832
Obs*R-squared	0.765913	Prob. Chi-Square(1)	0.3815

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 06/15/17 Time: 21:32
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.551071	0.127695	4.315526	0.0000
WGT_RESID^2(-1)	0.050783	0.058148	0.873340	0.3832

R-squared	0.002579	Mean dependent var	0.580558
Adjusted R-squared	-0.000802	S.D. dependent var	2.121485
S.E. of regression	2.122336	Akaike info criterion	4.349623
Sum squared resid	1328.771	Schwarz criterion	4.374496
Log likelihood	-643.9190	Hannan-Quinn criter.	4.359580
F-statistic	0.762722	Durbin-Watson stat	2.004836
Prob(F-statistic)	0.383188		

Appendix Q: Optimal Lag Selection for Conditional Variances

VAR Lag Order Selection Criteria
Endogenous variables: VDLDSEGEN
Exogenous variables: C @TREND
Date: 05/16/17 Time: 22:41
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	916.9871	NA	0.000109	-6.288571	-6.263325	-6.278457
1	1020.273	204.4416*	5.38e-05*	-6.991565*	-6.953695*	-6.976394*
2	1020.302	0.057040	5.42e-05	-6.984891	-6.934398	-6.964663
3	1020.455	0.302478	5.45e-05	-6.979075	-6.915960	-6.953791
4	1020.457	0.002489	5.49e-05	-6.972211	-6.896473	-6.941870
5	1022.014	3.038614	5.47e-05	-6.976038	-6.887676	-6.940640
6	1022.286	0.530059	5.50e-05	-6.971038	-6.870053	-6.930583
7	1022.318	0.061331	5.53e-05	-6.964383	-6.850775	-6.918871
8	1022.958	1.236888	5.55e-05	-6.961911	-6.835680	-6.911343

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLDSEGEN
Exogenous variables: C
Date: 05/16/17 Time: 22:41
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	913.0508	NA	0.000111	-6.268390	-6.255767	-6.263333
1	1019.527	211.4895*	5.37e-05*	-6.993315*	-6.968069*	-6.983201*
2	1019.576	0.096022	5.41e-05	-6.986775	-6.948906	-6.971605
3	1019.694	0.232445	5.44e-05	-6.980712	-6.930220	-6.960485
4	1019.694	0.000337	5.48e-05	-6.973841	-6.910725	-6.948556
5	1021.359	3.261571	5.46e-05	-6.978412	-6.902673	-6.948071
6	1021.592	0.455151	5.48e-05	-6.973142	-6.884780	-6.937744
7	1021.640	0.092581	5.52e-05	-6.966596	-6.865611	-6.926141
8	1022.219	1.122441	5.54e-05	-6.963704	-6.850096	-6.918192

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLDSEGEN)
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	993.6960	NA	6.27e-05	-6.839282	-6.813973	-6.829142
1	997.2480	7.030552	6.16e-05	-6.856883	-6.818918	-6.841672
2	998.5287	2.526038	6.15e-05	-6.858818	-6.808199	-6.838538

3	1000.381	3.640004	6.11e-05	-6.864694	-6.801420	-6.839343
4	1006.073	11.14916*	5.92e-05*	-6.897055*	-6.821126*	-6.866634*
5	1006.280	0.404163	5.95e-05	-6.891586	-6.803003	-6.856095
6	1007.499	2.371565	5.94e-05	-6.893100	-6.791862	-6.852539
7	1007.510	0.020314	5.98e-05	-6.886275	-6.772383	-6.840644
8	1008.270	1.467235	5.99e-05	-6.884619	-6.758071	-6.833918

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLDSEGEN
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	913.0508	NA	0.000111	-6.268390	-6.255767	-6.263333
1	1019.527	211.4895*	5.37e-05*	-6.993315*	-6.968069*	-6.983201*
2	1019.576	0.096022	5.41e-05	-6.986775	-6.948906	-6.971605
3	1019.694	0.232445	5.44e-05	-6.980712	-6.930220	-6.960485
4	1019.694	0.000337	5.48e-05	-6.973841	-6.910725	-6.948556
5	1021.359	3.261571	5.46e-05	-6.978412	-6.902673	-6.948071
6	1021.592	0.455151	5.48e-05	-6.973142	-6.884780	-6.937744
7	1021.640	0.092581	5.52e-05	-6.966596	-6.865611	-6.926141
8	1022.219	1.122441	5.54e-05	-6.963704	-6.850096	-6.918192

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLIPI
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2550.456	NA	1.36e-09	-17.57556	-17.55025	-17.56542
1	2694.051	284.2194*	5.10e-10*	-18.55897*	-18.52101*	-18.54376*
2	2694.352	0.593076	5.12e-10	-18.55415	-18.50353	-18.53387
3	2695.002	1.278201	5.14e-10	-18.55174	-18.48847	-18.52639
4	2695.684	1.335966	5.15e-10	-18.54955	-18.47362	-18.51913
5	2696.190	0.986587	5.16e-10	-18.54614	-18.45755	-18.51065
6	2696.761	1.110943	5.18e-10	-18.54318	-18.44194	-18.50262
7	2697.357	1.154714	5.19e-10	-18.54039	-18.42650	-18.49476
8	2698.130	1.491921	5.20e-10	-18.53882	-18.41228	-18.48812

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLIPI
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2548.063	NA	1.38e-09	-17.56595	-17.55329	-17.56088
1	2693.969	289.7998*	5.07e-10*	-18.56530*	-18.53999*	-18.55516*
2	2694.291	0.638136	5.09e-10	-18.56063	-18.52266	-18.54542
3	2694.908	1.217129	5.10e-10	-18.55799	-18.50737	-18.53771
4	2695.633	1.424129	5.11e-10	-18.55609	-18.49281	-18.53074
5	2696.104	0.923694	5.13e-10	-18.55244	-18.47652	-18.52202

6	2696.713	1.187688	5.15e-10	-18.54974	-18.46116	-18.51425
7	2697.333	1.206721	5.16e-10	-18.54713	-18.44589	-18.50657
8	2698.123	1.529497	5.17e-10	-18.54567	-18.43178	-18.50004

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLIPI)
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2666.168	NA	5.76e-10	-18.43715	-18.41178	-18.42698
1	2669.075	5.753624	5.68e-10	-18.45035	-18.41229*	-18.43510*
2	2669.120	0.089270	5.72e-10	-18.44374	-18.39299	-18.42341
3	2671.758	5.184712*	5.66e-10*	-18.45508*	-18.39164	-18.42966
4	2671.816	0.113421	5.69e-10	-18.44856	-18.37244	-18.41805
5	2672.715	1.753659	5.70e-10	-18.44785	-18.35905	-18.41227
6	2673.078	0.705854	5.72e-10	-18.44345	-18.34195	-18.40278
7	2673.170	0.177948	5.76e-10	-18.43716	-18.32298	-18.39141
8	2673.569	0.771387	5.78e-10	-18.43300	-18.30614	-18.38217

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLIPI)
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2666.085	NA	5.72e-10	-18.44350	-18.43081	-18.43841
1	2668.964	5.716683	5.65e-10	-18.45650	-18.43112*	-18.44633*
2	2669.005	0.081491	5.69e-10	-18.44986	-18.41180	-18.43461
3	2671.593	5.104673*	5.62e-10*	-18.46085*	-18.41010	-18.44052
4	2671.664	0.140128	5.66e-10	-18.45442	-18.39099	-18.42901
5	2672.494	1.625650	5.67e-10	-18.45325	-18.37713	-18.42275
6	2672.797	0.590768	5.69e-10	-18.44842	-18.35962	-18.41284
7	2672.854	0.111624	5.73e-10	-18.44190	-18.34041	-18.40123
8	2673.330	0.921027	5.75e-10	-18.43827	-18.32409	-18.39252

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLINT
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2632.578	NA	7.74e-10	-18.14192	-18.11661	-18.13178
1	2776.888	285.6340	2.88e-10	-19.13026	-19.09230*	-19.11505
2	2776.889	0.002537	2.90e-10	-19.12337	-19.07276	-19.10309
3	2777.820	1.828353	2.90e-10	-19.12289	-19.05962	-19.09754
4	2779.520	3.329981	2.89e-10	-19.12772	-19.05179	-19.09730
5	2780.643	2.191957	2.88e-10	-19.12857	-19.03999	-19.09308
6	2790.015	18.22700*	2.72e-10*	-19.18631*	-19.08507	-19.14575*
7	2790.015	0.000368	2.74e-10	-19.17941	-19.06552	-19.13378

8	2790.105	0.174622	2.76e-10	-19.17314	-19.04659	-19.12244

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLINT
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2626.359	NA	8.02e-10	-18.10593	-18.09327	-18.10086
1	2776.288	297.7883	2.87e-10	-19.13302	-19.10771*	-19.12288
2	2776.288	0.001132	2.89e-10	-19.12613	-19.08816	-19.11091
3	2777.330	2.054398	2.89e-10	-19.12641	-19.07579	-19.10613
4	2779.154	3.586505	2.87e-10	-19.13210	-19.06883	-19.10675
5	2780.361	2.363219	2.87e-10	-19.13352	-19.05760	-19.10310
6	2789.444	17.72690*	2.71e-10*	-19.18927*	-19.10068	-19.15378*
7	2789.446	0.004541	2.73e-10	-19.18239	-19.08115	-19.14183
8	2789.502	0.107978	2.75e-10	-19.17587	-19.06198	-19.13024

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLINT)
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2751.208	NA	3.20e-10	-19.02566	-19.00029	-19.01549
1	2752.673	2.900709	3.19e-10	-19.02888	-18.99082	-19.01363
2	2756.737	8.015283	3.12e-10	-19.05008	-18.99934	-19.02975
3	2761.192	8.755632	3.05e-10	-19.07399	-19.01056	-19.04858
4	2764.027	5.552635	3.01e-10	-19.08669	-19.01057	-19.05619
5	2769.543	10.76424*	2.92e-10*	-19.11794*	-19.02914*	-19.08236*
6	2770.238	1.352265	2.92e-10	-19.11584	-19.01434	-19.07517
7	2770.501	0.509652	2.94e-10	-19.11074	-18.99656	-19.06499
8	2770.765	0.508481	2.95e-10	-19.10564	-18.97877	-19.05480

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLINT)
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2751.203	NA	3.18e-10	-19.03255	-19.01986	-19.02746
1	2752.667	2.908597	3.17e-10	-19.03576	-19.01039	-19.02559
2	2756.729	8.038427	3.10e-10	-19.05695	-19.01889	-19.04170
3	2761.180	8.779004	3.03e-10	-19.08083	-19.03008	-19.06050
4	2764.011	5.564011	2.99e-10	-19.09350	-19.03007	-19.06808
5	2769.532	10.81348*	2.90e-10*	-19.12479*	-19.04867*	-19.09429*
6	2770.226	1.353622	2.90e-10	-19.12267	-19.03386	-19.08709
7	2770.488	0.509076	2.92e-10	-19.11756	-19.01607	-19.07689
8	2770.750	0.507666	2.93e-10	-19.11245	-18.99827	-19.06670

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLCPI
Exogenous variables: C @TREND
Date: 05/16/17 Time: 22:57
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2591.513	NA	1.03e-09	-17.85871	-17.83340	-17.84857
1	2997.161	802.9025*	6.30e-11*	-20.64939*	-20.61142*	-20.63418*
2	2997.435	0.540313	6.34e-11	-20.64438	-20.59376	-20.62410
3	2997.888	0.889478	6.36e-11	-20.64060	-20.57733	-20.61525
4	2998.119	0.453545	6.39e-11	-20.63530	-20.55938	-20.60488
5	2998.165	0.089574	6.44e-11	-20.62872	-20.54014	-20.59323
6	2998.735	1.109278	6.45e-11	-20.62576	-20.52452	-20.58520
7	2998.838	0.198009	6.49e-11	-20.61957	-20.50568	-20.57394
8	3000.008	2.259450	6.49e-11	-20.62074	-20.49419	-20.57004

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLCPI
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2527.331	NA	1.59e-09	-17.42297	-17.41032	-17.41790
1	2996.773	932.4093*	6.28e-11*	-20.65361*	-20.62830*	-20.64347*
2	2996.980	0.409900	6.31e-11	-20.64814	-20.61018	-20.63293
3	2997.533	1.090200	6.33e-11	-20.64506	-20.59444	-20.62477
4	2997.704	0.335164	6.37e-11	-20.63933	-20.57606	-20.61398
5	2997.781	0.152001	6.41e-11	-20.63297	-20.55704	-20.60255
6	2998.440	1.285896	6.42e-11	-20.63062	-20.54204	-20.59513
7	2998.509	0.134399	6.46e-11	-20.62420	-20.52296	-20.58364
8	2999.789	2.480931	6.45e-11	-20.62613	-20.51224	-20.58050

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLCPI)
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2984.318	NA*	6.37e-11*	-20.63888*	-20.61351*	-20.62871*
1	2984.417	0.195876	6.41e-11	-20.63265	-20.59459	-20.61740
2	2985.179	1.503147	6.42e-11	-20.63100	-20.58025	-20.61067
3	2985.272	0.181638	6.46e-11	-20.62472	-20.56129	-20.59930
4	2985.402	0.254005	6.50e-11	-20.61870	-20.54258	-20.58820
5	2986.262	1.679239	6.51e-11	-20.61773	-20.52892	-20.58215
6	2986.284	0.043207	6.55e-11	-20.61096	-20.50947	-20.57030
7	2987.828	2.991819	6.53e-11	-20.61473	-20.50055	-20.56898
8	2988.195	0.707343	6.56e-11	-20.61034	-20.48348	-20.55951

* indicates lag order selected by the criterion
VAR Lag Order Selection Criteria

Endogenous variables: D(VDLCPI)
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2984.240	NA*	6.33e-11*	-20.64526*	-20.63257*	-20.64017*
1	2984.343	0.205829	6.37e-11	-20.63905	-20.61368	-20.62889
2	2985.088	1.473597	6.38e-11	-20.63728	-20.59923	-20.62203
3	2985.188	0.197060	6.42e-11	-20.63106	-20.58031	-20.61072
4	2985.309	0.238013	6.46e-11	-20.62497	-20.56154	-20.59956
5	2986.157	1.660553	6.47e-11	-20.62392	-20.54780	-20.59342
6	2986.181	0.048470	6.51e-11	-20.61717	-20.52837	-20.58159
7	2987.708	2.968241	6.49e-11	-20.62082	-20.51932	-20.58015
8	2988.087	0.734185	6.51e-11	-20.61652	-20.50234	-20.57077

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLEXR
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2224.965	NA	1.29e-08	-15.33079	-15.30548	-15.32065
1	2343.223	234.0685	5.73e-09	-16.13947	-16.10150*	-16.12426
2	2343.958	1.451281	5.74e-09	-16.13764	-16.08703	-16.11736
3	2346.803	5.590913*	5.67e-09*	-16.15037*	-16.08709	-16.12501*
4	2346.804	0.001889	5.71e-09	-16.14348	-16.06755	-16.11305
5	2347.145	0.665928	5.73e-09	-16.13893	-16.05035	-16.10344
6	2347.358	0.413990	5.77e-09	-16.13350	-16.03227	-16.09294
7	2348.114	1.464854	5.78e-09	-16.13182	-16.01793	-16.08619
8	2348.638	1.012026	5.79e-09	-16.12854	-16.00199	-16.07784

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLEXR
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2222.224	NA	1.30e-08	-15.31878	-15.30613	-15.31371
1	2342.853	239.5955	5.71e-09	-16.14382	-16.11851*	-16.13368
2	2343.635	1.546693	5.71e-09	-16.14231	-16.10434	-16.12710
3	2346.545	5.739738*	5.64e-09*	-16.15548*	-16.10486	-16.13520*
4	2346.547	0.003728	5.68e-09	-16.14860	-16.08532	-16.12325
5	2346.900	0.691611	5.70e-09	-16.14414	-16.06821	-16.11372
6	2347.119	0.428686	5.74e-09	-16.13875	-16.05017	-16.10326
7	2347.883	1.485676	5.74e-09	-16.13713	-16.03589	-16.09656
8	2348.410	1.020447	5.76e-09	-16.13386	-16.01997	-16.08823

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLEXR)
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2315.026	NA	6.54e-09	-16.00710	-15.98173	-15.99694
1	2320.341	10.51811	6.35e-09	-16.03696	-15.99890	-16.02171
2	2327.888	14.88640	6.07e-09	-16.08227	-16.03153*	-16.06194*
3	2328.683	1.562217	6.08e-09	-16.08085	-16.01742	-16.05543
4	2330.474	3.507607	6.04e-09	-16.08633	-16.01021	-16.05583
5	2331.717	2.425632	6.03e-09	-16.08801	-15.99920	-16.05242
6	2333.749	3.952161	5.99e-09	-16.09515	-15.99366	-16.05448
7	2335.171	2.754994	5.97e-09	-16.09807	-15.98389	-16.05232
8	2337.352	4.211176*	5.92e-09*	-16.10624*	-15.97938	-16.05541

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLEXR)
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 289

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2315.025	NA	6.50e-09	-16.01402	-16.00133	-16.00893
1	2320.340	10.55484	6.31e-09	-16.04387	-16.01850	-16.03371
2	2327.888	14.94025	6.03e-09	-16.08919	-16.05113*	-16.07394*
3	2328.683	1.568078	6.04e-09	-16.08777	-16.03703	-16.06744
4	2330.474	3.519552	6.00e-09	-16.09324	-16.02981	-16.06783
5	2331.716	2.431928	5.99e-09	-16.09492	-16.01880	-16.06442
6	2333.744	3.959546	5.95e-09	-16.10204	-16.01323	-16.06645
7	2335.161	2.755006	5.93e-09	-16.10492	-16.00343	-16.06425
8	2337.332	4.206838*	5.88e-09*	-16.11303*	-15.99885	-16.06727

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLM2
Exogenous variables: C @TREND
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2714.107	NA	4.41e-10	-18.70418	-18.67887	-18.69404
1	3007.501	580.7176	5.87e-11	-20.72069	-20.68273	-20.70548
2	3008.833	2.628391	5.86e-11	-20.72299	-20.67237	-20.70271
3	3012.538	7.281624	5.75e-11	-20.74164	-20.67837	-20.71629
4	3014.856	4.541005	5.70e-11	-20.75073	-20.67480	-20.72031
5	3023.521	16.91113	5.40e-11	-20.80359	-20.71501	-20.76810
6	3035.009	22.34214	5.03e-11	-20.87592	-20.77469	-20.83536
7	3088.467	103.5982*	3.50e-11*	-21.23770*	-21.12381*	-21.19207*
8	3089.008	1.043743	3.51e-11	-21.23454	-21.10799	-21.18383

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLM2
Exogenous variables: C
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2379.443	NA	4.40e-09	-16.40305	-16.39040	-16.39798
1	3003.118	1238.747	6.01e-11	-20.69736	-20.67205	-20.68722
2	3005.351	4.420107	5.96e-11	-20.70587	-20.66790	-20.69066
3	3010.115	9.397522	5.81e-11	-20.73183	-20.68121	-20.71155
4	3013.047	5.763602	5.73e-11	-20.74516	-20.68188	-20.71980
5	3022.407	18.33182	5.41e-11	-20.80281	-20.72688	-20.77239
6	3034.359	23.32672	5.01e-11	-20.87834	-20.78975	-20.84285
7	3086.356	101.1262*	3.53e-11*	-21.23004*	-21.12881*	-21.18948*
8	3087.156	1.549399	3.53e-11	-21.22866	-21.11477	-21.18303

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLM2)
Exogenous variables: C @TREND
Date: 05/16/17 Time: 23:20
Sample: 1991M01 2015M12
Included observations: 282

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2930.902	NA	5.57e-11	-20.77235	-20.74652	-20.76200
1	2933.104	4.357150	5.53e-11	-20.78088	-20.74213	-20.76534
2	2937.879	9.414377	5.38e-11	-20.80765	-20.75599	-20.78694
3	2940.678	5.499607	5.31e-11	-20.82041	-20.75584	-20.79452
4	2948.804	15.90575	5.05e-11	-20.87095	-20.79346	-20.83988
5	2957.859	17.65987	4.77e-11	-20.92808	-20.83767	-20.89182
6	2999.028	80.00202	3.59e-11	-21.21296	-21.10965	-21.17153
7	2999.888	1.666530	3.59e-11	-21.21197	-21.09574	-21.16536
8	3001.493	3.095940	3.58e-11	-21.21626	-21.08712	-21.16448
9	3001.494	0.002410	3.60e-11	-21.20918	-21.06712	-21.15221
10	3004.550	5.850743	3.55e-11	-21.22376	-21.06878	-21.16161
11	3007.337	5.317722	3.50e-11	-21.23643	-21.06855	-21.16911
12	3066.254	111.9829*	2.32e-11	-21.64719	-21.46638*	-21.57468*
13	3067.661	2.664745	2.32e-11*	-21.65008*	-21.45636	-21.57239
14	3067.761	0.188769	2.33e-11	-21.64369	-21.43706	-21.56083
15	3067.781	0.037932	2.35e-11	-21.63675	-21.41720	-21.54870

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLM2)
Exogenous variables: C
Date: 05/16/17 Time: 23:21
Sample: 1991M01 2015M12
Included observations: 282

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2930.827	NA	5.54e-11	-20.77892	-20.76600	-20.77374
1	2933.013	4.339987	5.49e-11	-20.78732	-20.76150	-20.77697
2	2937.764	9.400653	5.35e-11	-20.81393	-20.77518	-20.79839

3	2940.545	5.483423	5.28e-11	-20.82656	-20.77490	-20.80584
4	2948.642	15.90801	5.02e-11	-20.87690	-20.81232	-20.85100
5	2957.661	17.65330	4.74e-11	-20.93377	-20.85628	-20.90269
6	2999.001	80.62707	3.56e-11	-21.21986	-21.12946	-21.18361
7	2999.849	1.647756	3.57e-11	-21.21878	-21.11547	-21.17735
8	3001.431	3.063426	3.55e-11	-21.22291	-21.10668	-21.17630
9	3001.433	0.003959	3.58e-11	-21.21584	-21.08669	-21.16405
10	3004.447	5.793843	3.53e-11	-21.23012	-21.08806	-21.17315
11	3007.186	5.244980	3.48e-11	-21.24246	-21.08748	-21.18031
12	3066.252	112.6851*	2.31e-11	-21.65427	-21.48638*	-21.58694*
13	3067.660	2.677575	2.30e-11*	-21.65717*	-21.47636	-21.58466
14	3067.761	0.190146	2.32e-11	-21.65079	-21.45707	-21.57310
15	3067.781	0.038037	2.33e-11	-21.64384	-21.43720	-21.56098

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLGDPRICE
Exogenous variables: C @TREND
Date: 05/16/17 Time: 23:21
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1635.075	NA	7.82e-07	-11.22389	-11.19864	-11.21377
1	1641.079	11.88403	7.55e-07	-11.25828	-11.22041*	-11.24311
2	1641.233	0.302959	7.60e-07	-11.25246	-11.20197	-11.23223
3	1641.245	0.023279	7.65e-07	-11.24567	-11.18255	-11.22038
4	1647.565	12.37934*	7.37e-07*	-11.28223*	-11.20649	-11.25189*
5	1647.590	0.049577	7.42e-07	-11.27553	-11.18717	-11.24014
6	1647.609	0.037358	7.47e-07	-11.26879	-11.16781	-11.22834
7	1647.864	0.492975	7.51e-07	-11.26367	-11.15006	-11.21816
8	1647.876	0.024624	7.56e-07	-11.25688	-11.13065	-11.20631

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: VDLGDPRICE
Exogenous variables: C
Date: 05/16/17 Time: 23:22
Sample: 1991M01 2015M12
Included observations: 291

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1634.304	NA	7.80e-07	-11.22546	-11.21284	-11.22040
1	1639.978	11.26958	7.56e-07	-11.25758	-11.23233*	-11.24747
2	1640.069	0.181139	7.61e-07	-11.25134	-11.21347	-11.23617
3	1640.114	0.087788	7.66e-07	-11.24477	-11.19428	-11.22454
4	1646.809	13.15986*	7.36e-07*	-11.28391*	-11.22079	-11.25863*
5	1646.861	0.101675	7.41e-07	-11.27739	-11.20166	-11.24705
6	1646.865	0.008611	7.46e-07	-11.27055	-11.18219	-11.23515
7	1647.197	0.645213	7.50e-07	-11.26596	-11.16497	-11.22550
8	1647.199	0.003361	7.55e-07	-11.25910	-11.14549	-11.21359

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLGDPRICE)
Exogenous variables: C @TREND
Date: 05/16/17 Time: 23:22
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1502.627	NA	1.87e-06	-10.34915	-10.32384	-10.33901
1	1562.941	119.3819	1.25e-06	-10.75822	-10.72025	-10.74301
2	1587.912	49.25140	1.06e-06	-10.92353	-10.87291	-10.90325
3	1617.046	57.26413	8.69e-07	-11.11756	-11.05428	-11.09221
4	1621.097	7.934333	8.51e-07	-11.13860	-11.06267	-11.10818
5	1623.286	4.271952	8.44e-07	-11.14680	-11.05821	-11.11131
6	1626.870	6.969890*	8.29e-07	-11.16462	-11.06338*	-11.12406*
7	1628.074	2.334039	8.28e-07*	-11.16603*	-11.05213	-11.12040
8	1628.192	0.228286	8.33e-07	-11.15995	-11.03340	-11.10924

* indicates lag order selected by the criterion

VAR Lag Order Selection Criteria
Endogenous variables: D(VDLGDPRICE)
Exogenous variables: C
Date: 05/16/17 Time: 23:23
Sample: 1991M01 2015M12
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1502.619	NA	1.86e-06	-10.35599	-10.34334	-10.35092
1	1562.941	119.8126	1.24e-06	-10.76511	-10.73980	-10.75497
2	1587.912	49.42362	1.05e-06	-10.93042	-10.89246	-10.91521
3	1617.046	57.46505	8.63e-07	-11.12445	-11.07384	-11.10417
4	1621.097	7.962279	8.45e-07	-11.14550	-11.08222	-11.12015
5	1623.285	4.286347	8.39e-07	-11.15369	-11.07776	-11.12327
6	1626.868	6.991928*	8.24e-07	-11.17150	-11.08292*	-11.13601*
7	1628.071	2.339422	8.23e-07*	-11.17290*	-11.07166	-11.13234
8	1628.188	0.228063	8.28e-07	-11.16682	-11.05292	-11.12119

* indicates lag order selected by the criterion

Appendix R: Unit Root Tests of Conditional Variances

R 1 ADF Unit Root Test

Null Hypothesis: VDLDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.378835	0.0000
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLDSEGEN)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLDSEGEN(-1)	-0.280576	0.043985	-6.378835	0.0000
D(VDLDSEGEN(-1))	-0.015745	0.058348	-0.269846	0.7875
C	0.003116	0.000973	3.203336	0.0015
@TREND("1991M01")	-5.37E-06	4.96E-06	-1.083955	0.2793

R-squared	0.143217	Mean dependent var	3.76E-06
Adjusted R-squared	0.134444	S.D. dependent var	0.007784
S.E. of regression	0.007242	Akaike info criterion	-7.004461
Sum squared resid	0.015367	Schwarz criterion	-6.954714
Log likelihood	1044.162	Hannan-Quinn criter.	-6.984545
F-statistic	16.32561	Durbin-Watson stat	1.999216
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.98728	0.0000
Test critical values:	1% level	-3.989365	
	5% level	-3.425080	
	10% level	-3.135645	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLIPI)
Method: Least Squares
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLIPI(-1)	-0.254533	0.021234	-11.98728	0.0000
D(VDLIPI(-1))	-0.010057	0.047227	-0.212955	0.8315
C	0.001236	0.000104	11.91616	0.0000

@TREND("1991M01")	-6.78E-09	1.60E-08	-0.424728	0.6713

R-squared	0.370613	Mean dependent var	-2.37E-06
Adjusted R-squared	0.364147	S.D. dependent var	2.84E-05
S.E. of regression	2.26E-05	Akaike info criterion	-18.54211
Sum squared resid	1.49E-07	Schwarz criterion	-18.49224
Log likelihood	2748.232	Hannan-Quinn criter.	-18.52214
F-statistic	57.31449	Durbin-Watson stat	1.994863
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLINT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.414721	0.0024
Test critical values:	1% level	-3.989908	
	5% level	-3.425343	
	10% level	-3.135800	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLINT)
Method: Least Squares
Sample (adjusted): 1991M10 2015M12
Included observations: 291 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLINT(-1)	-0.193262	0.043777	-4.414721	0.0000
D(VDLINT(-1))	-0.006016	0.063961	-0.094051	0.9251
D(VDLINT(-2))	-0.054902	0.063903	-0.859145	0.3910
D(VDLINT(-3))	-0.055810	0.062533	-0.892495	0.3729
D(VDLINT(-4))	-0.031722	0.060797	-0.521770	0.6022
D(VDLINT(-5))	0.250717	0.058963	4.252117	0.0000
D(VDLINT(-6))	0.001146	0.059628	0.019213	0.9847
C	3.89E-07	1.99E-06	0.195384	0.8452
@TREND("1991M01")	1.25E-08	1.18E-08	1.058122	0.2909

R-squared	0.180091	Mean dependent var	5.57E-09
Adjusted R-squared	0.156831	S.D. dependent var	1.77E-05
S.E. of regression	1.63E-05	Akaike info criterion	-19.18307
Sum squared resid	7.47E-08	Schwarz criterion	-19.06946
Log likelihood	2800.137	Hannan-Quinn criter.	-19.13756
F-statistic	7.742591	Durbin-Watson stat	1.999946
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.191389	0.4922
Test critical values:	1% level	-3.989365	
	5% level	-3.425080	
	10% level	-3.135645	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation

Dependent Variable: D(VDLCPI)
Method: Least Squares
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLCPI(-1)	-0.032477	0.014820	-2.191389	0.0292
D(VDLCPI(-1))	0.050879	0.058467	0.870207	0.3849
C	3.71E-06	2.10E-06	1.764134	0.0788
@TREND("1991M01")	-7.84E-09	6.91E-09	-1.134853	0.2574

R-squared	0.017612	Mean dependent var	-1.80E-07
Adjusted R-squared	0.007519	S.D. dependent var	8.00E-06
S.E. of regression	7.97E-06	Akaike info criterion	-20.62956
Sum squared resid	1.85E-08	Schwarz criterion	-20.57969
Log likelihood	3057.174	Hannan-Quinn criter.	-20.60959
F-statistic	1.744966	Durbin-Watson stat	1.994859
Prob(F-statistic)	0.157901		

Null Hypothesis: VDLCPI has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.895569	0.3342
Test critical values:	1% level	-3.452290	
	5% level	-2.871095	
	10% level	-2.571932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLCPI)
Method: Least Squares
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLCPI(-1)	-0.022039	0.011627	-1.895569	0.0590
D(VDLCPI(-1))	0.044223	0.058201	0.759840	0.4480
C	1.65E-06	1.07E-06	1.546784	0.1230

R-squared	0.013279	Mean dependent var	-1.80E-07
Adjusted R-squared	0.006544	S.D. dependent var	8.00E-06
S.E. of regression	7.97E-06	Akaike info criterion	-20.63191
Sum squared resid	1.86E-08	Schwarz criterion	-20.59451
Log likelihood	3056.523	Hannan-Quinn criter.	-20.61694
F-statistic	1.971566	Durbin-Watson stat	1.994576
Prob(F-statistic)	0.141081		

Null Hypothesis: D(VDLCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.56358	0.0000
Test critical values:	1% level	-3.989365	
	5% level	-3.425080	
	10% level	-3.135645	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation

Dependent Variable: D(VDLCPI,2)
Method: Least Squares
Date: 05/16/17 Time: 23:43
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VDLCPI(-1))	-0.966097	0.058327	-16.56358	0.0000
C	-4.09E-07	9.49E-07	-0.430646	0.6670
@TREND("1991M01")	1.56E-09	5.45E-09	0.285238	0.7757

R-squared	0.483575	Mean dependent var	1.85E-08
Adjusted R-squared	0.480050	S.D. dependent var	1.11E-05
S.E. of regression	8.02E-06	Akaike info criterion	-20.62000
Sum squared resid	1.88E-08	Schwarz criterion	-20.58260
Log likelihood	3054.760	Hannan-Quinn criter.	-20.60502
F-statistic	137.1811	Durbin-Watson stat	1.995873
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLEXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.531100	0.0016
Test critical values:	1% level	-3.989580	
	5% level	-3.425184	
	10% level	-3.135706	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLEXR)
Method: Least Squares
Date: 05/16/17 Time: 23:43
Sample (adjusted): 1991M07 2015M12
Included observations: 294 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLEXR(-1)	-0.204962	0.045235	-4.531100	0.0000
D(VDLEXR(-1))	-0.110514	0.064043	-1.725626	0.0855
D(VDLEXR(-2))	-0.135147	0.061214	-2.207803	0.0280
D(VDLEXR(-3))	-0.000671	0.058895	-0.011402	0.9909
C	2.81E-05	1.06E-05	2.653764	0.0084
@TREND("1991M01")	-4.70E-08	5.17E-08	-0.908939	0.3641

R-squared	0.147724	Mean dependent var	1.36E-08
Adjusted R-squared	0.132928	S.D. dependent var	8.00E-05
S.E. of regression	7.45E-05	Akaike info criterion	-16.15124
Sum squared resid	1.60E-06	Schwarz criterion	-16.07607
Log likelihood	2380.233	Hannan-Quinn criter.	-16.12114
F-statistic	9.983745	Durbin-Watson stat	2.000217
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.164867	0.5069
Test critical values:	1% level	-3.990019	
	5% level	-3.425397	
	10% level	-3.135832	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLM2)
Method: Least Squares
Sample (adjusted): 1991M11 2015M12
Included observations: 290 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLM2(-1)	-0.037370	0.017262	-2.164867	0.0312
D(VDLM2(-1))	-0.069401	0.059816	-1.160241	0.2469
D(VDLM2(-2))	-0.125363	0.051235	-2.446831	0.0150
D(VDLM2(-3))	-0.104086	0.050973	-2.041998	0.0421
D(VDLM2(-4))	-0.124130	0.047517	-2.612357	0.0095
D(VDLM2(-5))	-0.111850	0.047364	-2.361489	0.0189
D(VDLM2(-6))	0.509556	0.046952	10.85281	0.0000
D(VDLM2(-7))	-0.056873	0.055616	-1.022590	0.3074
C	9.83E-06	5.19E-06	1.892668	0.0594
@TREND("1991M01")	-2.61E-08	1.37E-08	-1.897041	0.0589

R-squared	0.451007	Mean dependent var	-8.00E-07
Adjusted R-squared	0.433361	S.D. dependent var	7.74E-06
S.E. of regression	5.83E-06	Akaike info criterion	-21.23454
Sum squared resid	9.50E-09	Schwarz criterion	-21.10799
Log likelihood	3089.008	Hannan-Quinn criter.	-21.18383
F-statistic	25.55834	Durbin-Watson stat	2.010471
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLM2 has a unit root
Exogenous: Constant
Lag Length: 7 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.177264	0.6850
Test critical values:	1% level	-3.452753	
	5% level	-2.871298	
	10% level	-2.572041	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLM2)
Method: Least Squares
Sample (adjusted): 1991M11 2015M12
Included observations: 290 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLM2(-1)	-0.006139	0.005214	-1.177264	0.2401
D(VDLM2(-1))	-0.086981	0.059366	-1.465162	0.1440

D(VDLM2(-2))	-0.148193	0.050031	-2.961992	0.0033
D(VDLM2(-3))	-0.123241	0.050193	-2.455351	0.0147
D(VDLM2(-4))	-0.137993	0.047168	-2.925568	0.0037
D(VDLM2(-5))	-0.122339	0.047257	-2.588776	0.0101
D(VDLM2(-6))	0.502473	0.047019	10.68665	0.0000
D(VDLM2(-7))	-0.069169	0.055492	-1.246466	0.2136
C	1.58E-07	9.93E-07	0.158573	0.8741

R-squared	0.443951	Mean dependent var	-8.00E-07
Adjusted R-squared	0.428121	S.D. dependent var	7.74E-06
S.E. of regression	5.85E-06	Akaike info criterion	-21.22866
Sum squared resid	9.63E-09	Schwarz criterion	-21.11477
Log likelihood	3087.156	Hannan-Quinn criter.	-21.18303
F-statistic	28.04393	Durbin-Watson stat	2.014511
Prob(F-statistic)	0.000000		

Null Hypothesis: D(VDLM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 13 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.679422	0.0253
Test critical values:	1% level	-3.990817	
	5% level	-3.425784	
	10% level	-3.136061	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLM2,2)
Method: Least Squares
Sample (adjusted): 1992M06 2015M12
Included observations: 283 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VDLM2(-1))	-0.850877	0.231253	-3.679422	0.0003
D(VDLM2(-1),2)	-0.128400	0.225399	-0.569656	0.5694
D(VDLM2(-2),2)	-0.180093	0.220416	-0.817062	0.4146
D(VDLM2(-3),2)	-0.342890	0.206698	-1.658894	0.0983
D(VDLM2(-4),2)	-0.358817	0.194436	-1.845422	0.0661
D(VDLM2(-5),2)	-0.396667	0.184567	-2.149181	0.0325
D(VDLM2(-6),2)	-0.273973	0.173011	-1.583562	0.1145
D(VDLM2(-7),2)	-0.306202	0.161702	-1.893615	0.0594
D(VDLM2(-8),2)	-0.390038	0.151027	-2.582581	0.0103
D(VDLM2(-9),2)	-0.318562	0.133556	-2.385242	0.0178
D(VDLM2(-10),2)	-0.416520	0.114524	-3.636963	0.0003
D(VDLM2(-11),2)	-0.471785	0.094886	-4.972102	0.0000
D(VDLM2(-12),2)	0.067423	0.079691	0.846055	0.3983
D(VDLM2(-13),2)	-0.024955	0.056772	-0.439574	0.6606
C	-5.79E-07	6.65E-07	-0.871800	0.3841
@TREND("1991M01")	9.51E-11	3.45E-09	0.027532	0.9781

R-squared	0.831591	Mean dependent var	-9.76E-09
Adjusted R-squared	0.822130	S.D. dependent var	1.11E-05
S.E. of regression	4.69E-06	Akaike info criterion	-21.64730
Sum squared resid	5.87E-09	Schwarz criterion	-21.44120
Log likelihood	3079.093	Hannan-Quinn criter.	-21.56466
F-statistic	87.89515	Durbin-Watson stat	2.001055
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.573112	0.0000
Test critical values:	1% level	-3.989580	
	5% level	-3.425184	
	10% level	-3.135706	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VDLGDPRICE)
Method: Least Squares
Date: 05/16/17 Time: 23:44
Sample (adjusted): 1991M07 2015M12
Included observations: 294 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLGDPRICE(-1)	-0.976903	0.148621	-6.573112	0.0000
D(VDLGDPRICE(-1))	-0.246825	0.136456	-1.808828	0.0715
D(VDLGDPRICE(-2))	-0.279406	0.117670	-2.374496	0.0182
D(VDLGDPRICE(-3))	-0.218025	0.092551	-2.355730	0.0192
D(VDLGDPRICE(-4))	-0.014530	0.059354	-0.244807	0.8068
C	0.001819	0.000294	6.185751	0.0000
@TREND("1991M01")	6.81E-07	6.03E-07	1.129176	0.2598

R-squared	0.619927	Mean dependent var	-6.15E-06
Adjusted R-squared	0.611981	S.D. dependent var	0.001384
S.E. of regression	0.000862	Akaike info criterion	-11.25110
Sum squared resid	0.000213	Schwarz criterion	-11.16340
Log likelihood	1660.912	Hannan-Quinn criter.	-11.21598
F-statistic	78.01956	Durbin-Watson stat	1.991244
Prob(F-statistic)	0.000000		

R 2 PP Unit Root Test

Null Hypothesis: VDLDSEGEN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.980231	0.0000
Test critical values:	1% level	-3.989153	
	5% level	-3.424977	
	10% level	-3.135584	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.16E-05
HAC corrected variance (Bartlett kernel)	5.10E-05

Phillips-Perron Test Equation
Dependent Variable: D(VDLDSEGEN)
Method: Least Squares
Date: 05/16/17 Time: 23:45
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLDSEGEN(-1)	-0.284560	0.040594	-7.009840	0.0000
C	0.003132	0.000947	3.307185	0.0011
@TREND("1991M01")	-5.30E-06	4.91E-06	-1.081131	0.2805

R-squared	0.142829	Mean dependent var	5.64E-06
Adjusted R-squared	0.137018	S.D. dependent var	0.007771
S.E. of regression	0.007219	Akaike info criterion	-7.014154
Sum squared resid	0.015374	Schwarz criterion	-6.976935
Log likelihood	1048.109	Hannan-Quinn criter.	-6.999256
F-statistic	24.57778	Durbin-Watson stat	2.023271
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLIPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.06333	0.0000
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.06E-10
HAC corrected variance (Bartlett kernel)	4.93E-10

Phillips-Perron Test Equation
Dependent Variable: D(VDLIPI)
Method: Least Squares
Date: 05/16/17 Time: 23:45
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLIPI(-1)	-0.238863	0.016000	-14.92912	0.0000
C	0.001160	7.85E-05	14.77230	0.0000
@TREND("1991M01")	-5.62E-09	1.59E-08	-0.354379	0.7233

R-squared	0.446221	Mean dependent var	-2.99E-06
Adjusted R-squared	0.442454	S.D. dependent var	3.03E-05
S.E. of regression	2.26E-05	Akaike info criterion	-18.54718
Sum squared resid	1.50E-07	Schwarz criterion	-18.50987
Log likelihood	2757.257	Hannan-Quinn criter.	-18.53225
F-statistic	118.4490	Durbin-Watson stat	2.048195
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLINT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.793349	0.0000
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.75E-10
HAC corrected variance (Bartlett kernel)	2.76E-10

Phillips-Perron Test Equation
Dependent Variable: D(VDLINT)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLINT(-1)	-0.205465	0.035484	-5.790440	0.0000
C	4.36E-07	1.96E-06	0.222605	0.8240
@TREND("1991M01")	1.32E-08	1.16E-08	1.138843	0.2557

R-squared	0.102403	Mean dependent var	1.02E-08
Adjusted R-squared	0.096297	S.D. dependent var	1.75E-05
S.E. of regression	1.67E-05	Akaike info criterion	-19.15460
Sum squared resid	8.18E-08	Schwarz criterion	-19.11729
Log likelihood	2847.458	Hannan-Quinn criter.	-19.13966
F-statistic	16.77065	Durbin-Watson stat	1.995154
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLCPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.154714	0.5126
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.27E-11
HAC corrected variance (Bartlett kernel)	6.58E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLCPI)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLCPI(-1)	-0.030822	0.014674	-2.100394	0.0365
C	3.38E-06	2.08E-06	1.628279	0.1045

@TREND("1991M01")	-6.82E-09	6.85E-09	-0.995895	0.3201

R-squared	0.015271	Mean dependent var	-2.02E-07
Adjusted R-squared	0.008572	S.D. dependent var	7.99E-06
S.E. of regression	7.96E-06	Akaike info criterion	-20.63499
Sum squared resid	1.86E-08	Schwarz criterion	-20.59767
Log likelihood	3067.295	Hannan-Quinn criter.	-20.62005
F-statistic	2.279641	Durbin-Watson stat	1.899396
Prob(F-statistic)	0.104127		

Null Hypothesis: VDLCPI has a unit root
Exogenous: Constant
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.922078	0.3219
Test critical values:	1% level	-3.452215	
	5% level	-2.871061	
	10% level	-2.571915	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.29E-11
HAC corrected variance (Bartlett kernel)	6.57E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLCPI)
Method: Least Squares
Date: 05/16/17 Time: 23:46
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLCPI(-1)	-0.021791	0.011537	-1.888802	0.0599
C	1.61E-06	1.06E-06	1.510844	0.1319

R-squared	0.011949	Mean dependent var	-2.02E-07
Adjusted R-squared	0.008600	S.D. dependent var	7.99E-06
S.E. of regression	7.96E-06	Akaike info criterion	-20.63835
Sum squared resid	1.87E-08	Schwarz criterion	-20.61348
Log likelihood	3066.795	Hannan-Quinn criter.	-20.62839
F-statistic	3.567575	Durbin-Watson stat	1.910179
Prob(F-statistic)	0.059899		

Null Hypothesis: D(VDLCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-16.56358	0.0000
Test critical values:	1% level	-3.989365	
	5% level	-3.425080	
	10% level	-3.135645	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.36E-11
HAC corrected variance (Bartlett kernel)	6.36E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLCPI,2)
Method: Least Squares
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VDLCPI(-1))	-0.966097	0.058327	-16.56358	0.0000
C	-4.09E-07	9.49E-07	-0.430646	0.6670
@TREND("1991M01")	1.56E-09	5.45E-09	0.285238	0.7757

R-squared	0.483575	Mean dependent var	1.85E-08
Adjusted R-squared	0.480050	S.D. dependent var	1.11E-05
S.E. of regression	8.02E-06	Akaike info criterion	-20.62000
Sum squared resid	1.88E-08	Schwarz criterion	-20.58260
Log likelihood	3054.760	Hannan-Quinn criter.	-20.60502
F-statistic	137.1811	Durbin-Watson stat	1.995873
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLEXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.273207	0.0000
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	5.52E-09
HAC corrected variance (Bartlett kernel)	4.95E-09

Phillips-Perron Test Equation
Dependent Variable: D(VDLEXR)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLEXR(-1)	-0.252468	0.038667	-6.529264	0.0000
C	3.28E-05	1.00E-05	3.276817	0.0012
@TREND("1991M01")	-4.72E-08	5.09E-08	-0.928185	0.3541

R-squared	0.126718	Mean dependent var	2.43E-09
Adjusted R-squared	0.120777	S.D. dependent var	7.96E-05
S.E. of regression	7.46E-05	Akaike info criterion	-16.15765
Sum squared resid	1.64E-06	Schwarz criterion	-16.12034
Log likelihood	2402.412	Hannan-Quinn criter.	-16.14272
F-statistic	21.33043	Durbin-Watson stat	2.105097
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLM2 has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.113696	0.1050
Test critical values:	1% level	-3.989259	
	5% level	-3.425028	
	10% level	-3.135614	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.43E-11
HAC corrected variance (Bartlett kernel)	4.33E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLM2)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLM2(-1)	-0.078337	0.021734	-3.604433	0.0004
C	2.19E-05	6.54E-06	3.349384	0.0009
@TREND("1991M01")	-5.66E-08	1.76E-08	-3.219226	0.0014

R-squared	0.043712	Mean dependent var	-8.68E-07
Adjusted R-squared	0.037206	S.D. dependent var	8.21E-06
S.E. of regression	8.06E-06	Akaike info criterion	-20.60980
Sum squared resid	1.91E-08	Schwarz criterion	-20.57249
Log likelihood	3063.556	Hannan-Quinn criter.	-20.59487
F-statistic	6.719351	Durbin-Watson stat	2.182558
Prob(F-statistic)	0.001401		

Null Hypothesis: VDLM2 has a unit root
Exogenous: Constant
Bandwidth: 7 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.739278	0.4104
Test critical values:	1% level	-3.452215	
	5% level	-2.871061	
	10% level	-2.571915	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.65E-11
HAC corrected variance (Bartlett kernel)	3.05E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLM2)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLM2(-1)	-0.011824	0.006849	-1.726464	0.0853
C	1.28E-06	1.33E-06	0.960267	0.3377

R-squared	0.010003	Mean dependent var	-8.68E-07
Adjusted R-squared	0.006647	S.D. dependent var	8.21E-06
S.E. of regression	8.18E-06	Akaike info criterion	-20.58189
Sum squared resid	1.98E-08	Schwarz criterion	-20.55702
Log likelihood	3058.411	Hannan-Quinn criter.	-20.57194
F-statistic	2.980677	Durbin-Watson stat	2.253964
Prob(F-statistic)	0.085311		

Null Hypothesis: D(VDLM2) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 13 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-21.54431	0.0000
Test critical values:	1% level	-3.989365	
	5% level	-3.425080	
	10% level	-3.135645	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.61E-11
HAC corrected variance (Bartlett kernel)	3.36E-11

Phillips-Perron Test Equation
Dependent Variable: D(VDLM2,2)
Method: Least Squares
Sample (adjusted): 1991M05 2015M12
Included observations: 296 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VDLM2(-1))	-1.131511	0.057868	-19.55326	0.0000
C	-1.68E-06	9.70E-07	-1.734173	0.0839
@TREND("1991M01")	4.50E-09	5.56E-09	0.809459	0.4189

R-squared	0.566143	Mean dependent var	-1.06E-08
Adjusted R-squared	0.563182	S.D. dependent var	1.24E-05
S.E. of regression	8.17E-06	Akaike info criterion	-20.58223
Sum squared resid	1.96E-08	Schwarz criterion	-20.54483
Log likelihood	3049.171	Hannan-Quinn criter.	-20.56726
F-statistic	191.1689	Durbin-Watson stat	2.050594
Prob(F-statistic)	0.000000		

Null Hypothesis: VDLGDPRICE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-21.05608	0.0000
Test critical values:	1% level	-3.989153	
	5% level	-3.424977	
	10% level	-3.135584	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.50E-07
HAC corrected variance (Bartlett kernel)	8.01E-07

Phillips-Perron Test Equation
Dependent Variable: D(VDLGDPRICE)
Method: Least Squares
Date: 05/16/17 Time: 23:48
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLGDPRICE(-1)	-1.209761	0.057106	-21.18459	0.0000
C	0.002249	0.000147	15.32249	0.0000
@TREND("1991M01")	8.65E-07	5.88E-07	1.472488	0.1420

R-squared	0.603387	Mean dependent var	-4.35E-06
Adjusted R-squared	0.600698	S.D. dependent var	0.001377
S.E. of regression	0.000870	Akaike info criterion	-11.24525
Sum squared resid	0.000223	Schwarz criterion	-11.20803
Log likelihood	1678.543	Hannan-Quinn criter.	-11.23035
F-statistic	224.3992	Durbin-Watson stat	2.012405
Prob(F-statistic)	0.000000		

Appendix S: ARDL Cointegration Test on Conditional Variances

S 1 ARDL Specification

Dependent Variable: VDLDSEGEN
Method: ARDL
Date: 05/17/17 Time: 23:09
Sample (adjusted): 1991M03 2015M12
Included observations: 298 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (7 lags, automatic): VDLIPI VDLINT VDLCPI VDLEXR VDLM2 VDLGDPRICE
Fixed regressors: C
Number of models evalulated: 262144
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
VDLDSEGEN(-1)	0.713286	0.040995	17.39933	0.0000
VDLIPI	0.924827	5.305521	0.174314	0.8617
VDLINT	-7.816845	15.89235	-0.491862	0.6232
VDLCPI	15.89025	12.45191	1.276130	0.2029
VDLEXR	1.403074	4.098828	0.342311	0.7324
VDLM2	-1.171358	7.787796	-0.150409	0.8805
VDLGDPRICE	-0.024549	0.477847	-0.051374	0.9591
C	-0.003254	0.025475	-0.127747	0.8984

R-squared	0.524420	Mean dependent var	0.008187
Adjusted R-squared	0.512940	S.D. dependent var	0.010412
S.E. of regression	0.007267	Akaike info criterion	-6.984531
Sum squared resid	0.015314	Schwarz criterion	-6.885280
Log likelihood	1048.695	Hannan-Quinn criter.	-6.944802
F-statistic	45.68310	Durbin-Watson stat	2.027215
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

S 2 ARDL Bounds Test

Date: 05/17/17 Time: 23:11
Sample: 1991M03 2015M12
Included observations: 297
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	7.224021	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Test Equation:
Dependent Variable: D(VDLDSEGEN)
Method: Least Squares
Sample (adjusted): 1991M04 2015M12
Included observations: 297 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002818	0.025439	0.110783	0.9119
VDLIPI(-1)	-0.246808	5.299682	-0.046570	0.9629
VDLINT(-1)	-9.592341	15.91407	-0.602758	0.5471
VDLCPI(-1)	17.51679	12.48700	1.402802	0.1617
VDLEXR(-1)	2.337657	4.099440	0.570238	0.5690
VDLM2(-1)	-1.435653	7.814228	-0.183723	0.8544
VDLGDPRICE(-1)	-0.281585	0.479318	-0.587469	0.5573
VDLDSEGEN(-1)	-0.289917	0.041086	-7.056335	0.0000

R-squared	0.148919	Mean dependent var	3.76E-06
Adjusted R-squared	0.128305	S.D. dependent var	0.007784
S.E. of regression	0.007268	Akaike info criterion	-6.984202
Sum squared resid	0.015265	Schwarz criterion	-6.884708
Log likelihood	1045.154	Hannan-Quinn criter.	-6.944371
F-statistic	7.224021	Durbin-Watson stat	2.023549
Prob(F-statistic)	0.000000		

S 3 ARDL Cointegrating And Long Run Form

Dependent Variable: VDLDSEGEN
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Sample: 1991M01 2015M12
Included observations: 298

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VDLIPI)	16.135613	14.131200	1.141843	0.2545
D(VDLINT)	-2.48628	24.056873	-0.103281	0.9178
D(VDLCPI)	-15.072055	54.000051	-0.279112	0.7804
D(VDLEXR)	-0.532310	5.311329	-0.100222	0.9202
D(VDLM2)	-22.834335	52.871271	-0.412972	0.6799
D(VDLGDPRICE)	0.093041	0.307158	0.302909	0.7622
C	-0.003274	0.000630	-5.198610	0.0000
CointEq(-1)	-0.291091	0.040919	-7.113874	0.0000

Cointeq = VDLDSEGEN - (3.2256*VDLIPI - 27.2636*VDLINT + 55.4220 *VDLCPI + 4.8936*VDLEXR - 4.0855*VDLM2 - 0.0856*VDLGDPRICE)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLIPI	3.225608	18.540106	0.173980	0.8620
VDLINT	-27.263562	55.472937	-0.491475	0.6235
VDLCPI	55.421955	43.320414	1.279350	0.2018
VDLEXR	4.893638	14.317226	0.341801	0.7327
VDLM2	-4.085459	27.190930	-0.150251	0.8807
VDLGDPRICE	-0.085621	1.666623	-0.051374	0.9591

S 4 Viability Check of the Model

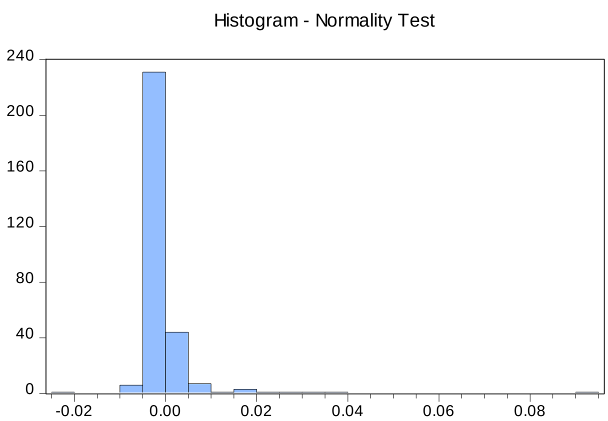
S 4.1 Correlogram Test

Sample: 1991M01 2015M12
Included observations: 298
Q-statistic probabilities adjusted for 1 dynamic regressor

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob*</th></tr>
<tr><td>.|. |</td><td>.|. |</td><td>1</td><td>-0.013</td><td>-0.013</td><td>0.0547</td><td>0.815</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>0.028</td><td>0.028</td><td>0.2968</td><td>0.862</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>3</td><td>-0.011</td><td>-0.011</td><td>0.3369</td><td>0.953</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>4</td><td>-0.084</td><td>-0.085</td><td>2.4804</td><td>0.648</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>5</td><td>0.073</td><td>0.072</td><td>4.0882</td><td>0.537</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>6</td><td>-0.012</td><td>-0.006</td><td>4.1315</td><td>0.659</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>7</td><td>0.066</td><td>0.061</td><td>5.4825</td><td>0.601</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>-0.018</td><td>-0.022</td><td>5.5851</td><td>0.694</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>9</td><td>-0.031</td><td>-0.024</td><td>5.8852</td><td>0.751</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>10</td><td>-0.011</td><td>-0.016</td><td>5.9214</td><td>0.822</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>0.008</td><td>0.021</td><td>5.9413</td><td>0.877</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>12</td><td>-0.014</td><td>-0.027</td><td>6.0047</td><td>0.916</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>-0.017</td><td>-0.019</td><td>6.0922</td><td>0.943</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>-0.051</td><td>-0.053</td><td>6.9019</td><td>0.938</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>-0.017</td><td>-0.010</td><td>6.9894</td><td>0.958</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>16</td><td>0.003</td><td>0.003</td><td>6.9919</td><td>0.973</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>17</td><td>-0.032</td><td>-0.032</td><td>7.3185</td><td>0.979</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>18</td><td>-0.034</td><td>-0.046</td><td>7.6972</td><td>0.983</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>19</td><td>0.013</td><td>0.022</td><td>7.7534</td><td>0.989</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>20</td><td>-0.025</td><td>-0.020</td><td>7.9530</td><td>0.992</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>21</td><td>0.004</td><td>0.002</td><td>7.9590</td><td>0.995</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>22</td><td>-0.032</td><td>-0.036</td><td>8.2965</td><td>0.996</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>23</td><td>-0.015</td><td>-0.013</td><td>8.3710</td><td>0.998</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>24</td><td>-0.034</td><td>-0.038</td><td>8.7429</td><td>0.998</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>25</td><td>-0.044</td><td>-0.037</td><td>9.3738</td><td>0.998</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>26</td><td>-0.026</td><td>-0.041</td><td>9.5909</td><td>0.999</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>27</td><td>-0.042</td><td>-0.042</td><td>10.166</td><td>0.999</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>28</td><td>-0.037</td><td>-0.048</td><td>10.619</td><td>0.999</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>29</td><td>-0.067</td><td>-0.069</td><td>12.099</td><td>0.998</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>30</td><td>0.025</td><td>0.020</td><td>12.313</td><td>0.998</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>31</td><td>0.138</td><td>0.140</td><td>18.688</td><td>0.960</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>32</td><td>-0.029</td><td>-0.035</td><td>18.961</td><td>0.967</td></tr>
<tr><td>.|** |</td><td>.|** |</td><td>33</td><td>0.234</td><td>0.235</td><td>37.363</td><td>0.275</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>34</td><td>-0.091</td><td>-0.082</td><td>40.163</td><td>0.216</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>35</td><td>-0.028</td><td>-0.019</td><td>40.439</td><td>0.243</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>36</td><td>0.001</td><td>-0.020</td><td>40.440</td><td>0.281</td></tr>
</table>

*Probabilities may not be valid for this equation specification.

S 4.2 Normality Test of the Residuals



Series: Residuals
Sample 1991M03 2015M12
Observations 298

Mean	-8.89e-07
Median	-0.001054
Maximum	0.094295
Minimum	-0.023050
Std. Dev.	0.007181
Skewness	8.641348
Kurtosis	105.5646
Jarque-Bera	134325.7
Probability	0.000000

S 4.3 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.152706	Prob. F(2,289)	0.8585
Obs*R-squared	0.314591	Prob. Chi-Square(2)	0.8545

Test Equation:
Dependent Variable: RESID
Method: ARDL
Sample: 1991M03 2015M12
Included observations: 298
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VDLDSEGEN(-1)	-0.012223	0.079449	-0.153850	0.8778
VDLIPI	0.009479	0.364543	0.026002	0.9793
VDLINT	-0.199948	15.90926	-0.012568	0.9900
VDLCPI	0.612239	12.77763	0.047915	0.9618
VDLEXR	0.037824	4.072178	0.009288	0.9926
VDLM2	-0.004597	7.444628	-0.000617	0.9995
VDLGDPRICE	0.001027	0.478387	0.002146	0.9983
RESID(-1)	-0.000740	0.099525	-0.007440	0.9941
RESID(-2)	0.036930	0.081907	0.450871	0.6524

R-squared	0.001056	Mean dependent var	-8.89E-07
Adjusted R-squared	-0.026597	S.D. dependent var	0.007181
S.E. of regression	0.007276	Akaike info criterion	-6.978819
Sum squared resid	0.015298	Schwarz criterion	-6.867162
Log likelihood	1048.844	Hannan-Quinn criter.	-6.934124
Durbin-Watson stat	1.999454		

S 4.4 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.584461	Prob. F(7,290)	0.0134
Obs*R-squared	17.49867	Prob. Chi-Square(7)	0.0144
Scaled explained SS	872.3588	Prob. Chi-Square(7)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1991M03 2015M12
Included observations: 298

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000359	0.001812	-0.197906	0.8433
VDLDSEGEN(-1)	0.011410	0.002916	3.913297	0.0001
VDLIPI	0.047311	0.377335	0.125383	0.9003
VDLINT	-0.049148	1.130284	-0.043483	0.9653
VDLCPI	0.596268	0.885595	0.673296	0.5013
VDLEXR	-0.017837	0.291514	-0.061189	0.9513
VDLM2	0.192560	0.553878	0.347658	0.7283
VDLGDPRICE	0.002340	0.033985	0.068859	0.9451

R-squared	0.058720	Mean dependent var	5.14E-05
Adjusted R-squared	0.036000	S.D. dependent var	0.000526
S.E. of regression	0.000517	Akaike info criterion	-12.27127
Sum squared resid	7.75E-05	Schwarz criterion	-12.17202
Log likelihood	1836.419	Hannan-Quinn criter.	-12.23154
F-statistic	2.584461	Durbin-Watson stat	1.997268
Prob(F-statistic)	0.013402		

Appendix T: Ordinary Least Squares Estimation of the Recovery Period

T 1 OLS Estimation

Dependent Variable: DLDSEGEN
Method: Least Squares
Date: 07/01/17 Time: 17:02
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLIPI	-0.125198	0.099959	-1.252485	0.2130
DLINT	-1.215100	3.062936	-0.396711	0.6923
DLCPI	-0.254598	0.719302	-0.353951	0.7240
DLEXR	0.276833	0.575249	0.481241	0.6313
DLM2	1.612529	0.441278	3.654222	0.0004
DLGDPRICE	-0.046181	0.100706	-0.458569	0.6474
C	-0.003141	0.008846	-0.355060	0.7232

R-squared	0.109098	Mean dependent var	0.016206
Adjusted R-squared	0.061794	S.D. dependent var	0.065863
S.E. of regression	0.063795	Akaike info criterion	-2.609710
Sum squared resid	0.459893	Schwarz criterion	-2.447106
Log likelihood	163.5826	Hannan-Quinn criter.	-2.543676
F-statistic	2.306298	Durbin-Watson stat	1.735739
Prob(F-statistic)	0.038779		

T 2 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.041505	Prob. F(2,111)	0.3563
Obs*R-squared	2.210421	Prob. Chi-Square(2)	0.3311

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLIPI	-0.002004	0.100032	-0.020036	0.9841
DLINT	0.295062	3.075309	0.095945	0.9237
DLCPI	-0.200058	0.732455	-0.273134	0.7853
DLEXR	-0.012221	0.575104	-0.021250	0.9831
DLM2	-0.057935	0.443608	-0.130599	0.8963
DLGDPRICE	-0.009670	0.100923	-0.095812	0.9238
C	0.001951	0.008945	0.218091	0.8278
RESID(-1)	0.137217	0.097533	1.406875	0.1623
RESID(-2)	0.014975	0.100536	0.148953	0.8819

R-squared	0.018420	Mean dependent var	-1.82E-18
Adjusted R-squared	-0.052324	S.D. dependent var	0.062166
S.E. of regression	0.063772	Akaike info criterion	-2.594969
Sum squared resid	0.451421	Schwarz criterion	-2.385907
Log likelihood	164.6981	Hannan-Quinn criter.	-2.510068
F-statistic	0.260376	Durbin-Watson stat	2.001235
Prob(F-statistic)	0.977145		

T 3 Heteroskedasticity Test: ARCH

F-statistic	0.279730	Prob. F(1,117)	0.5979
Obs*R-squared	0.283833	Prob. Chi-Square(1)	0.5942

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/01/17 Time: 17:03
Sample (adjusted): 2000M02 2009M12
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004049	0.000759	5.333480	0.0000
RESID^2(-1)	-0.048839	0.092341	-0.528895	0.5979

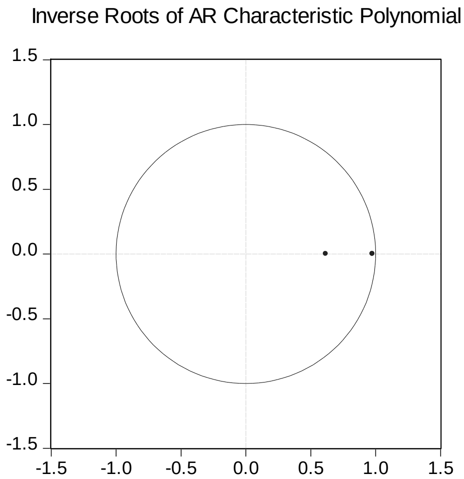
R-squared	0.002385	Mean dependent var	0.003861
Adjusted R-squared	-0.006141	S.D. dependent var	0.007290
S.E. of regression	0.007312	Akaike info criterion	-6.981930
Sum squared resid	0.006255	Schwarz criterion	-6.935222
Log likelihood	417.4249	Hannan-Quinn criter.	-6.962964
F-statistic	0.279730	Durbin-Watson stat	2.010636
Prob(F-statistic)	0.597881		

Appendix U: Optimal Lag Selection for Johansen Cointegration Test

Roots of Characteristic Polynomial
Endogenous variables: LDSEGEN LIPI
Exogenous variables: C @TREND
Lag specification: 1 1
Date: 07/08/17 Time: 16:24

Root	Modulus
0.976398	0.976398
0.617370	0.617370

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: LDSEGEN LIPI
Exogenous variables: C @TREND
Date: 07/08/17 Time: 16:06
Sample: 1991M01 2015M12
Included observations: 285

Lag	LogL	LR	FPE	AIC	SC	HQ
0	155.2097	NA	0.001186	-1.061120	-1.009857	-1.040570
1	654.3512	984.2721	3.67e-05	-4.535798	-4.433272*	-4.494698
2	658.9799	9.062374	3.66e-05	-4.540210	-4.386421	-4.478559
3	659.8802	1.750209	3.74e-05	-4.518458	-4.313406	-4.436258
4	666.3875	12.55788	3.67e-05	-4.536053	-4.279738	-4.433302
5	687.4122	40.27883	3.26e-05	-4.655524	-4.347946	-4.532224
6	695.0856	14.59301	3.18e-05	-4.681303	-4.322462	-4.537452
7	696.8234	3.280454	3.23e-05	-4.665427	-4.255323	-4.501027
8	700.3828	6.669095	3.24e-05	-4.662335	-4.200968	-4.477385
9	702.7868	4.470771	3.28e-05	-4.651136	-4.138506	-4.445635
10	704.5692	3.289591	3.33e-05	-4.635574	-4.071680	-4.409523
11	716.9298	22.63939	3.14e-05	-4.694244	-4.079088	-4.447644
12	742.1217	45.78736	2.71e-05	-4.842959	-4.176540	-4.575808*
13	745.9013	6.816454	2.71e-05	-4.841412	-4.123730	-4.553711
14	753.8888	14.29354*	2.64e-05*	-4.869395*	-4.100450	-4.561144
15	757.7106	6.785423	2.64e-05	-4.868145	-4.047937	-4.539344

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix V: Relationship between Stock Market and the Real Economy in Total Sample Period

V 1 Johansen Cointegration

Roots of Characteristic Polynomial
Sample (adjusted): 1992M04 2015M12
Included observations: 285 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LDSEGEN LIPI
Lags interval (in first differences): 1 to 14
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.036224	13.13324	25.87211	0.7278
At most 1	0.009143	2.617633	12.51798	0.9185

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.036224	10.51561	19.38704	0.5639
At most 1	0.009143	2.617633	12.51798	0.9185

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LDSEGEN	LIPI	@TREND(91M02)
3.566965	-13.41267	0.051911
-0.416523	-6.864691	0.056206

Unrestricted Adjustment Coefficients (alpha):

D(LDSEGEN)	-0.016807	-0.000320
D(LIPI)	-0.000402	0.004536

1 Cointegrating Equation(s): Log likelihood 756.4018

Normalized cointegrating coefficients (standard error in parentheses)

LDSEGEN	LIPI	@TREND(91M02)
1.000000	-3.760247	0.014553
	(1.57278)	(0.00965)

Adjustment coefficients (standard error in parentheses)

D(LDSEGEN)	-0.059952
	(0.01938)
D(LIPI)	-0.001433
	(0.01061)

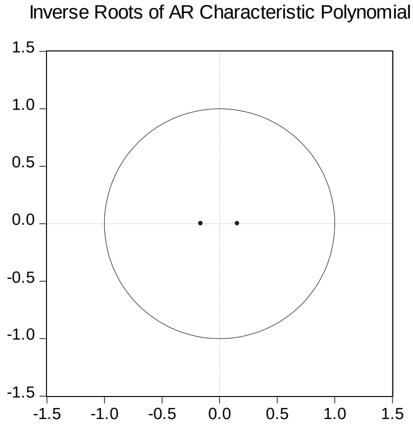
V 2 Restricted VAR Model

V 2.1 Lag Length Selection for VAR Model

Roots of Characteristic Polynomial
Endogenous variables: DLDSEGEN DLIPI
Exogenous variables: C
Lag specification: 1 1
Date: 07/08/17 Time: 16:07

Root	Modulus
-0.161166	0.161166
0.155556	0.155556

No root lies outside the unit circle.
VAR satisfies the stability condition.



VAR Lag Order Selection Criteria
Endogenous variables: DLDSEGEN DLIPI
Exogenous variables: C
Date: 07/08/17 Time: 16:08
Sample: 1991M01 2015M12
Included observations: 285

Lag	LogL	LR	FPE	AIC	SC	HQ
0	622.3304	NA	4.41e-05	-4.353196	-4.327564	-4.342921
1	630.6209	16.40642	4.28e-05	-4.383304	-4.306410	-4.352479
2	637.1760	12.88030	4.20e-05	-4.401235	-4.273078	-4.349860
3	650.1359	25.28305	3.95e-05	-4.464111	-4.284691	-4.392186
4	675.1575	48.46288	3.41e-05	-4.611631	-4.380948*	-4.519156
5	684.9787	18.88435	3.27e-05	-4.652482	-4.370536	-4.539457
6	686.5574	3.013309	3.33e-05	-4.635490	-4.302281	-4.501915
7	689.2629	5.126362	3.36e-05	-4.626407	-4.241934	-4.472281
8	691.7705	4.715977	3.39e-05	-4.615933	-4.180198	-4.441258
9	694.8618	5.770340	3.41e-05	-4.609556	-4.122558	-4.414331
10	709.8526	27.77259	3.16e-05	-4.686685	-4.148424	-4.470910
11	735.5104	47.17422	2.72e-05	-4.838669	-4.249145	-4.602344*
12	739.4461	7.180916	2.72e-05	-4.838218	-4.197430	-4.581342
13	747.5106	14.60098*	2.64e-05*	-4.866741*	-4.174690	-4.589315
14	751.1440	6.527474	2.65e-05	-4.864169	-4.120855	-4.566193

* indicates lag order selected by the criterion

V 2.2 Vector Autoregression Estimates

Date: 07/08/17 Time: 16:09
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DLDSEGEN	DLIPI
DLDSEGEN(-1)	0.155652	-0.000639
	(0.06209)	(0.03339)
	[2.50685]	[-0.01914]
DLDSEGEN(-2)	0.030253	-0.018066
	(0.06271)	(0.03372)
	[0.48245]	[-0.53574]

DLDSEGEN(-3)	0.077205	0.019588
	(0.06271)	(0.03372)
	[1.23109]	[0.58083]
DLDSEGEN(-4)	0.033236	-0.094637
	(0.06276)	(0.03375)
	[0.52956]	[-2.80406]
DLDSEGEN(-5)	-0.078799	-0.045347
	(0.06363)	(0.03422)
	[-1.23841]	[-1.32528]
DLDSEGEN(-6)	-0.081133	-0.040425
	(0.06399)	(0.03441)
	[-1.26795]	[-1.17480]
DLDSEGEN(-7)	0.075602	0.030088
	(0.06398)	(0.03441)
	[1.18165]	[0.87450]
DLDSEGEN(-8)	0.035892	-0.019751
	(0.06417)	(0.03451)
	[0.55936]	[-0.57239]
DLDSEGEN(-9)	0.015697	0.049890
	(0.06444)	(0.03465)
	[0.24359]	[1.43971]
DLDSEGEN(-10)	-0.029318	0.058148
	(0.06452)	(0.03470)
	[-0.45441]	[1.67597]
DLDSEGEN(-11)	0.005861	0.040737
	(0.06465)	(0.03477)
	[0.09066]	[1.17172]
DLDSEGEN(-12)	-0.012568	0.019988
	(0.06480)	(0.03485)
	[-0.19394]	[0.57357]
DLDSEGEN(-13)	-0.038789	0.116284
	(0.06445)	(0.03466)
	[-0.60181]	[3.35492]
DLIPI(-1)	0.088882	-0.620268
	(0.11276)	(0.06064)
	[0.78822]	[-10.2289]
DLIPI(-2)	0.090770	-0.548189
	(0.13021)	(0.07002)
	[0.69711]	[-7.82898]
DLIPI(-3)	0.046558	-0.558591
	(0.13924)	(0.07488)
	[0.33438]	[-7.46018]
DLIPI(-4)	0.046780	-0.536849
	(0.14393)	(0.07740)
	[0.32501]	[-6.93601]

DLIPI(-5)	0.162049	-0.363464
	(0.14796)	(0.07957)
	[1.09522]	[-4.56804]
DLIPI(-6)	0.108403	-0.264324
	(0.14529)	(0.07813)
	[0.74612]	[-3.38313]
DLIPI(-7)	-0.022395	-0.266721
	(0.14061)	(0.07562)
	[-0.15927]	[-3.52734]
DLIPI(-8)	-0.021916	-0.315238
	(0.13897)	(0.07473)
	[-0.15770]	[-4.21816]
DLIPI(-9)	0.010359	-0.239391
	(0.13905)	(0.07477)
	[0.07450]	[-3.20154]
DLIPI(-10)	0.081960	-0.319618
	(0.13333)	(0.07170)
	[0.61471]	[-4.45770]
DLIPI(-11)	-0.064165	-0.244722
	(0.12889)	(0.06931)
	[-0.49783]	[-3.53074]
DLIPI(-12)	0.081281	0.195950
	(0.12249)	(0.06587)
	[0.66356]	[2.97477]
DLIPI(-13)	-0.042095	0.107503
	(0.10927)	(0.05876)
	[-0.38522]	[1.82942]
C	0.004174	0.031547
	(0.01014)	(0.00545)
	[0.41147]	[5.78327]
R-squared	0.081163	0.547971
Adj. R-squared	-0.011075	0.502594
Sum sq. resids	2.253675	0.651724
S.E. equation	0.093282	0.050163
F-statistic	0.879932	12.07587
Log likelihood	286.7940	464.2136
Akaike AIC	-1.816741	-3.057438
Schwarz SC	-1.471595	-2.712292
Mean dependent	0.009678	0.006673
S.D. dependent	0.092769	0.071126

Determinant resid covariance (dof adj.)	2.19E-05
Determinant resid covariance	1.80E-05
Log likelihood	751.0134
Akaike information criterion	-4.874220
Schwarz criterion	-4.183928

Dependent Variable: DLDSEGEN
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/08/17 Time: 16:09
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
DLDSEGEN = C(1)*DLDSEGEN(-1) + C(2)*DLDSEGEN(-2) + C(3)
*DLDSEGEN(-3) + C(4)*DLDSEGEN(-4) + C(5)*DLDSEGEN(-5) + C(6)
*DLDSEGEN(-6) + C(7)*DLDSEGEN(-7) + C(8)*DLDSEGEN(-8) + C(9)
*DLDSEGEN(-9) + C(10)*DLDSEGEN(-10) + C(11)*DLDSEGEN(-11) +
C(12)*DLDSEGEN(-12) + C(13)*DLDSEGEN(-13) + C(14)*DLIPI(-1) +
C(15)*DLIPI(-2) + C(16)*DLIPI(-3) + C(17)*DLIPI(-4) + C(18)*DLIPI(-5)
+ C(19)*DLIPI(-6) + C(20)*DLIPI(-7) + C(21)*DLIPI(-8) + C(22)*DLIPI(
-9) + C(23)*DLIPI(-10) + C(24)*DLIPI(-11) + C(25)*DLIPI(-12) + C(26)
*DLIPI(-13) + C(27)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.155652	0.062091	2.506854	0.0128
C(2)	0.030253	0.062707	0.482455	0.6299
C(3)	0.077205	0.062713	1.231094	0.2194
C(4)	0.033236	0.062761	0.529561	0.5969
C(5)	-0.078799	0.063629	-1.238407	0.2167
C(6)	-0.081133	0.063988	-1.267949	0.2060
C(7)	0.075602	0.063980	1.181653	0.2384
C(8)	0.035892	0.064166	0.559364	0.5764
C(9)	0.015697	0.064439	0.243587	0.8077
C(10)	-0.029318	0.064519	-0.454407	0.6499
C(11)	0.005861	0.064652	0.090661	0.9278
C(12)	-0.012568	0.064802	-0.193942	0.8464
C(13)	-0.038789	0.064454	-0.601810	0.5478
C(14)	0.088882	0.112762	0.788221	0.4313
C(15)	0.090770	0.130208	0.697114	0.4864
C(16)	0.046558	0.139238	0.334378	0.7384
C(17)	0.046780	0.143932	0.325013	0.7454
C(18)	0.162049	0.147960	1.095222	0.2744
C(19)	0.108403	0.145289	0.746121	0.4563
C(20)	-0.022395	0.140612	-0.159271	0.8736
C(21)	-0.021916	0.138973	-0.157699	0.8748
C(22)	0.010359	0.139047	0.074502	0.9407
C(23)	0.081960	0.133332	0.614709	0.5393
C(24)	-0.064165	0.128891	-0.497827	0.6190
C(25)	0.081281	0.122491	0.663564	0.5076
C(26)	-0.042095	0.109275	-0.385220	0.7004
C(27)	0.004174	0.010144	0.411469	0.6811

R-squared	0.081163	Mean dependent var	0.009678
Adjusted R-squared	-0.011075	S.D. dependent var	0.092769
S.E. of regression	0.093282	Akaike info criterion	-1.816741
Sum squared resid	2.253675	Schwarz criterion	-1.471595
Log likelihood	286.7940	Hannan-Quinn criter.	-1.678396
F-statistic	0.879932	Durbin-Watson stat	2.006672
Prob(F-statistic)	0.637275		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.524706	(13, 259)	0.9085
Chi-square	6.821183	13	0.9111

Null Hypothesis: C(14)=C(15)=C(16)=C(17)=C(18)=C(19)=
C(20)=C(21)= C(22)=C(23)=C(24)=C(25)=C(26)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	0.088882	0.112762
C(15)	0.090770	0.130208
C(16)	0.046558	0.139238
C(17)	0.046780	0.143932
C(18)	0.162049	0.147960
C(19)	0.108403	0.145289
C(20)	-0.022395	0.140612
C(21)	-0.021916	0.138973
C(22)	0.010359	0.139047
C(23)	0.081960	0.133332
C(24)	-0.064165	0.128891
C(25)	0.081281	0.122491
C(26)	-0.042095	0.109275

Restrictions are linear in coefficients.

Dependent Variable: DLIPI
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/08/17 Time: 16:32
Sample (adjusted): 1992M03 2015M12
Included observations: 286 after adjustments
DLIPI = C(28)*DLDSEGEN(-1) + C(29)*DLDSEGEN(-2) + C(30)
*DLDSEGEN(-3) + C(31)*DLDSEGEN(-4) + C(32)*DLDSEGEN(-5) +
C(33)*DLDSEGEN(-6) + C(34)*DLDSEGEN(-7) + C(35)*DLDSEGEN(
-8) + C(36)*DLDSEGEN(-9) + C(37)*DLDSEGEN(-10) + C(38)
*DLDSEGEN(-11) + C(39)*DLDSEGEN(-12) + C(40)*DLDSEGEN(-13)
+ C(41)*DLIPI(-1) + C(42)*DLIPI(-2) + C(43)*DLIPI(-3) + C(44)*DLIPI(
-4) + C(45)*DLIPI(-5) + C(46)*DLIPI(-6) + C(47)*DLIPI(-7) + C(48)
*DLIPI(-8) + C(49)*DLIPI(-9) + C(50)*DLIPI(-10) + C(51)*DLIPI(-11) +
C(52)*DLIPI(-12) + C(53)*DLIPI(-13) + C(54)

	Coefficient	Std. Error	t-Statistic	Prob.
C(28)	-0.000639	0.033390	-0.019140	0.9847
C(29)	-0.018066	0.033721	-0.535735	0.5926
C(30)	0.019588	0.033724	0.580829	0.5619
C(31)	-0.094637	0.033750	-2.804058	0.0054
C(32)	-0.045347	0.034217	-1.325285	0.1862
C(33)	-0.040425	0.034410	-1.174798	0.2412
C(34)	0.030088	0.034406	0.874497	0.3827
C(35)	-0.019751	0.034506	-0.572391	0.5676
C(36)	0.049890	0.034653	1.439708	0.1512
C(37)	0.058148	0.034695	1.675968	0.0950
C(38)	0.040737	0.034767	1.171716	0.2424
C(39)	0.019988	0.034848	0.573575	0.5668
C(40)	0.116284	0.034661	3.354918	0.0009
C(41)	-0.620268	0.060639	-10.22891	0.0000
C(42)	-0.548189	0.070021	-7.828984	0.0000
C(43)	-0.558591	0.074876	-7.460181	0.0000
C(44)	-0.536849	0.077400	-6.936012	0.0000
C(45)	-0.363464	0.079567	-4.568044	0.0000
C(46)	-0.264324	0.078130	-3.383129	0.0008
C(47)	-0.266721	0.075615	-3.527344	0.0005
C(48)	-0.315238	0.074733	-4.218163	0.0000
C(49)	-0.239391	0.074774	-3.201540	0.0015
C(50)	-0.319618	0.071700	-4.457703	0.0000
C(51)	-0.244722	0.069312	-3.530736	0.0005
C(52)	0.195950	0.065871	2.974771	0.0032

C(53)	0.107503	0.058763	1.829421	0.0685
C(54)	0.031547	0.005455	5.783270	0.0000

R-squared	0.547971	Mean dependent var	0.006673
Adjusted R-squared	0.502594	S.D. dependent var	0.071126
S.E. of regression	0.050163	Akaike info criterion	-3.057438
Sum squared resid	0.651724	Schwarz criterion	-2.712292
Log likelihood	464.2136	Hannan-Quinn criter.	-2.919093
F-statistic	12.07587	Durbin-Watson stat	2.037499
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.829480	(13, 259)	0.0008
Chi-square	36.78324	13	0.0004

Null Hypothesis: C(28)=C(29)=C(30)=C(31)=C(32)=C(33)=
C(34)=C(35)=C(36)=C(37)=C(38)=C(39)=C(40)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(28)	-0.000639	0.033390
C(29)	-0.018066	0.033721
C(30)	0.019588	0.033724
C(31)	-0.094637	0.033750
C(32)	-0.045347	0.034217
C(33)	-0.040425	0.034410
C(34)	0.030088	0.034406
C(35)	-0.019751	0.034506
C(36)	0.049890	0.034653
C(37)	0.058148	0.034695
C(38)	0.040737	0.034767
C(39)	0.019988	0.034848
C(40)	0.116284	0.034661

Restrictions are linear in coefficients.

V 2.3 Pairwise Granger Causality Tests

Date: 07/08/17 Time: 20:45
Sample: 1991M01 2015M12
Lags: 12

Null Hypothesis:	Obs	F-Statistic	Prob.
LIPI does not Granger Cause LDSEGEN	288	0.97146	0.4765
LDSEGEN does not Granger Cause LIPI		2.09862	0.0174

V 3 ARDL Approach

V 3.1 ARDL Cointegration Test

Dependent Variable: LDSEGEN
Method: ARDL
Sample (adjusted): 1991M07 2015M12
Included observations: 294 after adjustments

Dependent lags: 2 (Fixed)
Dynamic regressors (6 lags, fixed): LIPI
Fixed regressors: C @TREND

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	1.142448	0.058338	19.58313	0.0000
LDSEGEN(-2)	-0.177291	0.058334	-3.039230	0.0026
LIPI	0.022446	0.089763	0.250060	0.8027
LIPI(-1)	0.068199	0.100686	0.677343	0.4987
LIPI(-2)	-0.014001	0.098824	-0.141680	0.8874
LIPI(-3)	-0.022366	0.098894	-0.226158	0.8212
LIPI(-4)	0.023801	0.098717	0.241104	0.8096
LIPI(-5)	0.125166	0.100669	1.243344	0.2148
LIPI(-6)	-0.107512	0.090335	-1.190146	0.2350
C	-0.261960	0.403214	-0.649680	0.5164
@TREND	-0.000299	0.000537	-0.556199	0.5785

R-squared	0.989610	Mean dependent var	6.100455
Adjusted R-squared	0.989243	S.D. dependent var	0.874036
S.E. of regression	0.090654	Akaike info criterion	-1.926847
Sum squared resid	2.325711	Schwarz criterion	-1.789026
Log likelihood	294.2465	Hannan-Quinn criter.	-1.871654
F-statistic	2695.385	Durbin-Watson stat	2.024204
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

V 3.2 ARDL Bounds Test

Date: 12/06/17 Time: 10:48
Sample: 1991M07 2015M12
Included observations: 294
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	1.992034	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 1991M07 2015M12
Included observations: 294

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.177291	0.058334	3.039230	0.0026
D(LIPI)	0.022446	0.089763	0.250060	0.8027
D(LIPI(-1))	-0.005088	0.118513	-0.042934	0.9658
D(LIPI(-2))	-0.019090	0.110985	-0.172002	0.8636
D(LIPI(-3))	-0.041455	0.104302	-0.397456	0.6913
D(LIPI(-4))	-0.017654	0.099352	-0.177693	0.8591
D(LIPI(-5))	0.107512	0.090335	1.190146	0.2350
C	-0.261960	0.403214	-0.649680	0.5164
@TREND	-0.000299	0.000537	-0.556199	0.5785
LIPI(-1)	0.095733	0.094740	1.010482	0.3131
LDSEGEN(-1)	-0.034843	0.014475	-2.407055	0.0167

R-squared	0.054349	Mean dependent var	0.009125
Adjusted R-squared	0.020934	S.D. dependent var	0.091618
S.E. of regression	0.090654	Akaike info criterion	-1.926847
Sum squared resid	2.325711	Schwarz criterion	-1.789026
Log likelihood	294.2465	Hannan-Quinn criter.	-1.871654
F-statistic	1.626468	Durbin-Watson stat	2.024204
Prob(F-statistic)	0.098602		

V 3.3 ARDL Cointegrating And Long Run Form

ARDL Cointegrating And Long Run Form
Dependent Variable: LDSEGEN
Selected Model: ARDL(2, 6)
Date: 12/06/17 Time: 10:48
Sample: 1991M01 2015M12
Included observations: 294

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.177291	0.058084	3.052331	0.0025
D(LIPI)	0.022446	0.088466	0.253725	0.7999
D(LIPI(-1))	-0.005088	0.099909	-0.050929	0.9594
D(LIPI(-2))	-0.019090	0.098587	-0.193632	0.8466
D(LIPI(-3))	-0.041455	0.096982	-0.427454	0.6694
D(LIPI(-4))	-0.017654	0.095649	-0.184573	0.8537
D(LIPI(-5))	0.107512	0.088591	1.213580	0.2259
C	-0.262259	0.109501	-2.395048	0.0173
CointEq(-1)	-0.034843	0.014203	-2.453230	0.0148

Cointeq = LDSEGEN - (2.7476*LIPI -0.0086*@TREND)

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	2.747572	2.392791	1.148271	0.2518
@TREND	-0.008574	0.014834	-0.578032	0.5637

V 3.4 VECM and Significance Test of the Coefficients

Estimation Command:
=========================
LS DLDSEGEN DLDSEGEN(-1) DLIPI DLIPI(-1) DLIPI(-2) DLIPI(-3) DLIPI(-4) DLIPI(-5) C @TREND LIPI(-1) LDSEGEN(-1)
Estimation Equation:
=========================
DLDSEGEN = C(1)*DLDSEGEN(-1) + C(2)*DLIPI + C(3)*DLIPI(-1) + C(4)*DLIPI(-2) + C(5)*DLIPI(-3) + C(6)*DLIPI(-4) + C(7)*DLIPI(-5) + C(8) + C(9)*@TREND + C(10)*LIPI(-1) + C(11)*LDSEGEN(-1)
Substituted Coefficients:
=========================
DLDSEGEN = 0.177291163235*DLDSEGEN(-1) + 0.0224460457385*DLIPI - 0.00508828517343*DLIPI(-1) - 0.0190895973861*DLIPI(-2) - 0.0414553211349*DLIPI(-3) - 0.0176542641602*DLIPI(-4) + 0.107511890654*DLIPI(-5) - 0.261960381682 - 0.000298754664635*@TREND + 0.0957331994438*LIPI(-1) - 0.0348428384748*LDSEGEN(-1)
Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.487973	(6, 283)	0.8172
Chi-square	2.927836	6	0.8178

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.022446	0.089763
C(3)	-0.005088	0.118513
C(4)	-0.019090	0.110985
C(5)	-0.041455	0.104302
C(6)	-0.017654	0.099352
C(7)	0.107512	0.090335

Restrictions are linear in coefficients.

V 3.4 Viability Check of the Model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.267876	Prob. F(2,281)	0.2830
Obs*R-squared	2.629338	Prob. Chi-Square(2)	0.2686

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 1991M07 2015M12
Included observations: 294
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLDSEGEN(-1)	0.990643	0.658544	1.504293	0.1336
DLIPI	-0.000120	0.089705	-0.001338	0.9989
DLIPI(-1)	0.130395	0.148001	0.881042	0.3790
DLIPI(-2)	0.072290	0.121767	0.593676	0.5532
DLIPI(-3)	0.075638	0.116328	0.650214	0.5161
DLIPI(-4)	0.102125	0.120660	0.846383	0.3981
DLIPI(-5)	0.076513	0.103782	0.737249	0.4616
C	0.421472	0.498744	0.845068	0.3988
@TREND	0.000498	0.000638	0.779688	0.4362
LIPI(-1)	-0.138776	0.135309	-1.025627	0.3059
LDSEGEN(-1)	0.041820	0.032558	1.284496	0.2000
RESID(-1)	-1.047336	0.691556	-1.514464	0.1310
RESID(-2)	-0.160771	0.140764	-1.142137	0.2544

R-squared	0.008943	Mean dependent var	-5.40E-17
Adjusted R-squared	-0.033379	S.D. dependent var	0.089093
S.E. of regression	0.090568	Akaike info criterion	-1.922225
Sum squared resid	2.304911	Schwarz criterion	-1.759346
Log likelihood	295.5671	Hannan-Quinn criter.	-1.856997
F-statistic	0.211313	Durbin-Watson stat	2.000752
Prob(F-statistic)	0.997897		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

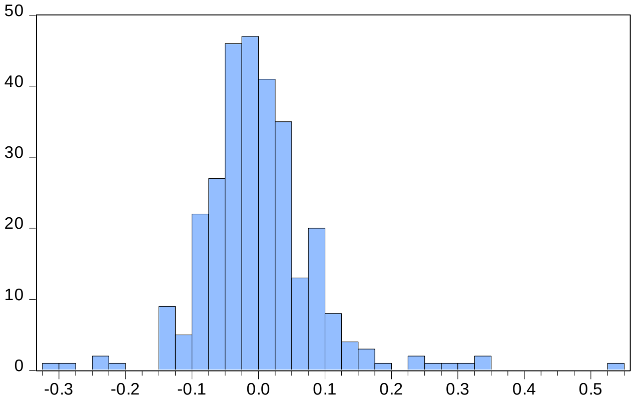
F-statistic	3.645506	Prob. F(10,283)	0.0001
Obs*R-squared	33.55022	Prob. Chi-Square(10)	0.0002
Scaled explained SS	131.5917	Prob. Chi-Square(10)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/17 Time: 11:39
Sample: 1991M07 2015M12
Included observations: 294

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.078953	0.098213	0.803892	0.4221
DLDSEGEN(-1)	0.002477	0.014209	0.174321	0.8617
DLIPI	-0.012051	0.021864	-0.551176	0.5819
DLIPI(-1)	0.008387	0.028867	0.290543	0.7716
DLIPI(-2)	0.013827	0.027033	0.511477	0.6094
DLIPI(-3)	0.006198	0.025405	0.243962	0.8074
DLIPI(-4)	0.021677	0.024200	0.895736	0.3712
DLIPI(-5)	0.006080	0.022003	0.276309	0.7825
@TREND	1.44E-05	0.000131	0.109977	0.9125
LIPI(-1)	-0.034628	0.023076	-1.500569	0.1346
LDSEGEN(-1)	0.019220	0.003526	5.451176	0.0000

R-squared	0.114116	Mean dependent var	0.007911
Adjusted R-squared	0.082813	S.D. dependent var	0.023056
S.E. of regression	0.022081	Akaike info criterion	-4.751498
Sum squared resid	0.137983	Schwarz criterion	-4.613677
Log likelihood	709.4701	Hannan-Quinn criter.	-4.696304
F-statistic	3.645506	Durbin-Watson stat	1.763216
Prob(F-statistic)	0.000137		

Histogram - Normality Test



Series: Residuals	
Sample 1991M07 2015M12	
Observations 294	
Mean	-5.40e-17
Median	-0.008444
Maximum	0.539843
Minimum	-0.309080
Std. Dev.	0.089093
Skewness	1.174181
Kurtosis	9.466127
Jarque-Bera	579.7386
Probability	0.000000

Appendix W: Relationships Between Stock Market and Real Economy in Different Periods

W 1 For Bubble Period

W 1.1 ARDL Cointegration Test

Dependent Variable: LDSEGEN
Method: ARDL
Sample: 1992M03 1996M11
Included observations: 57
Dependent lags: 4 (Fixed)
Dynamic regressors (1 lag, fixed): LIPI
Fixed regressors: C @TREND

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	0.913843	0.153064	5.970311	0.0000
LDSEGEN(-2)	0.272970	0.245606	1.111414	0.2718
LDSEGEN(-3)	-0.054681	0.239361	-0.228447	0.8202
LDSEGEN(-4)	-0.311659	0.203861	-1.528783	0.1327
LIPI	-0.217229	0.284878	-0.762532	0.4494
LIPI(-1)	-0.045634	0.285905	-0.159611	0.8738
C	1.888333	1.434943	1.315964	0.1943
@TREND	0.008923	0.003624	2.461895	0.0174

R-squared	0.969947	Mean dependent var	5.384880
Adjusted R-squared	0.965653	S.D. dependent var	0.606639
S.E. of regression	0.112427	Akaike info criterion	-1.403547
Sum squared resid	0.619356	Schwarz criterion	-1.116803
Log likelihood	48.00110	Hannan-Quinn criter.	-1.292109
F-statistic	225.9200	Durbin-Watson stat	1.990436
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

W 1.2 ARDL Bounds Test

Date: 12/06/17 Time: 11:47
Sample: 1992M03 1996M11
Included observations: 57
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.269957	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Date: 12/06/17 Time: 11:47
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.093370	0.174975	0.533621	0.5960
D(LDSEGEN(-2))	0.366340	0.198813	1.842640	0.0714
D(LDSEGEN(-3))	0.311659	0.203861	1.528783	0.1327
D(LIPI)	-0.217229	0.284878	-0.762532	0.4494
C	1.888333	1.434943	1.315964	0.1943
@TREND	0.008923	0.003624	2.461895	0.0174
LIPI(-1)	-0.262862	0.327325	-0.803062	0.4258
LDSEGEN(-1)	-0.179527	0.098589	-1.820971	0.0747

R-squared	0.201779	Mean dependent var	0.045328
Adjusted R-squared	0.087747	S.D. dependent var	0.117710
S.E. of regression	0.112427	Akaike info criterion	-1.403547
Sum squared resid	0.619356	Schwarz criterion	-1.116803
Log likelihood	48.00110	Hannan-Quinn criter.	-1.292109
F-statistic	1.769501	Durbin-Watson stat	1.990436
Prob(F-statistic)	0.114957		

W 1.3 ARDL Cointegrating And Long Run Form

Dependent Variable: LDSEGEN
Selected Model: ARDL(4, 1)
Date: 12/06/17 Time: 11:47
Sample: 1992M03 1996M11
Included observations: 57

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.093370	0.140611	0.664032	0.5098
D(LDSEGEN(-2))	0.366340	0.163485	2.240821	0.0296
D(LDSEGEN(-3))	0.311659	0.193190	1.613226	0.1131
D(LIPI)	-0.217229	0.233883	-0.928791	0.3576
C	1.897256	0.702816	2.699505	0.0095
CointEq(-1)	-0.179527	0.067433	-2.662297	0.0105

Cointeq = LDSEGEN - (-1.4642*LIPI + 0.0497*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	-1.464190	2.180707	-0.671429	0.5051
@TREND	0.049703	0.021497	2.312038	0.0250

W 1.4 Viability Check of the Model

W 1.4.1 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.076698	Prob. F(2,47)	0.9263
Obs*R-squared	0.185427	Prob. Chi-Square(2)	0.9115

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/17 Time: 12:03
Sample: 1992M03 1996M11
Included observations: 57
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLDSEGEN(-1)	-0.220125	0.902608	-0.243877	0.8084
DLDSEGEN(-2)	0.221674	0.642389	0.345077	0.7316
DLDSEGEN(-3)	0.048981	0.341337	0.143498	0.8865
DLIPI	-0.009485	0.295896	-0.032054	0.9746
C	0.177349	1.899808	0.093351	0.9260
@TREND	0.000603	0.006318	0.095416	0.9244
LIPI(-1)	-0.029604	0.384080	-0.077078	0.9389
LDSEGEN(-1)	-0.011065	0.135775	-0.081494	0.9354
RESID(-1)	0.224758	0.975053	0.230509	0.8187
RESID(-2)	-0.237455	0.623026	-0.381131	0.7048

R-squared	0.003253	Mean dependent var	7.79E-18
Adjusted R-squared	-0.187613	S.D. dependent var	0.105166
S.E. of regression	0.114608	Akaike info criterion	-1.336630
Sum squared resid	0.617341	Schwarz criterion	-0.978200
Log likelihood	48.09396	Hannan-Quinn criter.	-1.197332
F-statistic	0.017044	Durbin-Watson stat	1.985527
Prob(F-statistic)	1.000000		

W 1.4.2 Heteroskedasticity Test: Breusch-Pagan-Godfrey

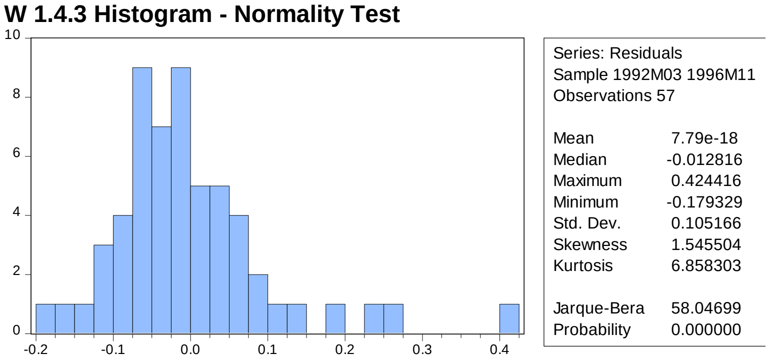
F-statistic	2.526627	Prob. F(7,49)	0.0266
Obs*R-squared	15.11739	Prob. Chi-Square(7)	0.0345
Scaled explained SS	32.72360	Prob. Chi-Square(7)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/17 Time: 12:03
Sample: 1992M03 1996M11
Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.588642	0.310337	1.896786	0.0638
DLDSEGEN(-1)	0.014327	0.037842	0.378593	0.7066
DLDSEGEN(-2)	0.025141	0.042997	0.584721	0.5614
DLDSEGEN(-3)	0.086842	0.044089	1.969697	0.0545
DLIPI	-0.128336	0.061611	-2.083011	0.0425
@TREND	0.001265	0.000784	1.613627	0.1130
LIPI(-1)	-0.129458	0.070791	-1.828736	0.0735
LDSEGEN(-1)	-0.000356	0.021322	-0.016688	0.9868

R-squared	0.265217	Mean dependent var	0.010866
Adjusted R-squared	0.160248	S.D. dependent var	0.026534
S.E. of regression	0.024315	Akaike info criterion	-4.465994
Sum squared resid	0.028969	Schwarz criterion	-4.179250
Log likelihood	135.2808	Hannan-Quinn criter.	-4.354555
F-statistic	2.526627	Durbin-Watson stat	2.490365
Prob(F-statistic)	0.026616		

W 1.4.3 Histogram - Normality Test



W 1.5 Pairwise Granger Causality Tests

Sample: 1992M03 1996M11
Lags: 12

Null Hypothesis:	Obs	F-Statistic	Prob.
DLIPI does not Granger Cause DLDSEGEN	57	0.48013	0.9116
DLDSEGEN does not Granger Cause DLIPI		1.50509	0.1734

W 2 For Meltdown Period

W 2.1 ARDL Cointegration Test

Dependent Variable: LDSEGEN
Method: ARDL
Sample: 1996M11 1999M12
Included observations: 38
Dependent lags: 2 (Fixed)
Dynamic regressors (2 lags, fixed): LIPI
Fixed regressors: C @TREND

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	0.994138	0.113804	8.735524	0.0000
LDSEGEN(-2)	-0.196977	0.118860	-1.657229	0.1076
LIPI	0.033869	0.253817	0.133440	0.8947
LIPI(-1)	0.119668	0.287018	0.416937	0.6796
LIPI(-2)	-0.179203	0.258804	-0.692430	0.4938
C	1.635078	1.763460	0.927199	0.3610
@TREND	-0.004425	0.003281	-1.348605	0.1872

R-squared	0.962514	Mean dependent var	5.644976
Adjusted R-squared	0.955259	S.D. dependent var	0.461233
S.E. of regression	0.097561	Akaike info criterion	-1.651860
Sum squared resid	0.295061	Schwarz criterion	-1.350200
Log likelihood	38.38534	Hannan-Quinn criter.	-1.544532
F-statistic	132.6623	Durbin-Watson stat	2.464886
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model seletion

W 2.2 ARDL Bounds Test
Date: 12/06/17 Time: 12:13
Sample: 1996M11 1999M12
Included observations: 38
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.949526	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.196977	0.118860	1.657229	0.1076
D(LIPI)	0.033869	0.253817	0.133440	0.8947
D(LIPI(-1))	0.179203	0.258804	0.692430	0.4938
C	1.635078	1.763460	0.927199	0.3610
@TREND	-0.004425	0.003281	-1.348605	0.1872
LIPI(-1)	-0.025666	0.314337	-0.081650	0.9354
LDSEGEN(-1)	-0.202839	0.071901	-2.821103	0.0083

R-squared	0.351140	Mean dependent var	-0.047683
Adjusted R-squared	0.225554	S.D. dependent var	0.110861
S.E. of regression	0.097561	Akaike info criterion	-1.651860
Sum squared resid	0.295061	Schwarz criterion	-1.350200
Log likelihood	38.38534	Hannan-Quinn criter.	-1.544532
F-statistic	2.796016	Durbin-Watson stat	2.464886
Prob(F-statistic)	0.027220		

W 2.3 ARDL Cointegrating And Long Run Form
Dependent Variable: LDSEGEN
Selected Model: ARDL(2, 2)
Sample: 1996M11 1999M12
Included observations: 38

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.196977	0.107516	1.832073	0.0766
D(LIPI)	0.033869	0.192384	0.176051	0.8614
D(LIPI(-1))	0.179203	0.197873	0.905649	0.3721
C	1.630653	0.421912	3.864917	0.0005
CointEq(-1)	-0.202839	0.051019	-3.975745	0.0004

Cointeq = LDSEGEN - (-0.1265*LIPI -0.0218*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	-0.126532	1.540205	-0.082153	0.9351
@TREND	-0.021817	0.011065	-1.971671	0.0576

W 2.4 VECM and Significance Test of the Coefficients

Estimation Command:
=========================
LS DLDSEGEN DLDSEGEN(-1) DLIPI DLIPI(-1) C @TREND LIPI(-1) LDSEGEN(-1)
Estimation Equation:
=========================
DLDSEGEN = C(1)*DLDSEGEN(-1) + C(2)*DLIPI + C(3)*DLIPI(-1) + C(4) + C(5)*@TREND + C(6)*LIPI(-1) + C(7)*LDSEGEN(-1)
Substituted Coefficients:
=========================
DLDSEGEN = 0.196977452605*DLDSEGEN(-1) + 0.0338692830994*DLIPI + 0.179203364017*DLIPI(-1) + 1.63507842812 - 0.00442529593509*@TREND - 0.025665655881*LIPI(-1) - 0.202839300566*LDSEGEN(-1)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.336647	(2, 31)	0.7167
Chi-square	0.673294	2	0.7142

Null Hypothesis: C(2)=C(3)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.033869	0.253817
C(3)	0.179203	0.258804

Restrictions are linear in coefficients.

W 2.5 Viability Check of the Model

W 2.5.1 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	11.24177	Prob. F(2,29)	0.0002
Obs*R-squared	16.59510	Prob. Chi-Square(2)	0.0002

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLDSEGEN(-1)	0.096538	0.110098	0.876832	0.3878
DLIPI	0.074046	0.198126	0.373731	0.7113
DLIPI(-1)	0.020742	0.200915	0.103236	0.9185
C	-1.935420	1.440116	-1.343933	0.1894
@TREND	0.004910	0.002755	1.781901	0.0852
LIPI(-1)	0.136818	0.247056	0.553794	0.5840

LDSEGEN(-1)	0.141345	0.063505	2.225745	0.0340
RESID(-1)	-0.685723	0.188186	-3.643859	0.0010
RESID(-2)	-0.659167	0.163560	-4.030131	0.0004

R-squared	0.436713	Mean dependent var	-9.40E-18
Adjusted R-squared	0.281324	S.D. dependent var	0.089301
S.E. of regression	0.075705	Akaike info criterion	-2.120563
Sum squared resid	0.166204	Schwarz criterion	-1.732714
Log likelihood	49.29071	Hannan-Quinn criter.	-1.982570
F-statistic	2.810443	Durbin-Watson stat	2.594855
Prob(F-statistic)	0.019498		

W 2.5.2 Heteroskedasticity Test: Breusch-Pagan-Godfrey

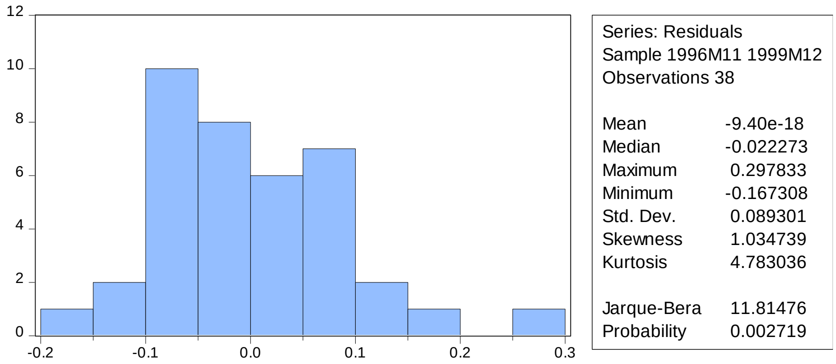
F-statistic	1.721164	Prob. F(6,31)	0.1492
Obs*R-squared	9.495620	Prob. Chi-Square(6)	0.1476
Scaled explained SS	11.95336	Prob. Chi-Square(6)	0.0630

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1996M11 1999M12
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.469770	0.261767	1.794615	0.0825
DLDSEGEN(-1)	-0.006570	0.017643	-0.372353	0.7122
DLIPI	-0.006275	0.037676	-0.166559	0.8688
DLIPI(-1)	0.033063	0.038417	0.860644	0.3960
@TREND	-0.000624	0.000487	-1.280071	0.2100
LIPI(-1)	-0.068390	0.046660	-1.465717	0.1528
LDSEGEN(-1)	-0.010185	0.010673	-0.954295	0.3473

R-squared	0.249885	Mean dependent var	0.007765
Adjusted R-squared	0.104701	S.D. dependent var	0.015305
S.E. of regression	0.014482	Akaike info criterion	-5.467020
Sum squared resid	0.006501	Schwarz criterion	-5.165359
Log likelihood	110.8734	Hannan-Quinn criter.	-5.359691
F-statistic	1.721164	Durbin-Watson stat	2.310018
Prob(F-statistic)	0.149162		

W 2.5.3 Histogram - Normality Test



W 2.6 Pairwise Granger Causality Tests

Date: 12/06/17 Time: 13:06
Sample: 1996M11 1999M12
Lags: 12

Null Hypothesis:	Obs	F-Statistic	Prob.
DLIPI does not Granger Cause DLDSEGEN	38	0.53036	0.8593
DLDSEGEN does not Granger Cause DLIPI		2.46593	0.0601

W 3 For Recovery Period

W 3.1 ARDL Cointegration Test

Dependent Variable: LDSEGEN
Method: ARDL
Sample: 2000M01 2009M12
Included observations: 120
Dependent lags: 10 (Fixed)
Dynamic regressors (12 lags, fixed): LIPI
Fixed regressors: C @TREND

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LDSEGEN(-1)	1.084883	0.099431	10.91090	0.0000
LDSEGEN(-2)	-0.198980	0.138409	-1.437626	0.1538
LDSEGEN(-3)	0.239452	0.133515	1.793441	0.0761
LDSEGEN(-4)	-0.178829	0.134632	-1.328278	0.1873
LDSEGEN(-5)	0.224122	0.133893	1.673890	0.0974
LDSEGEN(-6)	-0.222466	0.133491	-1.666525	0.0989
LDSEGEN(-7)	-0.014763	0.136902	-0.107838	0.9144
LDSEGEN(-8)	-0.350822	0.134625	-2.605913	0.0106
LDSEGEN(-9)	0.571208	0.138020	4.138601	0.0001
LDSEGEN(-10)	-0.277448	0.105192	-2.637542	0.0098
LIPI	-0.070626	0.135489	-0.521268	0.6034
LIPI(-1)	0.235085	0.123486	1.903745	0.0600
LIPI(-2)	-0.068854	0.122501	-0.562070	0.5754
LIPI(-3)	0.162868	0.123320	1.320698	0.1898
LIPI(-4)	-0.185719	0.123758	-1.500658	0.1368
LIPI(-5)	0.310943	0.124404	2.499467	0.0142
LIPI(-6)	-0.202955	0.125398	-1.618482	0.1089
LIPI(-7)	0.108748	0.124843	0.871080	0.3859
LIPI(-8)	-0.180605	0.122014	-1.480201	0.1421
LIPI(-9)	0.111351	0.122721	0.907351	0.3665
LIPI(-10)	-0.019808	0.122619	-0.161538	0.8720
LIPI(-11)	0.204117	0.122712	1.663376	0.0995
LIPI(-12)	0.011533	0.127369	0.090551	0.9280
C	-1.413650	1.262399	-1.119813	0.2656
@TREND	-0.000807	0.001658	-0.486682	0.6276

R-squared	0.990177	Mean dependent var	5.987846
Adjusted R-squared	0.987695	S.D. dependent var	0.525751
S.E. of regression	0.058320	Akaike info criterion	-2.662677
Sum squared resid	0.323121	Schwarz criterion	-2.081950
Log likelihood	184.7606	Hannan-Quinn criter.	-2.426841
F-statistic	398.9946	Durbin-Watson stat	2.019811
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

W 3.2 ARDL Bounds Test

Date: 12/06/17 Time: 12:19
Sample: 2000M01 2009M12
Included observations: 120
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.637625	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73

Test Equation:
Dependent Variable: D(LDSEGEN)
Method: Least Squares
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.208527	0.100304	2.078940	0.0403
D(LDSEGEN(-2))	0.009547	0.093014	0.102636	0.9185
D(LDSEGEN(-3))	0.248998	0.092463	2.692966	0.0084
D(LDSEGEN(-4))	0.070169	0.095009	0.738554	0.4620
D(LDSEGEN(-5))	0.294292	0.095702	3.075087	0.0027
D(LDSEGEN(-6))	0.071826	0.103150	0.696320	0.4879
D(LDSEGEN(-7))	0.057062	0.102382	0.557346	0.5786
D(LDSEGEN(-8))	-0.293760	0.101090	-2.905931	0.0046
D(LDSEGEN(-9))	0.277448	0.105192	2.637542	0.0098
D(LIPI)	-0.070626	0.135489	-0.521268	0.6034
D(LIPI(-1))	-0.251618	0.284180	-0.885418	0.3782
D(LIPI(-2))	-0.320473	0.265533	-1.206903	0.2305
D(LIPI(-3))	-0.157605	0.247201	-0.637556	0.5253
D(LIPI(-4))	-0.343324	0.232440	-1.477040	0.1430
D(LIPI(-5))	-0.032381	0.219090	-0.147797	0.8828
D(LIPI(-6))	-0.235336	0.208574	-1.128310	0.2620
D(LIPI(-7))	-0.126588	0.193813	-0.653146	0.5152
D(LIPI(-8))	-0.307193	0.172971	-1.775983	0.0789
D(LIPI(-9))	-0.195842	0.155982	-1.255541	0.2124
D(LIPI(-10))	-0.215650	0.145064	-1.486590	0.1404
D(LIPI(-11))	-0.011533	0.127369	-0.090551	0.9280
C	-1.413650	1.262399	-1.119813	0.2656
@TREND	-0.000807	0.001658	-0.486682	0.6276
LIPI(-1)	0.416077	0.300757	1.383435	0.1698
LDSEGEN(-1)	-0.123644	0.046013	-2.687160	0.0085

R-squared	0.374052	Mean dependent var	0.016206
Adjusted R-squared	0.215918	S.D. dependent var	0.065863
S.E. of regression	0.058320	Akaike info criterion	-2.662677
Sum squared resid	0.323121	Schwarz criterion	-2.081950
Log likelihood	184.7606	Hannan-Quinn criter.	-2.426841

F-statistic	2.365410	Durbin-Watson stat	2.019811
Prob(F-statistic)	0.001710		

W 3.3 ARDL Cointegrating And Long Run Form

Dependent Variable: LDSEGEN
Selected Model: ARDL(10, 12)
Sample: 2000M01 2009M12
Included observations: 120

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDSEGEN(-1))	0.208527	0.098266	2.122061	0.0364
D(LDSEGEN(-2))	0.009547	0.091689	0.104120	0.9173
D(LDSEGEN(-3))	0.248998	0.091435	2.723217	0.0077
D(LDSEGEN(-4))	0.070169	0.093867	0.747537	0.4566
D(LDSEGEN(-5))	0.294292	0.093904	3.133963	0.0023
D(LDSEGEN(-6))	0.071826	0.100611	0.713893	0.4770
D(LDSEGEN(-7))	0.057062	0.100159	0.569715	0.5702
D(LDSEGEN(-8))	-0.293760	0.098950	-2.968775	0.0038
D(LDSEGEN(-9))	0.277448	0.103139	2.690056	0.0084
D(LIPI)	-0.070626	0.130959	-0.539297	0.5909
D(LIPI(-1))	-0.251618	0.182533	-1.378481	0.1713
D(LIPI(-2))	-0.320473	0.178315	-1.797231	0.0755
D(LIPI(-3))	-0.157605	0.177160	-0.889617	0.3759
D(LIPI(-4))	-0.343324	0.180635	-1.900646	0.0604
D(LIPI(-5))	-0.032381	0.177959	-0.181957	0.8560
D(LIPI(-6))	-0.235336	0.176462	-1.333636	0.1855
D(LIPI(-7))	-0.126588	0.169677	-0.746051	0.4575
D(LIPI(-8))	-0.307193	0.157331	-1.952529	0.0538
D(LIPI(-9))	-0.195842	0.146080	-1.340648	0.1832
D(LIPI(-10))	-0.215650	0.139807	-1.542484	0.1263
D(LIPI(-11))	-0.011533	0.124948	-0.092305	0.9267
C	-1.414457	0.503881	-2.807127	0.0061
CointEq(-1)	-0.123644	0.043499	-2.842439	0.0055

Cointeq = LDSEGEN - (3.3651*LIPI -0.0065*@TREND)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI	3.365130	2.067713	1.627465	0.1070
@TREND	-0.006525	0.013079	-0.498889	0.6190

W 3.4 VECM and Significance Test of the Coefficients

Estimation Command:
=========================
LS DLDSEGEN DLDSEGEN(-1) DLDSEGEN(-2) DLDSEGEN(-3) DLDSEGEN(-4) DLDSEGEN(-5) DLDSEGEN(-6) DLDSEGEN(-7) DLDSEGEN(-8) DLDSEGEN(-9) DLIPI DLIPI(-1) DLIPI(-2) DLIPI(-3) DLIPI(-4) DLIPI(-5) DLIPI(-6) DLIPI(-7) DLIPI(-8) DLIPI(-9) DLIPI(-10) DLIPI(-11) C @TREND LIPI(-1) LDSEGEN(-1)

Estimation Equation:
=========================
DLDSEGEN = C(1)*DLDSEGEN(-1) + C(2)*DLDSEGEN(-2) + C(3)*DLDSEGEN(-3) + C(4)*DLDSEGEN(-4) + C(5)*DLDSEGEN(-5) + C(6)*DLDSEGEN(-6) + C(7)*DLDSEGEN(-7) + C(8)*DLDSEGEN(-8) +

C(9)*DLDSEGEN(-9) + C(10)*DLIPI + C(11)*DLIPI(-1) + C(12)*DLIPI(-2) + C(13)*DLIPI(-3) + C(14)*DLIPI(-4) + C(15)*DLIPI(-5) + C(16)*DLIPI(-6) + C(17)*DLIPI(-7) + C(18)*DLIPI(-8) + C(19)*DLIPI(-9) + C(20)*DLIPI(-10) + C(21)*DLIPI(-11) + C(22) + C(23)*@TREND + C(24)*LIPI(-1) + C(25)*LDSEGEN(-1)

Substituted Coefficients:

=========================

DLDSEGEN = 0.208526896603*DLDSEGEN(-1) + 0.00954662201785*DLDSEGEN(-2) + 0.248998489995*DLDSEGEN(-3) + 0.0701692232607*DLDSEGEN(-4) + 0.294291505081*DLDSEGEN(-5) + 0.0718256305352*DLDSEGEN(-6) + 0.0570623411242*DLDSEGEN(-7) - 0.293759972497*DLDSEGEN(-8) + 0.277448480854*DLDSEGEN(-9) - 0.0706260197846*DLIPI - 0.251618461476*DLIPI(-1) - 0.320472823988*DLIPI(-2) - 0.157604607292*DLIPI(-3) - 0.343323624262*DLIPI(-4) - 0.0323809359605*DLIPI(-5) - 0.235335953458*DLIPI(-6) - 0.126587840723*DLIPI(-7) - 0.307193240059*DLIPI(-8) - 0.195842313495*DLIPI(-9) - 0.215649901049*DLIPI(-10) - 0.0115333120635*DLIPI(-11) - 1.413650351 - 0.000806793642913*@TREND + 0.416077339512*LIPI(-1) - 0.123643770463*LDSEGEN(-1)

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.488377	(12, 95)	0.1420
Chi-square	17.86052	12	0.1200

Null Hypothesis: C(10)=C(11)=C(12)=C(13)=C(14)=C(15)=
C(16)=C(17)=C(18)=C(19)=C(20)=C(21)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(10)	-0.070626	0.135489
C(11)	-0.251618	0.284180
C(12)	-0.320473	0.265533
C(13)	-0.157605	0.247201
C(14)	-0.343324	0.232440
C(15)	-0.032381	0.219090
C(16)	-0.235336	0.208574
C(17)	-0.126588	0.193813
C(18)	-0.307193	0.172971
C(19)	-0.195842	0.155982
C(20)	-0.215650	0.145064
C(21)	-0.011533	0.127369

Restrictions are linear in coefficients.

W 3.5 Viability Check of the Model

W 3.5.1 Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.235612	Prob. F(2,93)	0.2954
Obs*R-squared	3.106138	Prob. Chi-Square(2)	0.2116

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/17 Time: 23:58
Sample: 2000M01 2009M12
Included observations: 120
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.

DLDSEGEN(-1)	0.560103	0.444473	1.260151	0.2108
DLDSEGEN(-2)	0.265145	0.207848	1.275671	0.2052
DLDSEGEN(-3)	-0.046547	0.097441	-0.477692	0.6340
DLDSEGEN(-4)	-0.172059	0.157413	-1.093041	0.2772
DLDSEGEN(-5)	-0.147736	0.134910	-1.095072	0.2763
DLDSEGEN(-6)	-0.248339	0.202207	-1.228139	0.2225
DLDSEGEN(-7)	-0.185076	0.156095	-1.185665	0.2388
DLDSEGEN(-8)	-0.085024	0.114589	-0.741989	0.4600
DLDSEGEN(-9)	0.194948	0.185407	1.051457	0.2958
DLIPI	0.010929	0.135486	0.080663	0.9359
DLIPI(-1)	0.362493	0.368436	0.983870	0.3277
DLIPI(-2)	0.213168	0.297587	0.716323	0.4756
DLIPI(-3)	0.175435	0.271631	0.645858	0.5200
DLIPI(-4)	0.083589	0.237973	0.351256	0.7262
DLIPI(-5)	0.178541	0.255146	0.699761	0.4858
DLIPI(-6)	0.085244	0.215519	0.395530	0.6934
DLIPI(-7)	0.104040	0.209011	0.497771	0.6198
DLIPI(-8)	0.091992	0.183687	0.500807	0.6177
DLIPI(-9)	0.205157	0.214366	0.957042	0.3410
DLIPI(-10)	0.212348	0.201032	1.056290	0.2936
DLIPI(-11)	0.177918	0.174856	1.017509	0.3116
C	1.084467	1.442588	0.751751	0.4541
@TREND	0.000348	0.001669	0.208466	0.8353
LIPI(-1)	-0.336953	0.371189	-0.907767	0.3663
LDSEGEN(-1)	0.118449	0.089365	1.325447	0.1883
RESID(-1)	-0.696231	0.526757	-1.321731	0.1895
RESID(-2)	-0.486786	0.320059	-1.520925	0.1317

R-squared	0.025884	Mean dependent var	-1.31E-16
Adjusted R-squared	-0.246449	S.D. dependent var	0.052109
S.E. of regression	0.058176	Akaike info criterion	-2.655569
Sum squared resid	0.314757	Schwarz criterion	-2.028384
Log likelihood	186.3342	Hannan-Quinn criter.	-2.400866
F-statistic	0.095047	Durbin-Watson stat	1.980785
Prob(F-statistic)	1.000000		

W 3.5.2 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.768172	Prob. F(24,95)	0.7661
Obs*R-squared	19.50291	Prob. Chi-Square(24)	0.7247
Scaled explained SS	13.33500	Prob. Chi-Square(24)	0.9603

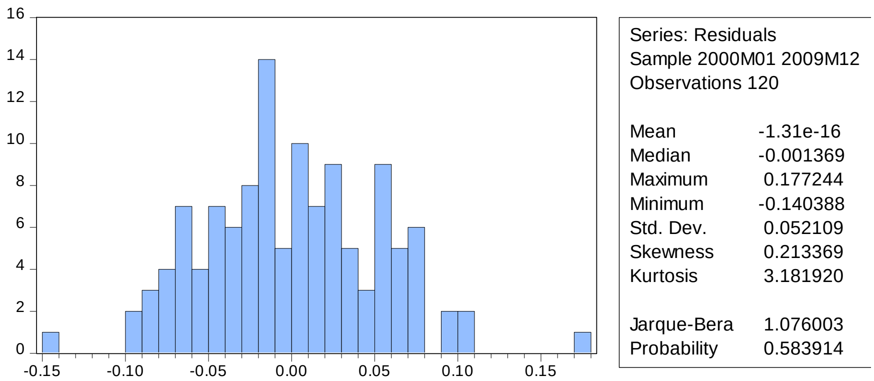
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/17 Time: 23:59
Sample: 2000M01 2009M12
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.095472	0.088551	1.078153	0.2837
DLDSEGEN(-1)	-0.002958	0.007036	-0.420351	0.6752
DLDSEGEN(-2)	-1.88E-05	0.006525	-0.002884	0.9977
DLDSEGEN(-3)	-0.009387	0.006486	-1.447378	0.1511
DLDSEGEN(-4)	-0.006273	0.006664	-0.941215	0.3490
DLDSEGEN(-5)	0.010835	0.006713	1.614003	0.1098

DLDSEGEN(-6)	-0.015503	0.007235	-2.142640	0.0347
DLDSEGEN(-7)	0.002982	0.007182	0.415277	0.6789
DLDSEGEN(-8)	-0.008634	0.007091	-1.217635	0.2264
DLDSEGEN(-9)	-0.000984	0.007379	-0.133292	0.8942
DLIPI	-0.003738	0.009504	-0.393273	0.6950
DLIPI(-1)	0.024650	0.019934	1.236583	0.2193
DLIPI(-2)	0.015296	0.018626	0.821218	0.4136
DLIPI(-3)	0.015691	0.017340	0.904889	0.3678
DLIPI(-4)	0.012180	0.016305	0.747013	0.4569
DLIPI(-5)	0.012481	0.015368	0.812144	0.4187
DLIPI(-6)	0.005562	0.014630	0.380168	0.7047
DLIPI(-7)	0.005562	0.013595	0.409115	0.6834
DLIPI(-8)	0.007037	0.012133	0.579976	0.5633
DLIPI(-9)	0.003358	0.010941	0.306952	0.7596
DLIPI(-10)	-0.001709	0.010175	-0.167934	0.8670
DLIPI(-11)	0.006382	0.008934	0.714325	0.4768
@TREND	9.39E-05	0.000116	0.807341	0.4215
LIPI(-1)	-0.025961	0.021097	-1.230597	0.2215
LDSEGEN(-1)	0.005875	0.003228	1.820195	0.0719

R-squared	0.162524	Mean dependent var	0.002693
Adjusted R-squared	-0.049049	S.D. dependent var	0.003994
S.E. of regression	0.004091	Akaike info criterion	-7.977056
Sum squared resid	0.001590	Schwarz criterion	-7.396328
Log likelihood	503.6233	Hannan-Quinn criter.	-7.741220
F-statistic	0.768172	Durbin-Watson stat	2.222736
Prob(F-statistic)	0.766145		

W 3.5.3 Histogram - Normality Test



W 3.6 Pairwise Granger Causality Tests

Date: 12/06/17 Time: 12:31
Sample: 2000M01 2009M12
Lags: 12

Null Hypothesis:	Obs	F-Statistic	Prob.
DLIPI does not Granger Cause DLDSEGEN	120	1.66724	0.0865
DLDSEGEN does not Granger Cause DLIPI		0.66191	0.7834