THE IMPACT OF SELECTED MICRO AND MACROECONOMIC VARIABLES ON THE STOCK PRICES OF EMERGING STOCK MARKET: A CASE OF DHAKA STOCK EXCHANGE (DSE)

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October, 2013.

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By

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DISSERTATION

Submitted to the Department of Finance of the University of Dhaka in partial fulfillment of the requirement for the degree of

DOCTOR OF PHILOSOPHY

October, 2013

Dhaka, Bangladesh

Approved by

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DEDICATION

This Thesis is dedicated to the memory of my mother…….

Late Bilkis Delowara Begum

.......you left fingerprints of eternal love and blessings in my life. You shan’t be forgotten.

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ACKNOWLEDGEMENT

I would like to express my sincere gratitude to the following:

At the very inception, all the praise and my sincere thanks are due to my *Almighty ALLAH (Subhanah Wtaala)*, who gave me the ability to make this dissertation possible, who also blessed me with everything, gave me every opportunity, save me from all difficulties and gift me with every single resources for the completion of this dissertation.

Prof. Dr. M. Farid Ahmed, my supervising professor, for guiding me in all aspects of my Ph.D. Program. I learned a lot from him not only in the field of stock market, but also how to become a better research person. His assistance and guidance really gave me the way to complete my study on due time. I am really grateful to him for believing in me and providing me the chance to study under his supervision.

My cousin and my mentor, Dr. K. S. Sarwar Uddin Ahmed who served me like a wizard in every spheres of my personal and academic life since my childhood. During my study in the Ph.D. Program, he helped me in selecting variables and econometric models, and also in organizing my dissertation. He also helped me to get one of the most essential econometric software (Eviews 7.1 Enterprise Edition) through one of his student Md. Zahirul Quiyum. Without this software it is nearly impossible to analyze the data and get the result. I would like to convey my heartfelt thanks to Md. Zahirul Quiyum.

Mrs. Roksana Parvin, Assistant Manager, Cash Department, Bangladesh Bank helped me in collecting data from Bangladesh Bank Library. In addition, my cousin, Md. Moshfiq Ali and his friend Md. Hasan Mamun for assisting in data collection and data processing. They have spent huge time for collecting and summarizing stock market data for this research.

My beloved maternal cousins Md. Golam Morshed Bhuiyan and Md. Monzur Morshed Bhuiya who provide me books and hand notes of different subjects at school and college level education and also taught me the basic concepts of debit and credit

in accounting. I used to go to them to understand my lesson even at the very unstable political period in 1990.
My maternal cousin, K.S. Salauddin Ahmed who opened my interest and get me feel the importance of learning English.

My maternal cousin Md. Zoaher Ali, Mrs. Sanzida Ali, my teacher Salman Chowdhury and uncle Md. Zahangir Alom who taught me various issues of science, mathematics and algebra since my childhood. They inspired me to get better result in my academic exams.

My maternal-uncle Md. Moshiur Ali, who opened my interest to be a better student. He inspired me and used to provoke me sometimes that actually gave me the strength to do better.

Most especially to my family members for their encouragement and all out support. My parent's spiritual support helped and encouraged me to complete my study. Especially, the endless blessings of my mother, Late Bilkis Delowara Begum, have worked like having a light in the long dark tunnel. Special thanks go to my mother-in-law for supporting me when I was hopeless in my study. My wife Supria for her unending love, patience, understanding and encouragement that helped me complete this dissertation. In particular, I would like to recognize my wife's affection and continued support when I got my left led seriously injured from a road accident. With all of those people that Almighty Allah has sent, I give all the honor and praise to them.

ABSTRACT

History has shown that the price of stocks and other financial assets are an important aspect of the dynamics of economic activity, performing a vital role in national economies. Stock prices can be an indicator of social mood and a leading indicator of the real economic activity. Therefore, economic policy makers keep an eye on the behavior and supervision of stock market, as its smooth and risk free operation is essential for economic and financial stability.

Investment in stock market with the intend of generating a positive return without risk is complicated and challenging. Investment in stocks involves risk and uncertainty and capital market helps managing these risk and uncertainty through the construction of efficient portfolio. Therefore, *'Portfolio Theory'* which was innovated and developed by economists and finance scholars, was a significant breakthrough in financial economics. An effectively diversified portfolio minimizes the *unsystematic risk* which is affected by factors that are specific to the firms and, to some extent, the industry in which the firm operates. The *unsystematic risk* is, therefore, manageable by diversification. The *systematic risk*, however, can not be managed by a simple approach of diversification. In addition to market oriented anomalies, there are many other factors that contribute to the systematic risk of the portfolio. Macroeconomic variables have systematic effects on stock market returns. Asset prices depend on their exposure to the fundamental variables describing the economy. Any systematic variable that affects the economy at the same time affects the returns of a single stock, and consequently the stock market return as a whole. Therefore, market oriented anomalies and systematic macroeconomic variables are vital responsible factors for any rise and fall in stock prices.

This research incorporates an interesting attempt to identify those factors that actually influences and causes the volatility in stock prices in Dhaka Stock Exchange (DSE). Few market oriented indicators (i.e. market capitalization, market dividend yield, market earnings per share, market price to earnings multiples and market trading volume) and few macroeconomic indicators (i.e. consumer price index, deposit interest rate, foreign exchange rate, export receipt, foreign exchange reserve, per

capita gross domestic product, import payment, investment at current market price, industrial production index, broad money supply, national income deflator, foreign remittances, and total domestic credit) have been incorporated to explain the behavior short run and long run behavior of stock prices in Dhaka Stock Exchange (DSE). In this research, *'Multivariate Time Series Regression Analysis'* has been applied to identify short run discrete relationship with stock price in Section: A; *'Johansen's Cointegration Test'* has been applied to estimate long run equilibrium relationship with stock price; *'Vector Error Correction Model'* has been applied to estimate short run dynamics (i.e. disequilibrium) adjustment of stock prices that leads to the convergence towards long run equilibrium relationship with other variables and finally, *'Toda-Yamamoto(T-Y) Granger Causality Test'* has been applied for the identification for long run dynamic causal relationship with stock price in Dhaka Stock Exchange (DSE). The findings of this research has been summarized and presented below:

Market capitalization has significant short run and long run positive relationship with stock price. Bi-directional causality is found to exist between market capitalization and stock price. Significant short run positive relationship has been found between market dividend yield and stock price but in the long run, the relationship is positive but significant. Uni-directional causality has been found from market dividend yield and stock price. Market earnings per share have found to have insignificant relationship with stock price both in the short run and long run. In addition, no causal relation is found between them. Market price to earnings multiples has significant negative relationship with stock price in the short run but in the long run, it is negative but insignificant. Uni-directional causality has been found from market price to earnings multiples to stock price. Market trading volume has insignificant positive relationship with stock price but in the long run, it is significant positive. Uni-directional causality has been found from market trading volume to stock price.

Consumer price index has insignificant positive relationship with stock price and also had uni-directional causality to stock price. Deposit interest rate has insignificant negative relationship with stock price but in the long run, it is insignificant positive. However, no causality has been found between them. Foreign exchange rate has significant negative relationship with stock price but no causality has been found between them. Relationship between export receipt and stock price is positive but insignificant in the short run but in the long run, it is negative and significant. In addition, bi-directional causal relation exists between them.

On the other hand, foreign exchange reserve has insignificant positive relationship with stock price and has unidirectional causality from foreign exchange reserve to stock price. Per capita GDP has significant negative relationship with stock price both in the short run and long run. However, bi-directional causality has been found between them. Import payment has insignificant relationship with stock price in the short run but in the long run, the relationship is positive and significant. Uni-directional causality has been found from import payment and stock price. Aggregate investment has significant negative relationship with stock price in the short run but in the long run, it is positive and significant. In addition, uni-directional causality has been found from aggregate investment and stock price. Industrial production index has insignificant positive relationship with stock price but in the long run, it is significant positive. Bi-directional causality has been found between them. Broad money supply has significant negative relationship with stock price but significant positive relationship has been found in the long run. Uni-directional causality has been found from broad money supply to stock price. National income deflator has significant negative relationship with stock price in the short run but in the long run, the relationship has been turned to be positive and insignificant. Bi-directional causality has been found between them. Foreign remittance has significant negative relationship both in the short run and long run and also has uni-directional causality from foreign remittance to stock price. Finally, total domestic credit has positive but insignificant relationship with stock price in the short run and has no causality with stock price.

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ACRONYMS

BB	Bangladesh Bank
ADF	Augmented Dickey-Fuller Test
AIC	Akaike Information Criterion
BOI	Board of Investment
CASPI	CSE all Share Price Index
CI	Cointegration
CPD	Centre for Policy Dialogue
CPI	Consumer Price Index
CSCX	CSE Selective Categories Index
CSE	Chittagong Stock Exchange
DIR	Deposit Interest Rate
DSE	Dhaka Stock Exchange
DSE Gen	DSE General Index
DSI	DSE all Share Price Index
DSI	DSE All Share Price Index
EME	Emerging Market Economy
EXR	Foreign Exchange Rate
EXRPT	Export Receipt
FINCAP	Financial Capitalization
FINDY	Financial Dividend Yield
FINEPS	Financial Earnings Per Share
FINPE	Financial Price Earnings Multiples
FPE	Final Prediction Error
FXRES	Foreign Exchange Reserve
GDPMP	Gross Domestic Product at Current Market Price
GHT	General Heteroskedasticity Test
HQ	Hannan-Quinn Information Criterion
ICB	Investment Corporation of Bangladesh
IFC	International Finance Corporation
IMPMT	Import Payment
INVMP	Investment at Current Market Price

IPD	Industrial Production Index
IPO	Initial Public Offering
LIR	Lending Interest Rate
LR	Sequential Modified LR Test Statistic
M2	Broad Money Supply
MB	Merchant Bank
MC	Margin Call
MFCCAP	Manufacturing Capitalization
MFCDY	Manufacturing Dividend Yield
MFCEPS	Manufacturing Earnings Per Share
MFCPE	Manufacturing Price Earnings Multiples
MNC	Multinational Corporations
MOF	Ministry of Finance
MTSRA	Multivariate Time Series Regression Analysis
MTV	Market Trading Volume
NID	National Income Deflator
NRB	Non-resident Bangladeshi
OTC	Over-the-Counter-Market
PP	Phillips-Perron Test
REMIT	Foreign Remittance
SC	Schwarz Information Criterion
SEC	Security and Exchange Commission
SOE	State Owned Enterprise
TDC	Total Domestic credit
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor
WMKTCAP	Weighted Market Capitalization
WMKTDY	Weighted Market Dividend Yield
WMKTEPS	Weighted Market Earnings Per Share
WMKTPE	Weighted Market Price Earnings Multiples

PART I

OVERVIEW AND GENERAL DISCUSSION

CHAPTER 1

INTRODUCTION OF THE STUDY

1.1 Introduction:

We all want to live in a well developed economy because of having a sturdy belief that gradual economic growth have significant association with increasing investment opportunities and industrial growth, reduced unemployment, a good financial system, reduced inflation, favorable balance of trade and balance of payment, rational relationship among macroeconomic indicators, rising per capita income, better earnings, and finally, a better living standard. Out of several measures, a well developed financial system is an important pre-requisite for having a developed economy. Financial system comprised of banking and non-banking financial institutions, development & specialized financial institutions, and capital market. In the absence of capital market, economic development heavily depends on internally generated corporate savings and capital which have obvious limitations of high profit margin to support required level of corporate savings, concentration of industrial ownership and likely inefficiency in the corporate and industrial units. Thus the development of stock market is an important and essential agenda for making the ownership of financial assets more attractive to medium and small investors and thereby to broaden the ownership of industrial wealth. In addition, development of stock market also ensures allocational efficiency of scarce resources through evaluating, ranking, and selecting investment alternatives according to expected returns and associated risks. Development of the stock market, thereby, play a significant role a bringing a good financial system in any economy.

In an emerging economy like Bangladesh, it is generally agreed that stock market under general equilibrium must play a very vital role in collecting and allocating funds and the optimal productive use of that funds in an efficient manner. Here stock markets are required to meet at least two basic requirements - supporting industrialization through savings mobilization, investment fund collections and maturity transformations; and ensuring the environment of safe and efficient discharge of the aforesaid functions (Ahmed M. F., 2000). In most of emerging markets, economic reform programs including liberalization, privatization ands restructuring have not yet been completed or in the process of completion. In this case, the knowledge of the prevailing relationship between stock prices and stock market oriented variables like market capitalization, market price to earnings (P/E) multiples, dividend per share, market dividend yield, retained earnings, book to market ratio, size of the industry and market etc. and macroeconomic variables like consumption, investment, inflation, exchange rates, international crude oil price, unemployment, industrial production, gross domestic products (GDP), and the like, are predominantly important in the view of the fact that a stable relationship among these variables are likely to reform the important postulate in a variety of economic models.

Given the recent experience of rapid fluctuations and extreme downfall in stock price indices at the Dhaka Stock Exchange (DSE) in 1996 and at the end of 2010, a relevant question may arise regarding the efficient allocation of scarce resources and efficiency of the stock market. A well meaning of efficient stock market is generally characterized by informational efficiency that leads the stock prices at its equilibrium position through the adjustment of historical, public and private information. All these information are generated either from the company itself, or from the industry or stock market or from the aggregate economy. This research has been undertaken with the basic objectives of identifying the factors from all these sources and to determine how and to what extent factor information has been adjusted to security prices at Dhaka Stock Exchange (DSE). The focus of this dissertation is to extend the existing study by incorporating additional variables[1]; increasing the size of the sample data; and by the application of improved and advanced methodology to design a stock pricing model at Dhaka Stock Exchange (DSE). This research is intended to develop a stock pricing model based on few selected micro and macro economic variables. However, the long-run equilibrium relationship, speed of short-run disequilibrium or dynamics adjustment as well as their causal relationship has also been identified.

[1] At first, existing literature on asset pricing model has been studied, variables used in those models has been identified and finally few additional variables are incorporated to design a better stock pricing model in this research.

1.2 <u>Objectives of the Study:</u>

The main objective of this research is to identify and list the micro and macroeconomic factors that have long run equilibrium relationship as well as long run causal relationship with Dhaka Stock Exchange (DSE) - all shares price index. More specific objectives of this research are outlined below:

Main Objective:

1. To identify the short run and long run equilibrium relationship between dependent variable i.e. DSE all share price index (DSI) and independent variables i.e. micro and macro factors under this study.
2. In addition, to identify Toda-Yamamoto (T-Y) Granger causal evidence between dependent variable i.e. DSE all share price index (DSI) and independent variables.

Other Objectives:

3. To establish the degrees of association between dependent and all the independent variables.
4. To identify the speed of short run dynamics adjustment in the disequilibrium condition between DSE all share price index and independent variables.

1.3 <u>Methodology of the Study:</u>

Different types of statistical and econometric methods and tools have been employed to design a stock pricing methodology in this research. ***Multivariate Time Series Regression Analysis*** has been used to estimate short run discrete relationship between selected independent variables and stock price. Soren Johansen's ***Cointegration Test*** has been incorporated to identify long run equilibrium relationship among the variables. ***Vector Error Correction Model (VECM)*** has been used to estimate the speed of short run disequilibrium adjustment within the long run equilibrium association among the variables under study. Finally, Granger causal relationship based on ***Toda and Yamamoto (T-Y) methodology*** has been employed to identify VAR based causal relationship among the selected variables. In addition to this, particular research methods followed are discussed in the respective chapters of the study in detail.

1.4 Significance of the Study:

This research is expected to have important significance outlined below:

i. The general and institutional investors at Dhaka Stock Exchange (DSE) will certainly get a wide focus to analyze their holdings of individual securities as well as for their portfolios.

ii. Existing and prospective investors, floor brokers and dealers of different securities as well as other academicians, researchers and financial analyst will get some idea about the underlying factors (micro and macro) that could cause the volatility of the stock prices in different market and economic situations.

iii. Different regulators like Dhaka Stock Exchange (DSE), Bangladesh Securities and Exchange Commission (BSEC), Bangladesh Bank (BB), Ministry of Finance (MOF), Board of Investment (BOI), National Board of Revenue (NBR), Ministry of Industries (MOI), other regulators and policy makers can use the findings of this research to develop, issue and pursue for efficient policy decisions that ultimately contribute to make the capital market active and economic activity at it’s desired level.

iv. Researchers, academicians, financial analyst and money managers can use this research result to find new ways to advance their study and research on the same relevant field.

1.5 Organization of the Dissertation:

This dissertation has three parts as follows:

Part I discusses introduction and theoretical background of the study. It contains six chapters: chapter 1 is regarding the introduction, objectives, methodology followed in this research. This chapter also discuss about the expected significance of this research. Chapter 2 discusses the historical and sequential development of asset pricing theories found in the existing literature. This chapter systematically discusses different asset pricing theories and models according to chorological order. Chapter 3 is concerned with the microstructure of Bangladesh stock market. This chapter elaborates the discussion about the historical background and development phase of the two stock markets in Bangladesh: Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE). Chapter 4 elaborates the discussion by defining and explaining efficient market hypothesis (EMH), different forms of market efficiency and emerging stock market. This chapter also includes a detailed assessment of Dhaka Stock Exchange (DSE) as an emerging stock market. Chapter 5 summarizes a brief review about the past and existing research to examine the behavior of stock prices in different developed and emerging economies. Finally, chapter 6 includes brief discussion about the definitions and concepts of different endogenous variables used in this research, description about sample time frame and data sources, data generating procedure and detailed research methods.

Part II includes the application of different types and statistical and econometric tools and techniques to analyze the data and the explanation of their test result. It consists of 3 chapters. Chapter 7 incorporates brief discussion about the theory of multivariate time series regression analysis and its application within our selected data set. Chapter 8 incorporates the application and explanation of the test result of Soren Johansen’s cointegration test and vector error correction model (VECM). Finally, the application of Toda-Yamamoto Granger causality and its test output has been explained in chapter 9.

Finally, **Part III** summarizes and discusses the entire findings of this dissertation and draws important conclusion. Some recommendations are also provided for conducting future asset pricing studies.

CHAPTER 2

HISTORY OF ASSET PRICING THEORIES

The *Efficient Market Hypothesis (EMH)* and asset pricing models are interrelated topics. The hypothesis made under efficient market is that the price of stocks quickly and instantaneously reflects all relevant information that is available about the intrinsic value of the asset and thus provides no opportunity to the profit seeking investors to receive more than above average return repeatedly based on their trading strategy. That means stock market efficiency considers informational efficiency in terms on stock prices. It implies that when all information is readily available, nobody can beat another in making abnormal profits in financial markets. Fama (1970; 1991) has made a significant contribution in making the efficient market hypothesis testable and operational and explain the levels of EMH as Weak, Semi-Strong and Strong Forms of Efficiency. On the other hand, optimal designing and appropriate selection of asset pricing model helps to identify the level of informational efficiency prevailing in the stock market. From that view point, optimal stock pricing model can be utilized as a barometer for estimating market efficiency.

Numerous forms of asset pricing model have been developed in the past 60 years. John Burr William's doctoral dissertation entitles *"The Theory of Investment Values"* in 1937 is considered to be the first asset pricing theory which ultimately leads to the development of *"Modern Portfolio Theory"* by Harry Markowitz in 1952. Later, Tobin's "The *Separation Theorem in Asset Pricing"* in 1958, Sharpe, Lintner, Mossin's development of *"Capital Asset Pricing Model* (CAPM)*"* in 1964; 1965 and 1966 respectively, Merton's *"Intertemporal Capital Asset Pricing Model"* (ICAPM) in 1973, Stephen Ross's *"Arbitrage Pricing Theory"* (APT) in 1976 and Chen, Roll, Ross's *"Factor Loading Model"* and *"Macro Variable Model"* in 1986 are few significant stock pricing models. The objective of this research is to investigate the absolute short run, dynamic long run and causal relationship of the joint micro-macro variables on the stock market returns. That's why, it is essential to have a bird's eye view on all significant stock pricing models from the history of asset pricing.

2.1 Capital Budgeting:

Capital budgeting is about how returns are generated and the supply of shares increased or decreased. It relates to the supply side of shares, and valuation models relate to the demand side of the shares. They all integrate the effects of economic risk factors on the investment evaluation process.

There are four commonly used capital budgeting methods: i) the payback method, ii) the accounting rate of return (ARR), iii) the net present value (NPV), and iv) the internal rate of return (IRR). But the most common valuation techniques are the NPV and the IRR. These techniques incorporate the effects of economic variables into the share prices and therefore stock market return as a whole. The discounted cash flow model or the NPV model has the following form:

$$\boxed{NPV = \sum_{t=1}^{N} \frac{NCF_t}{(1+k)^t} - I_0}$$

Where NCF_t is the net cash flow in time period t, I_0 is the initial cash outlay, k is the firms weighted average cost of capital (WACC), and N is the number of years.

The internal rate of return (IRR) is defined as the rate that equates the present value of the cash outflows and inflows: the rate that makes the NPV equal to zero. The IRR has the following form:

$$\boxed{NPV = 0 = \sum_{t=1}^{N} \frac{NCF_t}{(1+IRR)^t} - I_0}$$

The NPV and the IRR techniques of capital budgeting are the most sophisticated of the four commonly used methods. They both consider cash flows and discount them to take into account the time value of money. These two techniques integrate the effect of the economic variables into the stock prices through the effect on the nominator and denominator of these two capital budgeting models.

2.2 Valuation of Individual Shares:

Capital budgeting relates to the *supply* of shares while stock valuation models relate to the *demand* for shares. It is generally known that supply of shares is fixed, independent of price and interest rates. Therefore, valuation of shares analyses the demand side of the stock market. The first step in valuation is to determine the stream of expected return. It involves the expectation of future possible return and discounting the expected future cash flows.

According to Peirson *et al.* (2006), if a company is assumed to have an infinite life, and the dividends are assumed to continue indefinitely, the current market price of its shares can be expressed as the present value of an infinite stream of dividends. Even in a market where investors are seeking capital gains, the valuation formula may be written as follows:

$$\boxed{P_0 = \sum_{t=1}^{\alpha} \frac{D_t}{(1+r)^t}}$$

Where,

P_0 is the selling price today;

D_t is the dividend per share in period *t;*

r is the discount rate;

The present value approach to common-stock valuation will be compared with the multiplier approach. The multiplier is a shortcut computation to find the present value of shares. The *price-earning (P/E) ratio* is commonly used by investors. Financial analysts estimate earnings per share for the year ahead and then divide the current market price by the estimated earnings per share. The terms *multiplier* and *price-earnings ratio* (P/E) are used interchangeably. Therefore:

P/E Ratio = Current Market Price / Estimated Earnings per Share

Or

Current Market Price = Estimated Earnings per Share * P/E Ratio

Valuation of individual stocks, both from supply side and demand side, uses the above valuation formulas. The underlying economic forces are the primary influences on the stock market return through their effects on the numerator and denominator of the valuation formulas over time. The underlining macroeconomic forces influence cash flow, capital gains, discount rates and causes variations in these variables over time. In other words, what affects the numerator or denominator of the above equations has effect on stock returns.

2.3 Modern Portfolio Theory (MPT):

Modern Portfolio Theory analyses how assets can be invested optimally and how risk can be minimized under a set of assumptions. This theory is the philosophical opposite of traditional stock picking. It is based on the principle which attempt to understand the market as a whole. It provides a broad context for the interactions of *systematic risk* and *return*.

An effectively diversified portfolio minimizes the *unsystematic risk,* which is affected by microeconomic factors specific to the individual firms. The *systematic risk,* which is mainly created by macroeconomic factors, cannot be eliminated by diversification.

In the 1950s, Harry Markowitz, who is considered as the *Father of Modern Portfolio Theory (MPT)*, developed the basic portfolio principles that underlie modern portfolio theory. His original contribution was published in 1952. The primary impact of MPT on the portfolio management is to provide a framework for the systematic selection of portfolios based on expected returns and risk principles. Markowitz was among the first who attempt to quantify risk and demonstrate quantitatively why and how portfolio diversification reduces unsystematic risk. He formulated the theory of optimal portfolio selection in the context of trade-offs between risk and return, focusing on diversification as a method of reducing unsystematic risk. He found that portfolio risk is not simply a weighted average of the individual security risk. That's why, he depends on the interrelationship among security returns in order to calculate portfolio risk, and in order to reduce portfolio risk to its minimum level for any given level of return.

2.4 Separation Theorem in Asset Pricing:

James Tobin (1958) expanded on Harry Markowitz's work of mean-variance analysis by adding a risk-free asset component to that analysis. The key 'separation theorem' developed by Tobin is that, in a world with one safe asset and a large number of risky assets, portfolio choice by any risk-averse portfolio holder can be described as a choice between the safe asset and the same portfolio of risky assets. The ratio of the shares in the total portfolio accounted for by any pair of risky assets is the same for all risk-averse portfolio holders. The degree of risk aversion only determines the shares in the total portfolio accounted for by the safe asset and by the common portfolio of risky assets. This is an important and beautiful result which has been found by Tobin's own statement: *"Don't put all your eggs in one basket"* (Tobin [1996], p. 12). Indeed, Tobin's remarkable result is better summarized as *'regardless of your degree of risk aversion and caution, you will only need two baskets for all your eggs'.*

He argued that investors balance high-risk, high-return investments with safer ones so as to achieve a balance in their portfolios. This made it possible to leverage or de-leverage portfolios on the efficient frontier. This lead to the notions of a super-efficient portfolio and the capital market line. Through leverage, portfolios on the capital market line are able to outperform portfolio on the efficient frontier.

2.5 <u>Capital Asset Pricing Model (CAPM):</u>

The Capital Asset Pricing Model (CAPM) is known as the single factor (or single index) asset pricing model which integrates only one variable, the return on the market, to the return on individual stock through the value of the beta (β).

Portfolio theory was not very practical to minimize the systematic risk and it required 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. Therefore, the CAPM is an attempt to minimize total risk (i.e. through eliminating unsystematic risk) by using the market return.

Because of these calculation difficulties, Sharpe (1963) extended Markowitz's portfolio theory by developing a simplified portfolio selection model on the second stages of the portfolio selection process. The model developed in Sharpe (1963) is also called the *Market Model* or *Single Index Model*. He suggested abandoning the covariance between each security and related each security to the market. This model, to obtain the same results with much larger relationships between securities, uses relatively few parameters. Benefits are low cost and less information is needed to establish an effective portfolio. In Sharpe's (1963) suggestion, the return for any security is given by the following equation:

$$\boxed{R_i = \alpha_i + \beta_i I + \varepsilon_i}$$

Where

R_i = The return on security i;

α_i and β_i = Parameters;

ε_i = error terms assumed to be uncorrelated with its lagged values;

I = Return on market index.

The rate of return on any security is dependent on a constant plus slope coefficient (β) multiplied by market return plus a random element. The benefit of this equation is that the covariance between pairs of assets can be estimated using the beta (β).

The Capital Asset Pricing Model (CAPM) was developed by Sharpe (1964), and contributed to by Lintner (1965) and Mossin (1966). However, William Sharpe was the leading figure. Sharpe (1964) used Markowitz‟s portfolio theory and developed the CAPM. The CAPM has the following form:

$$\boxed{R_{it} - r_t = \alpha_i + \beta_i R_{mt} - r_t + u_{it}}$$

Where

R_{it} is the actual return on stock *i* in each past period *t*;

R_{mt} is the actual return on a market index;

r_t is the yield on bonds;

u_{it} is a random error;

α_i and β_i are parameters.

In this equation α_i can be defined as intercept term and the term β_i is the sensitivity of the particular share to movements in the market return. Formally, the concept of β_i can be expressed by the following equation:

$$\boxed{\beta_i = \frac{Cov\ (R_{it}, R_{mt})}{\sigma_m^2}}$$

where R_{it} is the return of the asset, R_{mt} is the return of the market portfolio, and σ_m^2 is the variance of the market portfolio.

But how effective is the CAPM in practice? Performance of the CAPM has been the subject of empirical studies. The most cited papers are Friend and Blume (1970), Blume and Friend (1973), Fama and MacBeth (1973) and Ahmed M. F. (1990). A recent Australian study by Durack *et al.* (2004) and more recent studies by Ang and Chen (2005), Fama and French (2006) and Kassimatis (2008) investigated the performance of the CAPM. Studies have found evidence of irregularities in the performance of the CAPM.

2.6 Intertemporal Capital Asset Pricing Model (ICAPM):

The CAPM has been challenged empirically in a series of papers. One of the alternatives offered was the *Intertemporal Capital Asset Pricing Model (ICAPM)* by Robert C. Merton (1973). Merton developed the ICAPM using utility maximization to get exact multifactor predictions of expected security returns. Fama (1996) built Merton's ICAPM on similar intuition. The ICAPM risk-return relation is a natural generalization of the CAPM. It adds risk premiums for the sensitivities of *Ri* to the returns, *Rs,* s=1,…,S, on the (economic) state- variable related portfolios. The ICAPM has the following form:

$$\boxed{R_{it} - r_t = \alpha_i + \beta_i (R_{mt} - r_t) + \sum_{s=1}^{s} \beta_{is} (R_{st} - r_t) + u_{it}}$$

where, *i* and *is*, are the slopes from the multiple regression of *Ri* and *Rm* and *Rs*. As in the CAPM, the relation between expected return and multifactor risks in the ICAPM is the condition on the weights for securities that holds in any multifactor-efficient portfolio.

Although the CAPM has had significant impact on the non-academic financial community, it is still subject to theoretical and empirical criticism. The model assumes that investors choose their portfolios according to Markowitz's mean-variance criterion. There are, however, theoretical objections to this criterion (Merton 1973). An intertemporal model for the capital market is deduced from the portfolio selection behavior by an arbitrary number of investors who act to maximize the expected utility of lifetime consumption and who can trade continuously in time. Explicit demand functions for assets are derived, and it is shown that, unlike the one period model, current demands are affected by the possibility of uncertain changes in the future investment opportunities. After aggregating demands and requiring market clearing, the equilibrium relationships among expected returns are derived, and contrary to the classical capital asset pricing model, expected return on risky assets may differ from the riskless rate even when they have no systematic or market risk (Merton 1973).

2.7 <u>Arbitrage Pricing Theory (APT):</u>

Multifactor asset-pricing models are based on the Arbitrage Pricing Theory (APT) and they deal with a multifactor equilibrium in which there are numerous sources of risk other than market factor. Stephen Ross (1976) developed the APT and Roll and Ross (1995) provided a more intuitive explanation of the APT and discussed its merits for portfolio management. It offers a testable alternative to the capital asset pricing model (CAPM). It assumes that the rate of return on any security is a linear function of *k* factors:

$$\boxed{\tilde{R}_i = E(\tilde{R}_i) + b_{i1}\tilde{F}_1 + \ldots\ldots\ldots\ldots\ldots + b_{ik}\tilde{F}_k + \tilde{\varepsilon}_i}$$

Where

$\tilde{R}_i$ = the random rate of return on the *i*th asset;

$E(\tilde{R}_i)$ = the expected rate of return on the *i*th asset;

b_{ik} = the sensitivity of the *i*th asset's returns to the *k*th factor;

$\tilde{F}_k$ = the mean zero *k*th factor common to the returns of all assets;

$\tilde{\varepsilon}_i$ = a random zero mean noise term for the *i*th asset.

The model begins with the assumption that actual return on any security is equal to its expected return plus a series of impacts on return (i.e. impacts of macroeconomic variables). It breaks up the single factor CAPM into several components. The CAPM predicts that security rates of return are linearly related to a single common factor, the rate of return on the market portfolio. 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 rate of return is the single relevant factor.

The APT is an alternative asset-pricing model to the CAPM differing in its assumptions and explanation of risk factors associated with the risk of an asset. The CAPM specifies returns as a linear function of only systematic risk. The APT specifies returns as a linear function of more than a single factor. It predicts a relationship between the returns of portfolio and the returns of a single asset through a linear combination of variables. The APT approach moved away from the risk versus return logic of the CAPM, and exploited the notion of "pricing by arbitrage" to its fullest possible extent. As Ross (1976) himself has noted, arbitrage-theoretic reasoning is not unique to his particular theory but is in fact the underlying logic and methodology of virtually all of finance theory.

2.8 Factor Loading Model:

According to Chen (1983), factors of APT can be determined through making assumptions and producing a theory specifying the variables of the equation, and then test this theory. This procedure of factor determination in the APT is known as *Factor Loading Model*. The factor loading model uses factor analysis technique based on artificial factors to identify the number of factors and their significance in estimating the responsiveness of individual securities to different systematic risk factors. 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, and pre-specified macroeconomic variables, or on fundamental variables (Merville *et al.* (2001). In many of the empirical studies factors are artificially created using principal components analysis (or factor analysis) rather than using an economic transmission mechanism. Naturally they have no real-world explanation (Groenewold and Fraser 1997).

2.9 Macro Variables Model:

The Macro Variable version of the APT uses observed factors assuming that stock prices react to news about macroeconomic and financial variables. Following the pioneering work of Chen *et al* (1986), there has been significant work in the literature. These works confirmed that stock market return is affected by macroeconomic and financial variables.

As most recent studies used this framework, it is important to first understand the true factor structure of the study. According to Chen *et al.* (1986) economic state variables have systematic effects on stock returns. 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.

Chen *et al.* (1986) correlated various macroeconomic variables with returns on five portfolios. They found that four macroeconomic variables were significant:

- ✓ Industrial Production;
- ✓ Unanticipated Inflation;
- ✓ Twist in the yield curve; and
- ✓ Changes in risk premium (spread between low grade bonds and high grade bonds)

Chen *et al.* (1986) chose a set of economic state variables as candidates for sources of systematic asset risk. Several of these economic variables were found to be significant in explaining expected stock returns. The authors did not completely investigate the significant macroeconomic variables but selected some variables that showed some significance compared to other possible macro variables. The methodology of Chen *et al.* (1986), the macro variable model of the APT, is considered as the best and the most economically interpretable model.

CHAPTER 3

MICROSTRUCTURE OF BANGLADESH STOCK MARKET

Stock market is one of the most important financial institutions in any economy regardless of whether the economy is developed or emerging. It opens the door for the companies to raise required amount of capital from scattered investors inside and outside of a country. Hafer and Hein (2007) pointed that growth of new businesses or growth of economy would not be possible without availability of stocks and development of financial markets. Here investors participate voluntary to buy ownership of a company in the public market. It is said that stock market is an intermediary institution to adjust the gap between surplus units and deficit units of an economy. In these days, for millions of middle class educated people in Bangladesh investing in stocks is more popular than investing in any other investment sectors. For an investor, stocks are more liquid than any other investment sources as it gives ability to sell and buy ownership anytime without any hassle.

Since 2007 share prices of Bangladesh stock market have been increasing steadily over the past four years and it outperformed almost all the world’s markets. The financial year 2008-09 is known for the global financial and economic crisis. Many developed and developing countries fall into recession. However, it could not affect Bangladesh economy greatly. So, the stock market of the country did not see any significant changes or fall. As Center for Policy Dialogue (CPD) (2011) reported, financial year 2008-09 was a volatile year but during this year Bangladesh economy benefited from low prices of importable and was able to avoid negative pressure on its export of goods and services.

The consecutive outstanding performance of Bangladesh stock market in recent years before the crash lured millions of investors to the stock market to invest their tiny savings. Before the stock market crash the market had become a route of easy money for too many new individual investors. That is why millions of fresh investors invest their small savings in the market during this period. For these fresh and inexperienced investors investing in this market provided a way to avoid working a job. Even some beneficiary owner (BO) account holders worked as intermediaries of friends, relatives to invest their money in the stock market.

3.1 Evolution of Stock Market in Bangladesh:

The development of capital market of Bangladesh dates back before the independence of Pakistan in 1947 when only two stock exchanges were functioning in the areas of the then Pakistan. However, both these exchanges stopped functioning soon after 1947 due to large scale migration of the non-Muslims members to the India. This Pakistan did not have any stock exchanges in August 1947. The need for such an institution was acutely felt; and therefore, the Karachi Stock Exchange was organized in September, 1948. Subsequently another stock exchange was incorporated on April 28, 1954 in the then East Pakistan in the name of The East Pakistan Stock Exchange Association Limited. It changed its name to the East Pakistan Stock Exchange Limited on June 23, 1962 and finally to its present name of Dacca Stock Exchange (DSE) Limited on May 13, 1964. Although incorporated in 1954, formal trading on the Stock Exchange started in 1956 at Narayangonj. But in 1958 it was shifted to Dhaka and started functioning at the then Narayangonj Chamber Building in Motijheel Commercial Area. The company subsequently purchased some land and erected the Exchange's own building at 9F Motijheel C/A and shifted the Stock Exchange to its own building in 1959.

But since most of the promoters of the joint stock companies belonged to the west wing of the then Pakistan, Karachi was considered to be the principle capital market and Dhaka Stock Exchange (DSE) had to follow the tone and temperament of Karachi market. On liberation, the socialization program in Bangladesh drastically curtailed the scope of exchange operation. Most of the companies listed with DSE were either nationalized or declared abandoned. Consequently, the operation of DSE virtually came to a standstill. In the middle of 1976, DSE resumed its operation following some pragmatic measures initiated by the Government of the Peoples Republic of Bangladesh. Raising the ceiling of private investment in both public and private sector, disinvestment of a larger number of small and medium industries, revival of Investment Corporation are among the economic measures included in those programs. These programs tended to create an environment in the economy for an effective capital market. And DSE took the initiative once again to channelized investment possibilities towards the most useful direction. Right now DSE has a total of 486 listed securities with a total market capitalization of 2,668,330 million market capitalization that includes 230 equity securities, 33 mutual funds securities, 8 debentures, 212 treasury bonds, and 3 corporate bonds.

Table 3.1: Historical Development of Stock Market in Bangladesh
(In chronological order)

Year	Brief Description of the Development Stock Market in Bangladesh
April 28, 1954	Dhaka Stock Exchange (DSE) at first established in the name of East Pakistan Stock Exchange Association.
1956	Former trading started at Narayangonj.
1958	Shifted to Dhaka at Narayangonj Chamber Building.
1959	Shifted to own building at 9F Motijheel C/A.
July 23, 1962	Renamed as East Pakistan Stock Exchange Limited.
May 13, 1964	Became Dacca Stock Exchange (DSE).
December 16, 1971	Suspended trading activities in DSE under new state policy.
August 16, 1976	Resumed trading activities in DSE with 9 companies.
September 16, 1986	Starting calculation of DSE all share price index
November 1, 1993	DSE starts calculations of share price indices on the basis of IFC designed formula
February 12, 1995	Chittagong Stock Exchange (CSE) received approval of Bangladesh Government
April 1, 1995	Establishment and incorporation of Chittagong Stock Exchange (CSE) as a limited company
October 10, 1995	Introduced floor trading in CSE
January 1, 1996	CSE became corresponding member of World Federation of Exchanges (Former FIBV)
2nd June and 10th August, 1998	Introduced screen-based state-of-the art Automated Trading System through wide are network (WAN) in CSE and local area network (LAN) & wide are network (WAN) in DSE respectively.

January , 2001	Starting of DSE-20 index calculation on DSE.
November 27, 2001	Starting of DSE General index calculation in DSE.
December 23, 2003	Central Depository Bangladesh Limited (CDBL) starts its commercial operation upon receipt of business commencement certificate from SEC
January 24, and 26, 2004	Central Depository System (CDS) for electronic settlement of share trading formed in DSE and CSE respectively
July 4, 2004	Over-the-Counter (OTC) market launched in CSE
March 10, 2007	CSE launched Comprehensive Training Program on Stock Market for investors, professionals and others.
May 30, 2004	Internet Trading Service (ITS) launched at CSE
July 14, 2004	CSE initiates the idea of Securities Institute by raising formal proposal
December 14, 2004	CSE organizes Capital Market Fair
March 10, 2007	CSE introduced Comprehensive Training Program on Stock Market for investors, professionals and others.
June 12, 2007	CSE submits draft copy to SEC about the Regulatory Framework on Financial Derivatives
October 18, 2008	CSE became a member of OIC Member States' Stock Exchange Forum
February 22, 2010	CSE introduced Book Building Method in the country
January 13, 2011	Execution of trade of short Sell under the Regulation in CSE.
September 11, 2011	CSE signs on the agreement with Bangladesh Electronic Fund Transfer Network (BEFTN) for launching electronic fund transfer

Source: Ahmed M. F. (1992); Stock Market Behavior in Bangladesh, Bureau of Business Research, University of Dhaka and different published sources.

The second Stock Exchange of the country – Chittagang Stock Exchange (CSE) was established on December 1995 in Chittagang. Bangladesh Government has now set policies for liberalization and privatization. Meanwhile, Securities and Exchange Commission (SEC) has been constituted to foster well functioning Stock Markets in Bangladesh. Government is also trying to develop the stock markets through different policy measures, even though the rate of development is not up to expectation. Thus, the situation warrants detailed examination of the stock market of Bangladesh and drawback in the system need to be point out.

3.2 Structure of Bangladesh Stock Market:

Primary Market: Initial Public Offerings (IPOs), new share issuance of a company comes through primary market. Companies can issue new securities after getting permission from the market regulators.

Secondary Market: Secondary market deals with existing securities or previously issued securities. Securities can be sold or bought from this market. In a stock exchange most of the trading figures comes from the secondary market. This market is also divided according to its different trading characteristics.

i. **Public Market**: Instruments are traded on this market in normal volume which is called lot share.

ii. **Spot Market**: Trading is done in normal volume under corporate actions and must be settled in 24 hours.

iii. **Block Market**: In this market bulk volume of instruments are trades through pick & fill basis.

iv. **Odd lot Market**: Odd lot refers to a quantity of shares that is less than market lot. Odd lots of all instruments are traded through pick & fills in this market. Basically odd lots generated from bonus and rights issues.

3.3 Importance of Stock Market in the Economy:

The capital market is the market for long-term loans and equity capital. Developing countries, in fact, view capital market as the engine for future growth through mobilizing of surplus fund to the deficit group. An efficient capital market may perform as an alternative to many other financing sources as being the least cost capital source. Especially in a country like Bangladesh, where savings is minimal, and capital market can no wonder be a lucrative source of finance. The securities market provides a linkage between the savings and the preferred investment across the business entities and other economic units, specially the general households that in aggregate form the surplus savings units. It offers alternative investment windows to the surplus savings units by mobilizing their savings and channelized them through securities into optimal destinations. The stock market enables all individuals, irrespective of their means, to share the increased wealth provided by competitive enterprises. Moreover, the stock market also provides a market system for purchase and sale of listed securities and thereby ensures liquidity (transferability of securities), which is the basis for the joint stock enterprise system. The existence of the stock market actually makes it possible to satisfy simultaneously the needs of the firms for increased capital and of investors for liquidity. Especially at times when the banking sector of the country is facing the challenge of bringing down the advance-deposit ratio to sustainable level, the economy of the country is unfolding newer horizon of opportunities. Due to over-exposure level of the financial system, the securities market could play a very positive role, had there been no market debacle. Due to the last two market crash in 1996 and in 2010 and follow-through events, it will be difficult to utilize the primary market to raise significant volume of funds. Thus the greatest economic importance of securities market at this point can be understood from the opportunities being lost. Bangladesh having its target to become a middle income country must have significant level of rise in investment, which at the present state of banking system cannot be met. The securities market could play the key role in meeting these huge investment demands if the secondary market would remain stable. The capital market also helps increase savings and investment, which are essential for economic development. An equity market, by allowing diversification across a variety of assets, helps reduce the risk that the investors must bear, thus reducing the cost of capital, which in turn spurs investment and economic growth. However, volatility and market efficiency are two important features which will ultimately determine the effectiveness of the stock market in economic development. If a stock market is inefficient due to lack of information supply, investors face difficulty in choosing the optimal investment as information on corporate performance is slow or less available. The resulting uncertainty may induce investors either to liquidate their investment from the market until this uncertainty is resolved or discourage them to invest funds for long term. Moreover, if investors are not rewarded for taking on higher risk by investing in the stock market, or if excess volatility weakens investor's confidence, they will not invest their savings in the stock market, and hence deter economic growth. The emerging stock markets offer an opportunity to examine the evolution of stock return distributions and stochastic processes in response to economic and political changes in these emerging economies.

3.4 Development of Dhaka Stock Exchange (DSE):

Capital market in developing economies like Dhaka Stock Exchange (DSE) sometimes fails to support industrialization through savings mobilization and investment fund allocation and maturity transformation because of the existence of active informal credit market; low degree of owner-management separation; drawbacks of informational asymmetry, and difficulty in maturity transformations (Ahmed M.F., 1998). An understanding of the stock market performance and development may be conceived by examining its relative contribution in resource mobilization. With the resumption of DSE activities since 1976, the structure of Dhaka Stock Exchange (DSE) has changed and the number of listed securities has been increasing gradually. Naturally, the functions of DSE are getting increasing importance in a freer market economy. It is, therefore, worthwhile to study Dhaka Stock Exchange (DSE) with the objective to clarify whether or not the particular asset pricing model is well functioning over there.

The Bangladesh Government is intended to open the capital market to foreign participation in order to attract foreign capital since 1994 along with easy convertibility of Taka into foreign currency. Investors are allowed to manage their portfolio like domestic investors. Government owned corporations are being privatized for the last decade although at a slow pace. Ahmed M. F. (2000) examined some statistical variables to show the spectacular growth of the DSE. Basically, the growth of the stock market has been orchestrated by the government through various policies and programs. Trading is conducted by the broker-members of the stock exchanges in Bangladesh. In order to execute an order to buy or sell on behalf of his client, a broker is supposed to provide services at the time of executing a sell order as well as provide services and funds for a buy order for commission. Thus, the stock market in Bangladesh predominantly operates through the agents without any responsible market makers or specialists.

All securities traded on the stock exchange are subjected to daily price limitations in an attempt to discourage speculative investors. The exchange sets upper and lower limits on daily price movements and transactions by large shareholders. Sometimes, Securities and Exchange Commission (SEC) of Bangladesh also interferes in this process through regulating DSE activities. This practice can cause low returns and thus delay the effect of new information on stock prices. However, computerization of trading system and Central Depository System (CDS) has already been implemented. In the view of the growing size of the market, frequent allegations about the market manipulation and the recent upsurges followed by sharp downswings in 1996 and 2010, the credibility of the system as a whole has been brought into question. The system, therefore, needs to combine the advantage of the technology- efficiency, accuracy and speed - with those of human interaction, visibility and information exchangeability on the trading floor so that better market condition with less price volatility can be ensured.

Market activity and development can be easily visualizes through analyzing different market oriented performance indicators. Figure: 3.1 presents number of listed securities at DSE between 1976 and 2010. This upward moving curve with positive slope clearly presents a rising tendency of the listed securities over time. But the rate of growth in the number of listed securities is very low between 1976 and 1982. But this low rate rise from 1984 and onwards. It is also found that a significant rise in the number of listed securities takes place between 2006 and 2010.

Figure 3.1: Number of Listed Securities

Figure 3.2: Number of Listed Companies

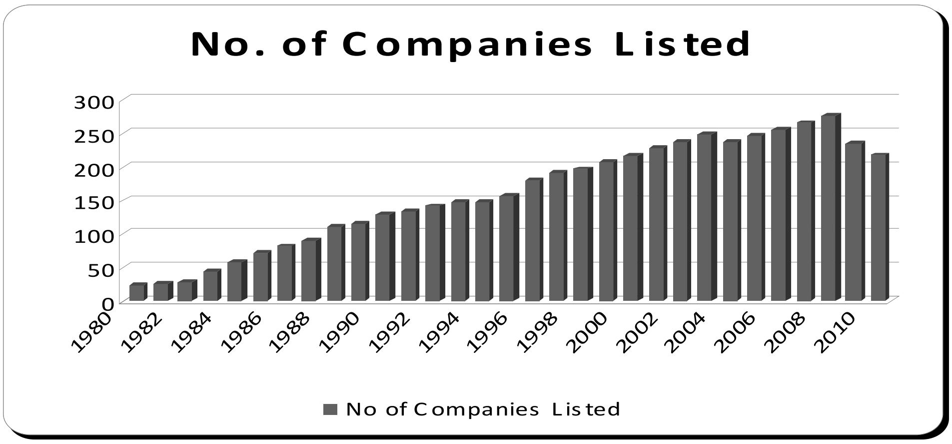


Table: 3.2 presents bar diagram of the number of listed companies between 1980 and 2010 in DSE. It is clearly visible from the size of the bar that number of listed companies gradually increases from 1980 to 2004. But in 2005 number of listed companies slightly decreases. But after then this figure increase between 2006 and 2008. In 2009 and 2010 this figure decreases again. In short DSE has been, on an average, experiencing a rising tendency in terms of the number of listed companies.

Figure: 3.3 shows the number of securities traded in million taka from 1976 to 2010. The line showing the number of securities traded is very close to the horizontal axis representing very poor number of securities traded between 1976 and 1995. But in 1996, then it seems to go little up implying an increase in the traded securities. Then a gradual rise takes place from the year 2000 and onwards which reveals a satisfactory DSE activities between the year 2000 and 2010.

Figure 3.3: Number of Securities Traded

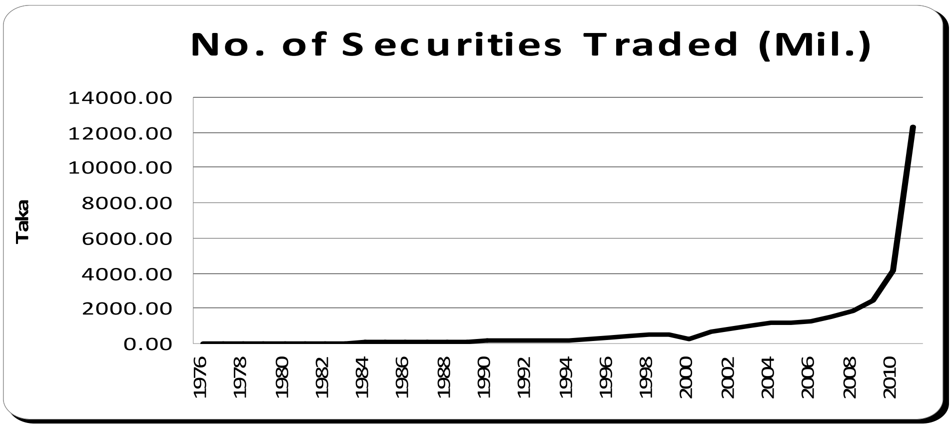


Figure 3.4: Trading Value at DSE

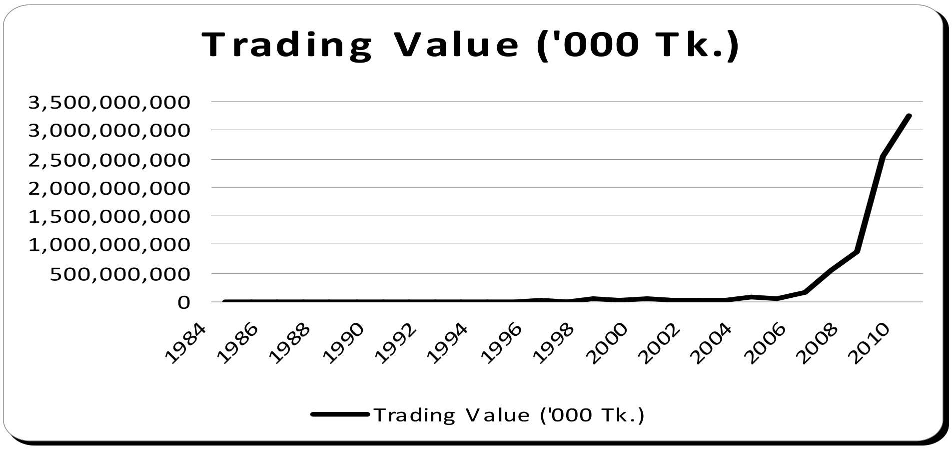
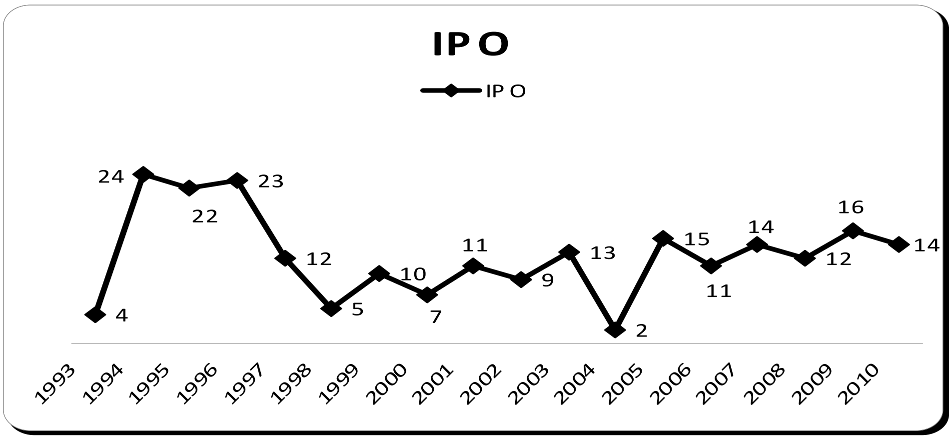


Figure: 3.4 presents the value of all transactions between 1984 and 2010 held at DSE. In terms of the numerical figure of the trading value, the year between 1984 and 2004 is very close to horizontal axis, implying very poor trading value within these years. But after then, from the year 2005 to 2009 this trading value holds a rising tendency. Finally, it is found that the line goes sharply up, representing very large amount of trading value in the year 2010.

Market capitalization is considered to be another important stock market development indicator. Figure: 3.5 present the status of the market capitalization of DSE between the year 1976 and 2010. The line representing total market capitalization moves closely similar to the line representing trading value at DSE. But in the year 1996 capitalization line seems to go slightly up but after 2003 the line has got a gradual rising tendency.

Figure 3.5: Total Market Capitalization at DSE

Figure 3.6: Initial Public Offering at DSE



Number of initial public offering (IPO) is another development indicator for the stock market. The number of IPOs between 1993 and 2010 held at DSE has been presented in figure: 3.6. It has been found that the number of IPOs is significantly large between 1994 and 1996. Then a sharp decline takes place between 1997 and 1999. Then the line moves like zigzag pattern except in the year 2003 when the no. of IPO is only 2. But after 2003, the number of IPOs seems to be relatively stable over the years up to 2010.

Figure: 3.7 shows monthly market EPS of DSE between January 2001 and September 2010. Except October 2004; March 2008, and August 2009, the line presenting Market EPS moves above the horizontal line, implies positive market EPS throughout the years.

Figure 3.7: Market EPS at DSE

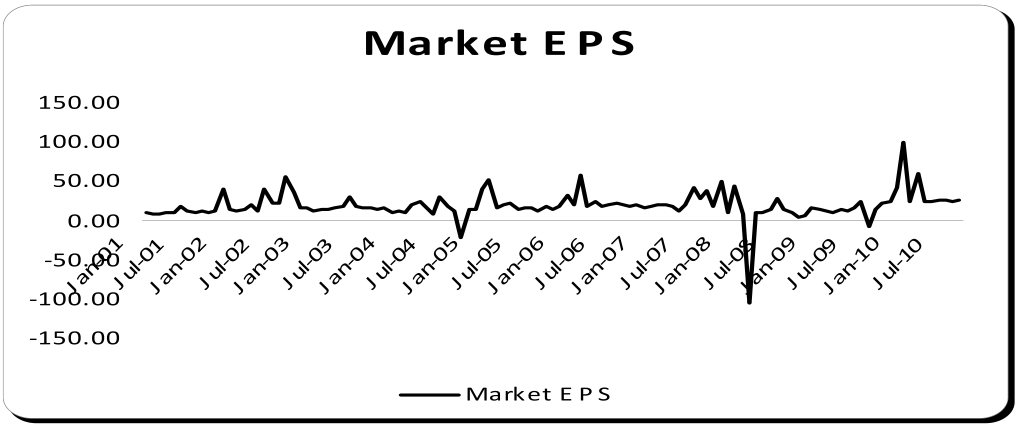
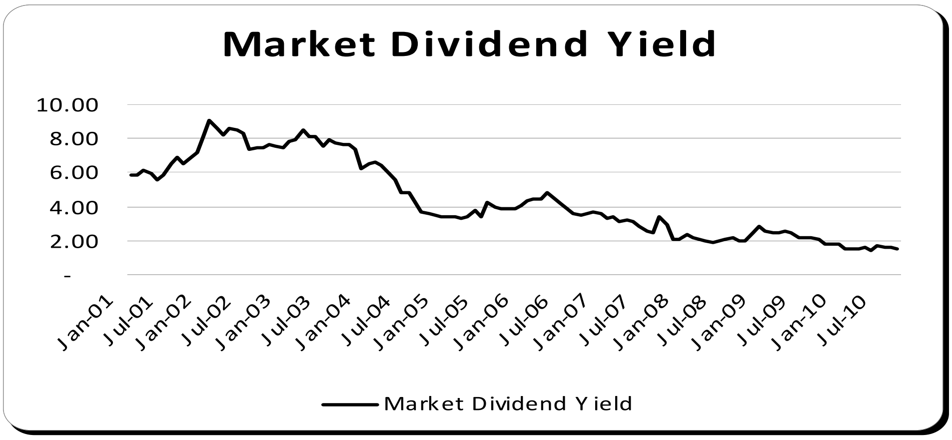
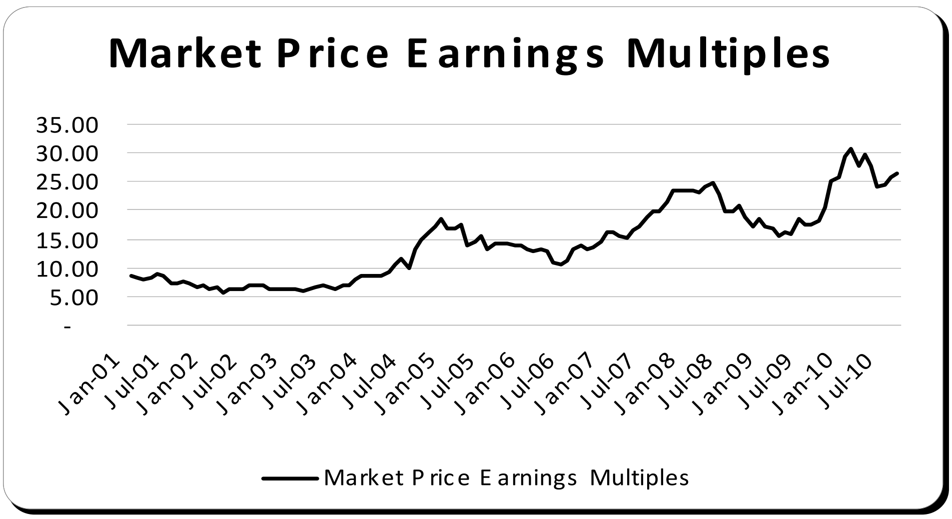


Figure 3.8: Market Dividend Yield at DSE



Market dividend yield is another important development indicator in stock exchange. It is commonly believed that large market dividend, on an average, can attract prospective investors which ultimately contributes to make the stock market active and running. On the other hand, a lower dividend yield implies larger corporate investment opportunities that lead to higher return and higher capital gain. Figure: 3.8 presents market dividend yield of DSE between January 2001 and September 2010. It is found that the line representing market dividend yield is relatively stable between January 2001 and July 2003. But after then the line shows a gradual declining trend from January 2004 and onwards which simply indicate that the amount of distributed dividend, on an average lower relative to the market price of the companies' stocks.

Figure 3.9: Market P/E Multiples at DSE



Price earning multiples is a measure of current mood of the stockholders about how much they are ready to pay for per unit of the company's earnings. Higher the P/E multiples, greater the amount that the investors are ready to pay to purchase the company's stock. Figure: 3.9 presents the market P/E multiples of DSE between January 2001 and September 2010. It has been found that the line indicating market P/E multiples is relatively stable between January 2001 and July 2004. After then, an average rising tendency has been found in the line from January 2007 and onwards.

3.4.1 <u>Functions and Legal Control of DSE:</u>

The major functions of Dhaka Stock Exchange (DSE) are found to be:

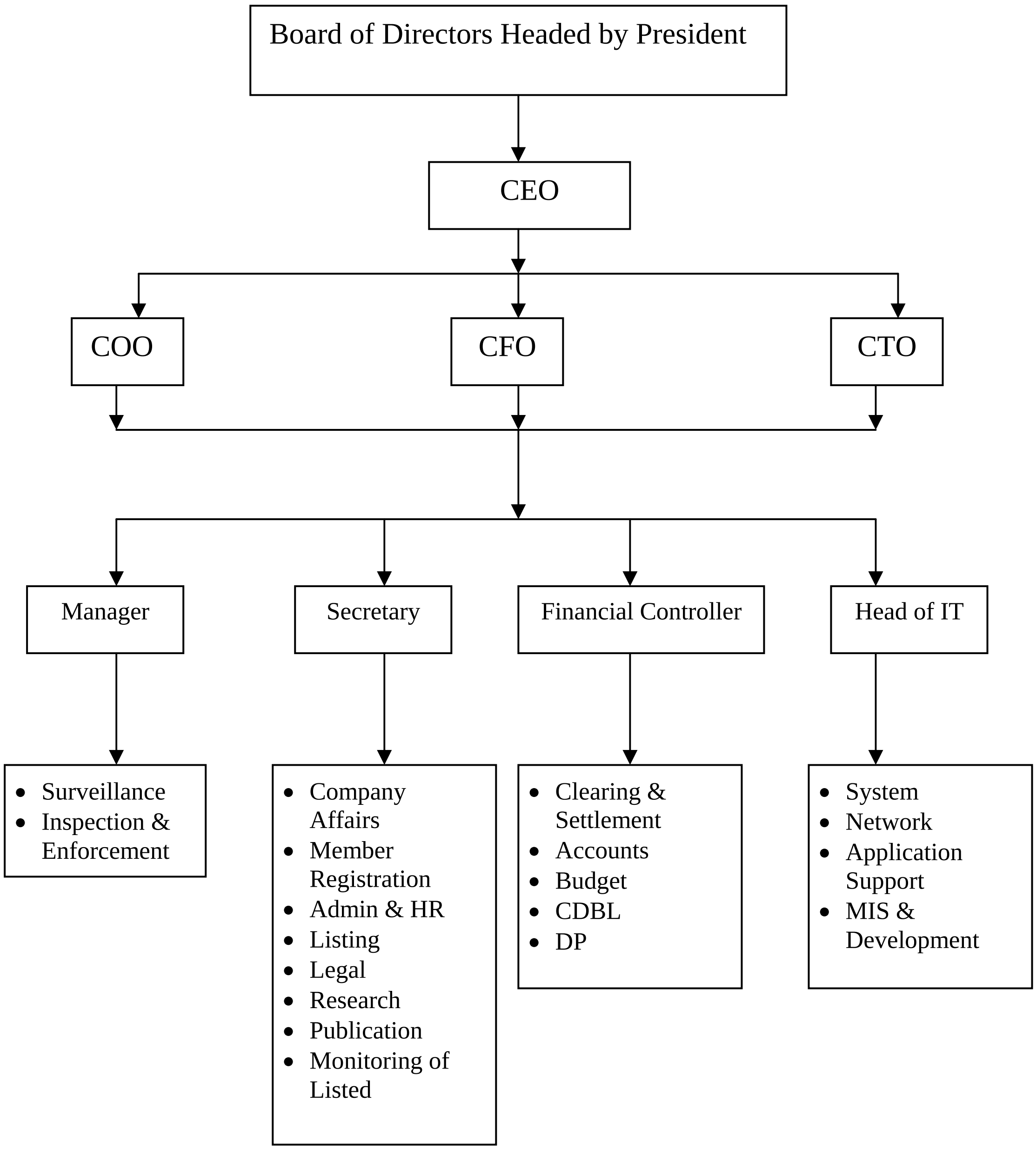
- ✓ Listing of Companies (As per Listing Regulations).
- ✓ Providing the screen based automated trading of listed Securities.
- ✓ Settlement of trading (As per Settlement of Transaction Regulations).
- ✓ Gifting of share / granting approval to the transaction/transfer of share outside the trading system of the exchange (As per Listing Regulations 42).
- ✓ Market Administration & Control.
- ✓ Surveillance of the Market.
- ✓ Publication of Monthly Review.
- ✓ Monitoring the activities of listed companies (As per Listing Regulations).
- ✓ Creating Investors' grievance Cell (Disposal of complaint bye laws 1997).
- ✓ Establishing Investors Protection Fund (As per investor protection fund Regulations 1999).
- ✓ Announcement of Price sensitive or other information about listed companies through online.

Legal Control:

The Dhaka Stock Exchange (DSE) is registered as a Public Limited Company and its activities are regulated by its Articles of Association rules and regulations and bye-laws along with the Securities and Exchange Ordinance, 1969, Companies Act 1994 & Securities and Exchange Commission Act, 1993.

3.4.2 Management Structure of DSE:

As per Article 105B, the management of DSE is totally separated from council. A highly qualified and trained professional Management Team is running day to day operations and the Chief Executive Officer is the head of Management Team of the exchange. The management team runs independently under policies set by the Board of Directors. Other members are Secretary, Financial Controller and IT Director. The organogram of the management structure of DSE is presented below:



Flow Chart: Organigram of the DSE Management Structure

3.4.3 Criteria of the Share Category in DSE:

Dhaka Stock Exchange (DSE) has classified five different types of companies based on their distribution of dividend and holding of annual general meeting (AGM). The securities issued by them also belong to five different categories. Brief descriptions of these five different types of issuing companies are presented below:

(i) ***'A' Category Companies:*** Companies which are regular in holding the annual general meetings (AGM) and have declared dividend at a rate of 10 percent or more in a calendar year (Mutual funds, debentures, and bonds are being traded in this category) and newly listed companies with at least 10 percent EPS.

(ii) ***'B' Category Companies:*** Companies which are regular in holding the AGM but have failed to declare dividend at least at the rate of 10 percent in a calendar year and newly listed companies with less than 10 percent EPS.

(iii) ***'G' Category Companies:*** Newly listed green field companies shall be grouped under this category.

(iv) ***'N' Category Companies:*** All newly listed companies except Greenfield companies will be placed in this category and their settlement system would be like 'B' category companies.

(v) ***'Z' Category Companies:*** Companies which have failed to hold the AGM or failed to declare any dividend or which are not in operation continuously for more than six months or whose accumulated loss after adjustment of revenue reserve, if any, is negative and exceeded its paid-up capital.

3.4.4 Clearing and Settlement Process of DSE:

The clearing and settlement module provides the management of trade from the point of entry into the Settlement Pool trade database until it has been delivered, settled and removed from the Settlement Pool. It consists of three major business processes:

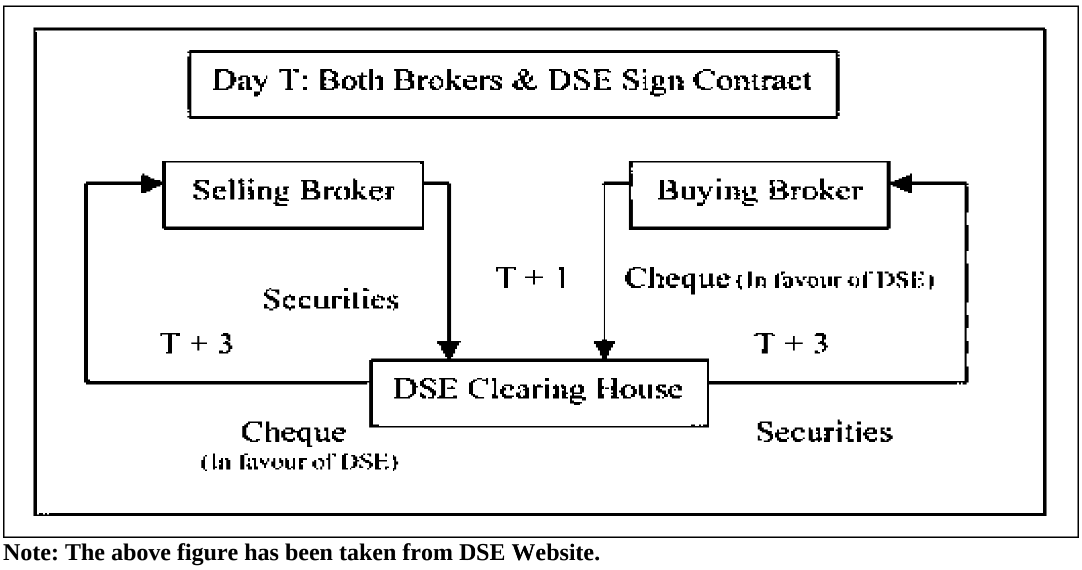
Clearing: This part participates trade reporting, affirmation, billing and assigning settlement instructions.

Settlement: This part involves with the process of overseeing that delivery of all instruments to the buyer and payment of all moneys to the seller has occurred before removing the trade from the settlement pool.

Here is a complete picture of the settlement system for all of our 427 instruments in five (5) groups in the four (4) markets**.**

A Group: Number of Instruments are **338 (150 + 8D + 22M + 158TB),** Here D for Debentures, M for Mutual funds & TB for Treasury Bonds (Trading in Public, Block & Odd-lot Market with trade for trade settlement facility for scrip only through DSE Clearing House on T+1, T+3 basis). "A" and "DA" are marked in BASES columns for Non-Demat & Demat instrument respectively in TESA Trading Software.

Figure 3.10: The Valid Cycle for A, B, G, & N Category Instruments Traded in Public, Block and Odd- lot Market



Note: The above figure has been taken from DSE Website.

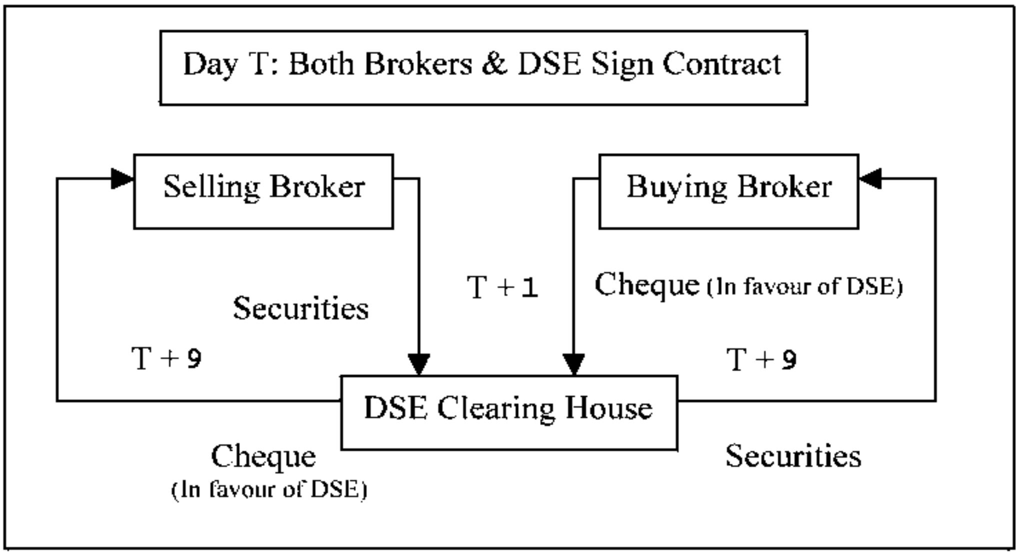
B Group: Number of Instruments are **44**(Trading in Public, Block & Odd-lot Market with trade for trade settlement facility through DSE Clearing House on T+1, T+3 basis). "B" and "DB" are marked in BASES columns for Non-Demat & Demat instrument respectively in TESA Trading software.

G Group: Number of Instrument is **0** (Trading in Public, Block & Odd-lot Market with trade for trade settlement facility through DSE Clearing House on T+1, T+3 basis). "G" and "DG" are marked in BASES columns for Non-Demat & Demat instrument respectively in TESA Trading software.

N Group: Number of Instrument is **11**(Trading in Public, Block & Odd-lot Market with trade for trade settlement facility through DSE Clearing House on T+1, T+3 basis). "N" and "DN" are marked in BASES columns for Non-Demat & Demat instrument respectively in TESA Trading software.

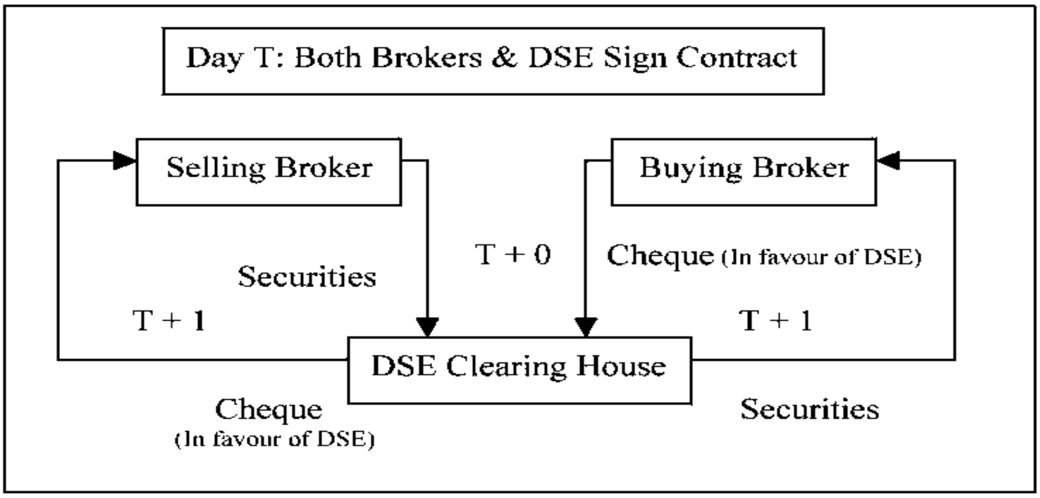
Z Group: Number of Instruments are **34**(Trading in Public, Block & Odd-lot Market with trade for trade settlement facility through DSE Clearing House on T+1, T+9 basis). "Z" and "DZ" are marked in BASES columns for Non-Demat & Demat instrument respectively in TESA Trading software.

Figure 3.11: The Valid Cycle Only for Z Group Instruments Traded in Public, Block and Odd-lot market



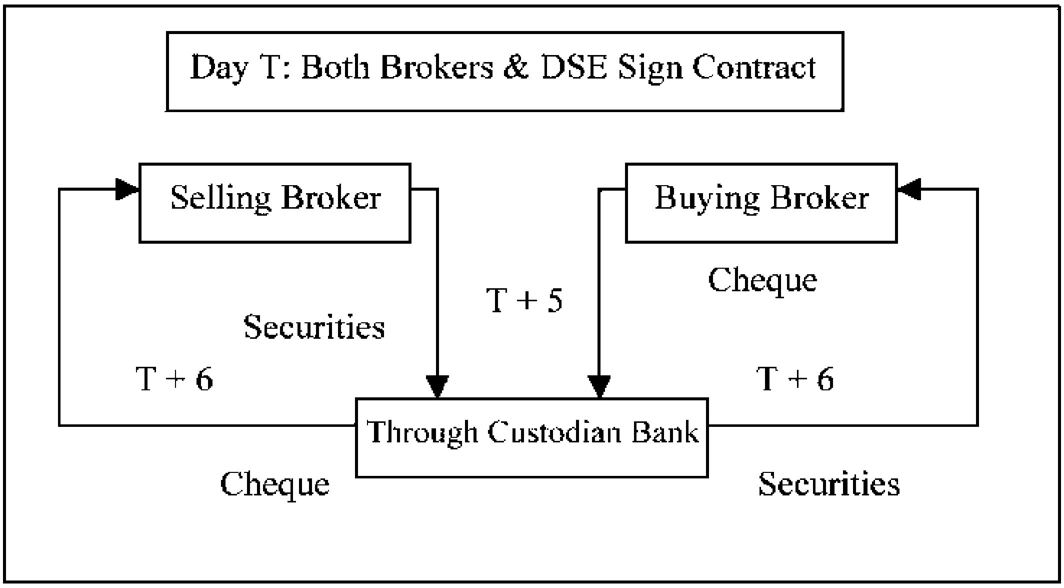
Note: The above figure has been taken from DSE Website.

Figure 3.12: The Valid Cycle for all Group's Instruments Traded In Spot Market



Note: The above figure has been taken from DSE Website.

Figure 3.13: The Valid Cycle for All Group's Instruments Used in Foreign Trades



Note: The above figure has been taken from DSE Website.

Demate Shares: All selling shares have to transfer to the clearing account of selling Brokers from concerned BO account within settlement period. Regarding the cash payment the procedure will remain unchanged as mentioned above.

3.4.5 Dhaka Stock Exchange Indices:

Stock index is parameter of measuring stock market performance of a country. The performance of stock market is positively and significantly linked to the development of an economy. It contributes to the formation of capital for else by the entrepreneur or industrialists, fiscal performance of government, socio-economic development of the country etc[1]. There are, in general, three indices in Dhaka Stock Exchange (DSE). A brief description of all these indices is given below:

DSE all Share Price Index (DSI): DSE all share index which is commonly known as DSI was introduced in November 1, 1993. The base value of this index was 350 and the shares from every category have been used in the formation and estimation of this index.

DSE General Index (DGEN): DSE General index or DSE Gen is a benchmark price barometer which was introduced on November 27, 2001 with a base index of 817.62. This index excludes the companies which belongs to Z-categories and is calculated on the basis of price movement of the individual stocks. The index is a value-weighted index in nature. The entire market capitalization excluding Z category is taken into consideration in driving the general index.

DSE 20 Index (DSE20): The DSE 20 index was introduced on January 01, 2001. The DSE 20 index has a basis point of 1000as base index. This index was introduced to reflect the behavior of 20 blue chips companies taken from different industries and having a good track of paying high dividend and remaining “A” category companies. The criteria tables taken into account in the formation of this separate index were:

- Minimum market capitalization worth Tk. 200 million.
- Minimum 20 percent shares in public hands.
- Minimum payment of 10 percent dividend for the last six months.
- 95 percent trading days in the last six months.

[1] Comments has been taken from the News Article in The Financial Express titled, “Construction of Stock Index in Bangladesh: Issues and Suggestions for Policy Makers” by Dr. Mohammad Saleh Jahur, Professor, Department of Finance & Banking, University of Chittagong.

However, subjective criteria such as good corporate governance, regular holding of annual general meeting, sectoral representative were the other key qualification for becoming eligible for inclusion in the DSE 20 index.

Dhaka Stock Exchange presently computes three indices, DSE General Index (DGEN), DSE Board Index (DSEX) and DSE 30 Index (DS30). None of these DSE indices include mutual funds, debentures and bonds. Here DSEX and DS30 indices are based on free float and S & P methodology with effect from January 28, 2013. DSEX is the Board Index of the Exchange (Benchmark Index) which reflects around 97 percent of the total equity market capitalization. On the other hand, DE30 constructed with 30 leading companies which can be said as investable Index of the Exchange. DS30 reflects around 51 percent of the total equity market capitalization.

3.5 <u>Development of Chittagong Stock Exchange (CSE):</u>

Chittagong Stock Exchange (CSE) is the second Stock Exchange of Bangladesh. It is said that CSE is the pioneer of the modern capital market of the country as it introduces modern technology & sophisticated logistic support for the settlement of trading activities in CSE. It was incorporated as a self regulated non-profit organization on 1st April, 1995 and formally opened on November 4, 1995. It started its trading through cry-out system. Then Chittagong Stock Exchange started first automated trading bourse of the country. CSE started its automated trading on 2nd June, 1998 and internet trading service on 30th May, 2004.

The trading time of CSE is between 11:00 am to 15:00 pm. The working days & holidays of CSE are same as like as DSE. CSE consists of 25 members of whom 12 are elected through election of CSE members, 12 members are elected from different major economic & social arena of Bangladesh and CEO is nominated and appointed by its own board but the approval of SEC is mandatory.

Now CSE has 147 members and 238 of listed securities. There are four different markets in CSE too which are public, Spot, Block & Odd Lot market. Trading is done through all these four markets. A, B, N, G and Z these are the 5 categories of company listed in CSE and it is mentionable that in G category there is not any company. Chittagong Stock Exchange has its own indices to calculate movements of its total market value. CSE maintained only one index that was All Share Price Index until 10th October, 1995. Now CSE has 3 indices in the stock exchange. Indices are All Share Price Index (CASPI), CSE Selective Index (CSE30) and CSE Selective Categories' Index (CSCX).

Market activity and development of CSE can be easily visualizes through analyzing different market oriented performance indicators. In this case different market indicators such as market turnover, number of listed securities, amount of issued capital, number of IPOs per year and market capitalzization have been analyzed to measure the development of Chittagong Stock Exchange (CSE) during the period of 2000 to 2011.

Turnover of securities has been considered to be a significant development indicator of the stock exchange. Figure: 3.20 present the trend of turnover in Chittagong Stock Exchange (CSE). This trend line depicts that in the year between 2000 and 2006, turnover value is relatively stable but a significant rise takes place between the year 2007 and 2010. But after the stock market crash at the end of 2010, turnover value is found to be decreasing. In brief, it can be said that market turn in CSE is satisfactory as the line representing market turnover has, on an average, a positive trend during this period.

Figure 3.14: Yearly Turnover in Chittagong Stock Exchange (CSE)

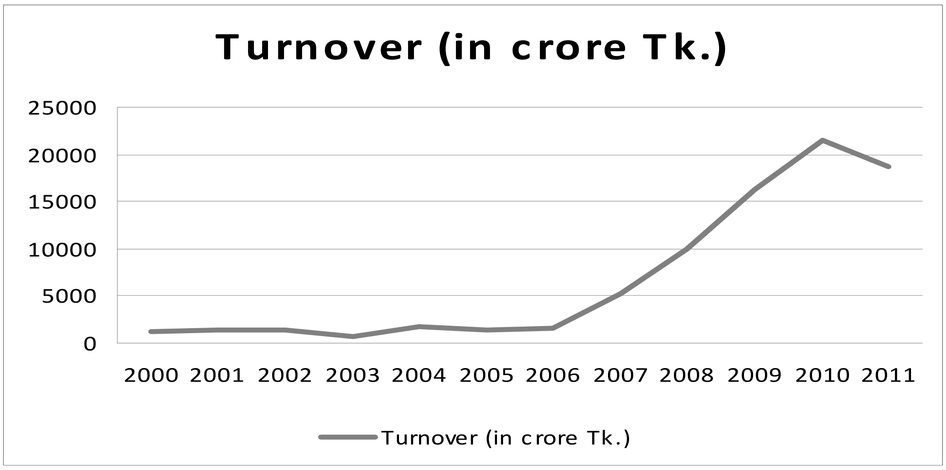
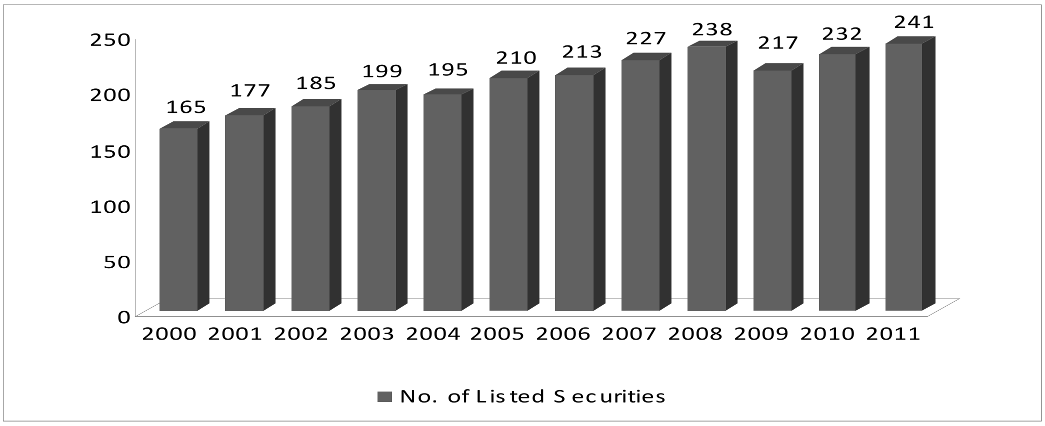


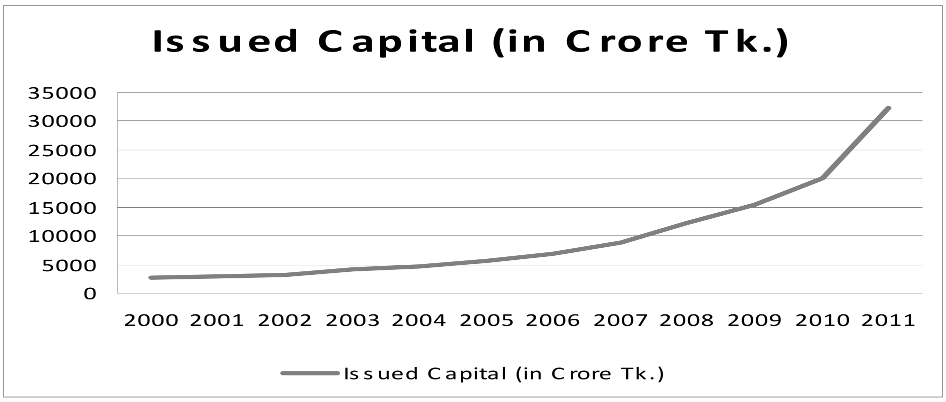
Figure: 3.21 presents number of listed securities at CSE between the year 2000 and 2011. It is clearly evident that the number of listed securities are increasing every year during this sample period except in the year 2009. However, it can be concluded that Chittagong Stock Exchange (CSE) is growing over time by its number of listed securities.

Figure 3.15: Number of Listed Securities in Chittagong Stock Exchange (CSE)



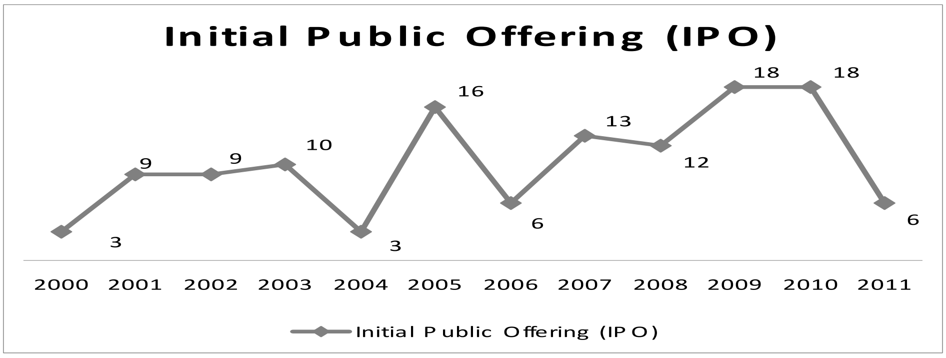
The size of the market can also be measured in terms of the amount of issued capital. Figure: 3.22 present the status of the issued capital in CSE during the period between 2000 and 2011. This upward slopping line representing issued capital reveals that the issued capital in CSE was relatively small between the year 2000 and 2005. But at the beginning of 2006 up to the year of 2011, issued capital is found to have a significant rising trend. On an average, the issued capital at CSE has increased significantly over time.

Figure 3.16: Amount of Issued Capital in Chittagong Stock Exchange (CSE)



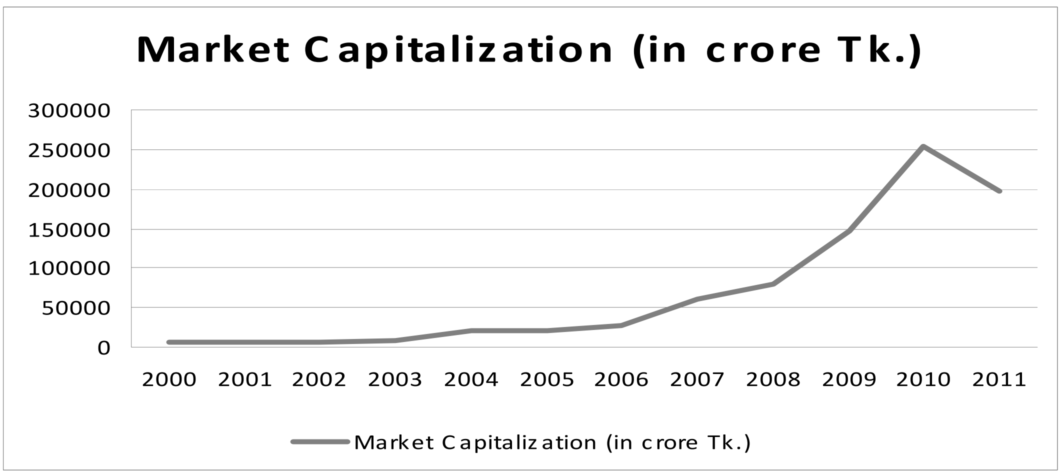
Number of initial public offering (IPO) is another important development indicator for the stock market. The number of IPOs between 2000 and 2011 held at CSE has been presented in figure: 3.23. It has been found that a satisfactory amount of IPOs are held in CSE except in the year of political change like the year 2000 and 2004 or after significant market downfall like the year 2011. But overall, Chittagong Stock Exchange (CSE) is found to have gradual consistency in announcing IPOs to the general public throughout this sample period.

Figure 3.17: Number of Initial Public Offering (IPO) in Chittagong Stock Exchange (CSE)



Market capitalization is considered to be another important stock market development indicator. Figure: 3.24 present the status of the market capitalization of CSE between 2000 and 2011. The line indicating total market capitalization is found to have a rising trend and it reaches its peak level in the year 2010. But after the stock market crash at the end of 2010, market capitalization value is found to have a decreasing tendency.

Figure 3.18: Market Capitalization in Chittagong Stock Exchange (CSE)



3.5.1 Functions and Objectives of CSE:

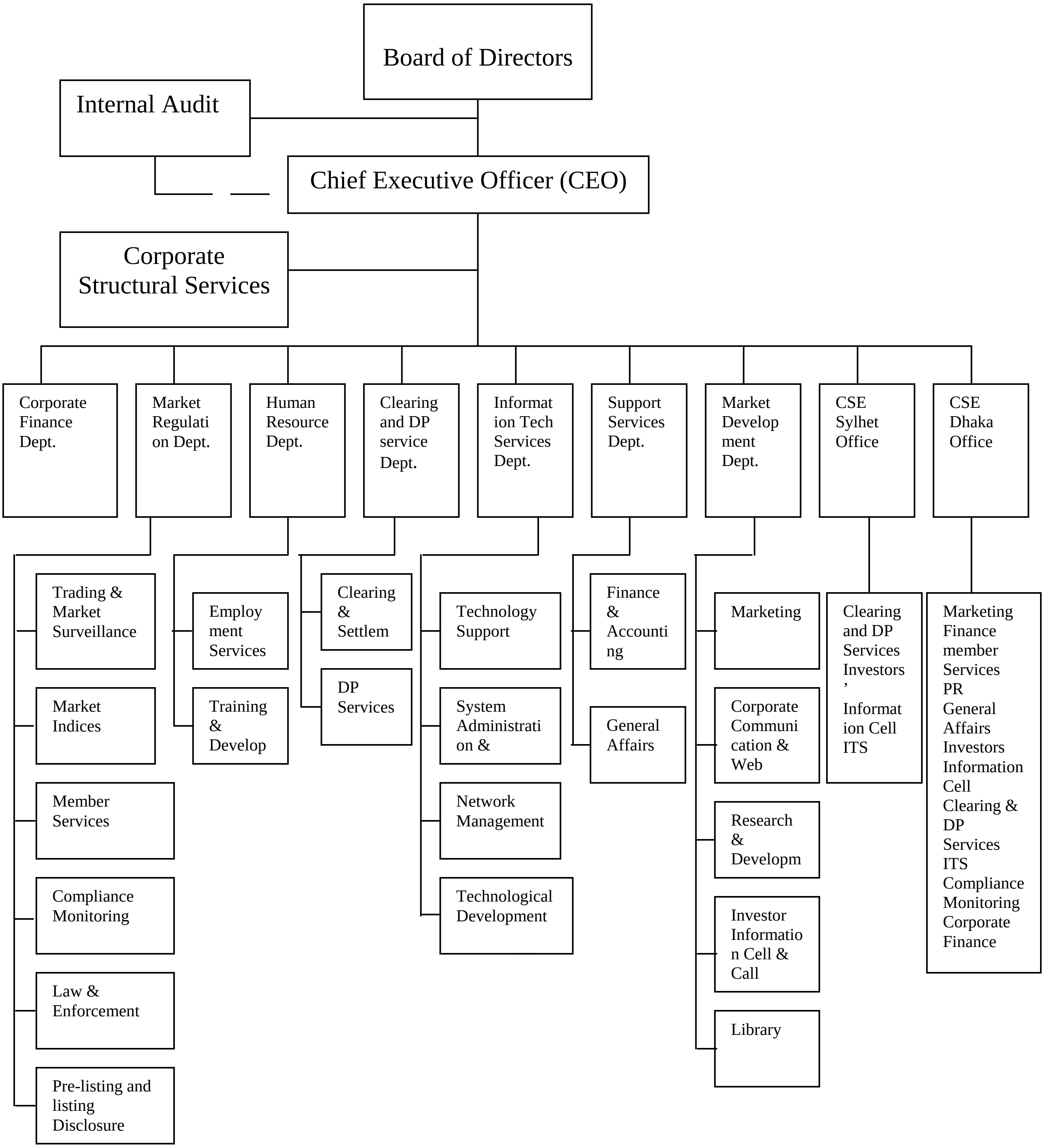
The main functions of CSE are mostly identical to DSE. The major functions of CSE are:

- ✓ Listing of Companies (As per Listing Regulations).
- ✓ Providing the screen based automated trading of listed Securities.
- ✓ Settlement of trading (As per Settlement of Transaction Regulations).
- ✓ Gifting of share / granting approval to the transaction/transfer of share outside the trading system of the exchange (As per Listing Regulations 42).
- ✓ Market Administration & Control.
- ✓ Surveillance of the Market.
- ✓ Publication of Monthly Review.
- ✓ Monitoring the activities of listed companies (As per Listing Regulations).
- ✓ Creating Investors' grievance Cell (Disposal of complaint bye laws 1997).
- ✓ Establishing Investors Protection Fund (As per investor protection fund Regulations 1999).
- ✓ Announcement of Price sensitive or other information about listed companies through online.

The objectives of CSE are:

- ✓ Increase business turnover.
- ✓ Modernizing trading system.
- ✓ Ensure effective relationship management.
- ✓ Achieve high level of confidence and professionalism.
- ✓ Engage in product and market diversification.
- ✓ Contribute to capital market policy development.
- ✓ Ensure exchange related quality services.
- ✓ To develop a strong platform for the entrepreneurs for raising capital.
- ✓ To develop transparent market ensuring investor protection.
- ✓ To provide fully automated trading system.
- ✓ To ensure quick and easy settlement system.
- ✓ To attract non-resident Bangladeshis to invest in Bangladesh Stock Market.
- ✓ To develop high standard of commercial practice.
- ✓ To develop a research cell for analysis status of the market.

3.5.2 Regulatory Structure and Organogram of CSE:



Flow Chart: Organigram of the CSE Management Structure

3.5.3 Management Functions of CSE:

The CEO is responsible for implementing the decisions of the Board, the day to day running of the exchange and formulating strategic plans for agreement with the Board. The following are the functions of the CSE and various departments of CEO:

a. Systems: The System Department carries out the following functions:

- ✓ Deal with user queries.
- ✓ Manage communication network.
- ✓ Manage information technology developments and suppliers.
- ✓ Manage internal information technology awareness.
- ✓ Manage trading and operate clearing and settlement system.
- ✓ Maintain master file.
- ✓ Print daily reports and produce statistics.
- ✓ Support internal users and setup and train new system users.

b. Clearing, Settlement & DP: This department is responsible for:

- ✓ Ensuring Exchange clearing and settlement activities through clearing house.
- ✓ Handling settlement failure.
- ✓ Handling auction settlement.
- ✓ Monitor foreign trade settlement.
- ✓ Monitor OTC trade settlement.
- ✓ Maintenance of members' margin.
- ✓ Provide depositary related services.

c. Market Operations: This department is responsible for the following**:**

- ✓ Monitor public information.
- ✓ Monitor, receive and disseminate regular company information.
- ✓ On-line surveillance.
- ✓ Inspection visits to members.
- ✓ Receive and disseminate price sensitive company information.
- ✓ Receive and manage investor complaints.

- ✓ Receive and manage other complaints.
- ✓ Manage and monitor OTC facilities.

d. Finance and Administration: This department is responsible for the following**:**

- ✓ Conducting statutory and management meetings of the company and provide secretarial services relating thereto.
- ✓ Prepare annual and periodic Financial Statement.
- ✓ Prepare Budgets and monitor the income and expenditure with the budget.
- ✓ Controlling banking operations of the company.
- ✓ Keeping inventory of the assets of the company.
- ✓ Managing financial settlement of the trading operations.
- ✓ Provide MIS to concerned departments.
- ✓ Payment to different party bills after due verification.
- ✓ Preparation of payroll of confirmed and casual staff.
- ✓ Compliance of taxation rules and policies including withholdings, payment and filling of tax returns and documents.
- ✓ Issuing certificates to brokers and other authorities.
- ✓ Maintaining IPF (Investor Protection Fund) Accounts.
- ✓ Oversee the development activities of the exchange including acquisition and development of properties, schedule payments, and coordinate associated activities.
- ✓ Providing support to develop and implement corporate strategies, mission and vision.

e. Research, Corporate Development and Information: This department carries out the following functions:

- ✓ Maintain library contents.
- ✓ Press cutting and press relations.
- ✓ Produce portfolio and other CSE publications.
- ✓ Public relations.
- ✓ Investor’s information cell.

3.6 Debacles in Bangladesh Stock Market:

The capital market of Bangladesh had two major debacles which occurred in the middle of the year 1996 and at the end of the year 2010, creating some bad impacts upon the country's total capital market. A brief debacle scenario that Bangladesh stock market had experienced in 1996 and 2010 is discussed below:

3.6.1 Debacle during 1996:

During 1996 some local and foreign initiatives succeeded in drawing some international attention which was followed by an international conference in 1994. The conference followed by some regional as well international market destabilizing events, some hedge fund managers started investing in the local capital market. The market was neither operational nor in terms of legal structure ready to absorb such sudden surge in demand both at home and abroad. Consequently within a very short tenure (from July to October of 1996) the market price level soared to a record level (of that time) height with the index rising from 894 levels to 3627 level. The market P/E ratio of all the listed securities reached to the level of 66.5 within a short period of 4 months. The 'cry-out' auction based trading system of DSE could not handle the huge demand coming from several thousand investors who crowded the Motijheel thoroughfare. Consequently street based curb market took over the legal trade executed through stock market system. Unsuspecting inexperienced new entrant investors allured by very quick profit potentials were buying anything without understanding substance, legality and validity of their investment. Unscrupulous market players (which even include some issuers) were minting fortunes by selling fake securities to the crowd who were eager to make quick profit from the market. Thereafter, for obvious reason the market experienced first major crash in l996 affecting about fifty thousand investors.

3.6.2 Factors Contributed to the Stock Market Crash in 1996:

Diverse factors contribute to the stock market crash of Dhaka Stock Exchange (DSE) in 1996. A lot of research has also been done to identify the responsible factors. A brief description of the commonly identified factors is given below:

Foreign portfolio investors (FPIs), few brokers and sponsors of few listed companies were behind the stock price manipulation in October 1996. As a result all share price index of DSE dramatically sky rocketed to 3600 point from 1000 point in six months time. Few foreign & local investors that had inside information made huge profit and a lot of general investors paid heavily.

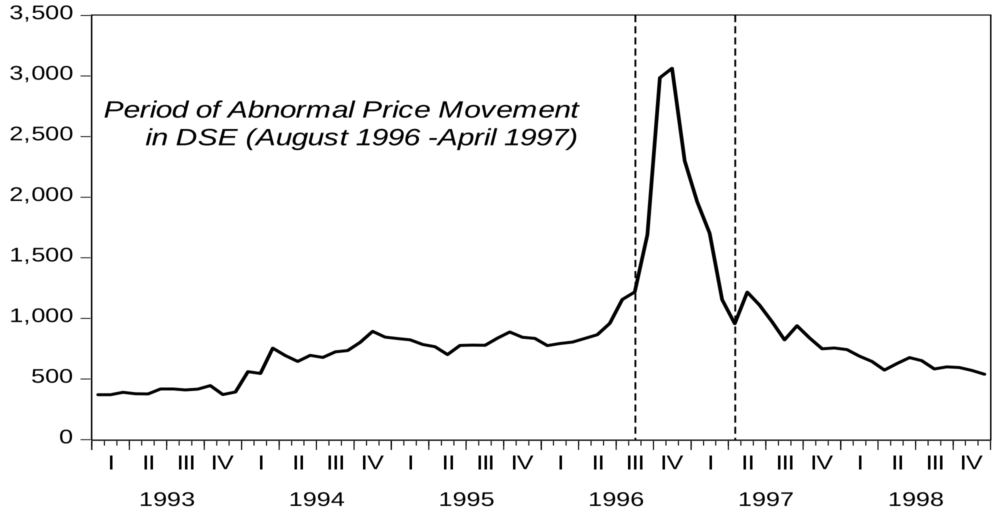
The cause of stock market crash in 1996 was the failure of market regulators mentioned by Afroz (2006). Stock Exchanges did not take any action against the dramatic price increase of listed securities during June to November 1996. Bubble formed due to abnormal demand of securities by new investors where the numbers of listed securities were very few. The reason of huge influx of investors was due to political stability in the country at that time and bringing confidence in the mind of the investors.

The Delivery versus Payment (DVP) system of trading used Delivery versus Payment (DVP) mechanism which was used as one of the main vehicle of manipulation. One of the pleas to facilitate high volume transactions, DVP device was initiated by the member-brokers. During the upsurge of share trade in DSE and CSE, the members-brokers used the DVP mechanism between themselves in respect of big domestic deals. It was reported that there were fake DVP deals in a good number of cases. These deals were recorded in the transaction sheet only when the concerned party settled the transactions. A good number of such cases were not settled and as such had not been recorded. Both the involved parties didn’t raise objections to this state of affairs. This transpires the fake deals which were purported to impress the market about the rising trend of the share price of particular scripts. It is interesting to note that DSE authorities denied of any fake deals of DVP. However, as there were no official record of the unsettled local DVP deals between the member-brokers except those through custodial banks, it may be difficult to provide conclusive evidence. But circumstantial evidence suggests the existence of fake and unsettled DVP deals.

The usual practice of T+4 of DSE had not been followed in respect of DVP deals. It is presumed that this practice was not purposely followed to help manipulation in favor of the DVP dealers. What followed is that the buyer took time to contact the clients and on getting advances from them, he went for materializing the said DVP deal.

Thus DVP mechanism not only helped in raising the share prices beyond proportion but also provided the scope to make money without investments by the member-brokers.

Figure 3.19: Stock Market Crash of Dhaka Stock Exchange (DSE) in 1996



The number one vehicle to effect manipulation in share prices had been spreading of rumors amongst prospective investors. The brokers, agents and in some cases employees of the related companies were engaged in exhibiting rosy picture about future expansions or important business developments. To exploit the circumstances, some of the agents entered into transactions at noticeably higher prices and in big volumes. Of course some of the transactions were purported to make the rumors believable to the investors. The prevalence of big kerb market provided wider scope to make use of the rumors to effect price hike of the shares through infiltration into kerb market by the agents of the sponsors and member-brokers.

The Stock Exchange members concurrently functioned as brokers and dealers. Although it is an established norm that the brokers have to discharge duties on behalf of the clients first, it had rarely been so when the interest of the clients and the member themselves clashed. In fact, the money received from the clients to purchase shares was rampantly utilized towards their own end. The concerned client was told that the share were not available. On the other hand, in the falling market clients were given the shares which were bought afterwards at lower prices. This could happen because these clients were not provided with 'hawla' details.

The 'success stories' of making quick money by some new entrant youngsters spread to every nook and corner of Bangladesh. This sudden generation of income to new investors had tremendous demonstration effect. Many were tempted to think that they were missing the bus. So the stage was set to make stock market a business hub for anybody and everybody who could manage to have some money.

3.6.3 Debacle during 2010:

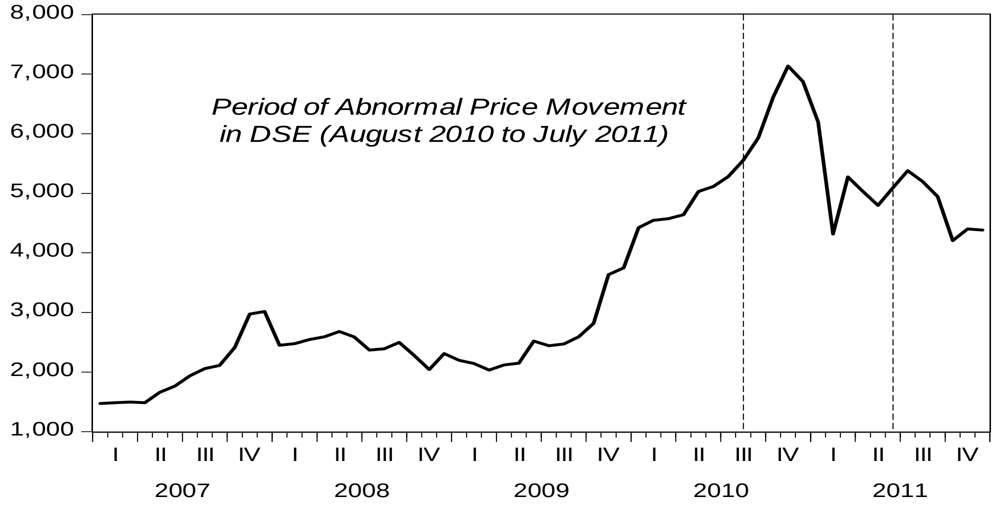
History of the stock market crashes show that 'Bull Run' before a stock market crash is kind of normal phenomenon. There was no exception for the stock market crash of Bangladesh in 2010-11. Most important factors that guided to the Bull Run are described here.

3.6.4 Root of Bubbles:

Due to political unrest of Bangladesh, state of emergency was declared and military took power of the country in 2007. During military-backed regime investment in real sectors as well as FDI decreased but the inflow of foreign remittance increased. Investors tried to find alternative investment sector to invest their savings and found stock market as an attractive alternative (Khaled, 2011).

According to CPD (2011), the total number of BO Account holders on 20th December, 2010 reached to 3.21 million though the number was 1.25 million in December 2009. Most of these new investors don't have enough knowledge about the stock market but invest their most or all of their savings in the market. 238 brokerage houses opened 590 branches at 32 districts. As CPD (2011) found, internet-based trading operation, opening branches of brokerage houses across the country, easy access to the market information, arranging a countrywide 'Share Mela (fair)' are the factors for increasing investors. But supplies of new securities through IPOs were not enough to chase huge capital of too many investors in the market.

Figure 3.20: Stock Market Crash of Dhaka Stock Exchange (DSE) in 2010



Banks & other financial institutions of Bangladesh had a lot of excess liquidity due to less business opportunities in the recession period of 2009-10. To minimize the cost of bearing excess liquidity and as a great opportunity, theses financial institutions & its officials as well as other people took loan and invest in the share market. This made a huge influx of liquidity in the share market. It was seen that the daily transaction in the share market was on an average from Taka 20,000 to 30,000 million in 2010 and the figure was double comparing to 2009 (Raisa, 2011).

To make sure that the economy of Bangladesh grows by 7-8% per year, Bangladesh Bank (BB) adopted accommodative monetary policy during the high inflation periods to support investment. Bangladesh Bank has pegged Taka against dollar to support exports. As Taka has been undervalued it has made excess growth in money supply. In the last couple of years, broad money has made excess liquidity and the main motive behind it was Bangladesh Bank’s exchange rate policy. A big portion of this excess liquidity had gone to the stock market but there were very few shares in the market. The policy that was adopted by BB to grow economy by increased exports & investment eventually misguided and ended up blowing the mother of all bubbles. Then government again fuelled the bubble after permitting whitening of black money through tax breaks and schemes (Rahman, 2011).

Moreover Security & Exchange Commissions (SEC) was not capable to monitor the market conditions properly and adequately. Due to the poor monitoring & market surveillance, share prices of Z Category Companies and small companies were increased dramatically. Moreover, some initiatives taken by SEC were not effective and changed directives frequently such as; it changed directives of margin loan ratio 19 times (Raisa, 2011).

3.6.5 <u>Factors Contributed to the Stock Market Crash in 2010:</u>

Bangladesh Government commissioned a committee consisting of four members led by Mr. Khondhkar Ibrahim Khaled (chairman) to find out individual and institutions involved in the stock market scam in 2010. The committee submitted a report consisting of the reasons for crash and recommendations with couple of case studies on 7th April, 2011. The report has identified a group of manipulators including key officials, auditors, issuers, issue-managers, brokers, individual investors and some other stakeholders. According to the Investigation Report (2011) of the probe committee, reasons for the stock market crash are following:

- **Role of Market Regulators and their Employees:** The role of SEC to control and monitor capital market, working in favor of manipulators, approving unethical proposals and issuing wrong directives which lead to unexpected market conditions deteriorated the image of the SEC. Investigation report mention some names of corrupt employees of the market regulators who were directly or indirectly responsible in the market manipulation. There is a job overlapping between SEC and Exchanges. Such as, DSE & CSE both organizations have surveillance department for the same job but there is no co-ordination. Listing committee of DSE & CSE examines listing application of company but SEC doesn't do it properly and approve it. Placement of mutual fund & IPO at a price lower than the market value has become a new method of bribery for powerful employees of regulators. There is another accusation that these senior level employees received placement by using other's name which is very difficult to identify. The report admits that the SEC doesn't have enough employees for example; qualified accountant, financial analyst, and researcher to control and monitor the market. Rahman & Moazzem (2011) identified in their study that Dhaka Stock Exchange (DSE) is becoming more volatile but the regulators are unable to defend it. They also suggested increasing manpower and quality of professionals in SEC.

- **Demutualization of Exchanges:** There are both elected and nominated members in DSE and CSE. Basically, elected members run the administration due to less interest & relation of nominated members. As a result, the players of the capital market act as controllers. Meanwhile, controllers are inactive during unethical activities due to conflict of interest. In the investigation report it was said that different stake holders of capital market and civil society support & demand for demutualization of exchanges. The meaning of Demutualization is separating controlling functions from controller's functions, empowering controller and taking decisions without being motivated by the market players.

- **Investment of Bank in the Capital Market:** In 2009 & 2010, banks and financial institutions invested huge amount of deposit money in the stock market. As a result share prices sky rocketed until December 2010. When Bangladesh Bank restricted more than 10 percent investment of deposited money, increased CRR and SLR ratio, created liquidity crisis and market crashed.

- **Pre-IPO & IPO process:** Investigation committee considered that due to Pre-IPO & IPO manipulation share prices sky rocketed and that is the main reason for the share market crash. Manipulators illegally & unethically created a Kerb market in Pre-IPO stage. Without recommendation by the listing committee, application for IPO was accepted. SEC did not examine abnormal asset revaluation and indicative price. As a result in Pre-IPO or IPO stage placement process and placement trade kerb market overvalued share prices. This eventually generated liquidity crisis in the capital market.

- **Uniform face value of share**: During the meeting between investigation committee and different stake holders of share market, a most important reason for abnormal climbing of index was indicated to ***uniform face value of share at***

Taka 10. Splitting share does not change revenue or asset of a company and should not affect the share price. But Small investors showed their utmost interest to buy split share with their small investment and consequently pushed the price up. Up to 62 listed companies split their shares in 2009 & 2010. So, it abnormally increased liquidity in the market and brought notable change in market capitalization. Investigation report shows that Margin Call (MC) increased by 655% of companies those adopted share uniform and MC increased only 46% of those that did not adopt. From July 2009 to December 2010 the role of total MC were 81.5% of companies which adopted share uniform and only18.5% those that did not adopt.

- **Placement trade / Kerb market:** Before issuing IPO, Issue manager or Issuer Company sell shares to their nominated person and that is called Private placement or pre-IPO placement. Private placement is risky because it doesn't have accounting discloser. In the developed countries there are some fixed rules but in Bangladesh, SEC didn't have proper rules for it. As a result some manipulators used it as a tool of price manipulation. Investigation committee found that in most of the cases placement was offered at less than the IPO price. Though aim of public offering is participation of public but placement doesn't make sure it. Eight companies issued convertible preference share in 2009 & 2010 in which average 69% went for placement. So, participation of the public was hindered and that created placement trade or Kerb market. Some companies distributed 50-90 percent of their paid up capital in private placement. However, when a company raises too much paid up capital through private placement, the number of free-floating shares decreased. That's why the difference between demand & supply push share prices up. Moreover, non-listed companies created liquidity crisis as huge investment was stuck up with these companies. Placement created new process of trading outside of the share market and that is illegal. By taking chance of placement many small companies raised capital from illiterate and un-informed investors with their artificial financial reports.

- **Omnibus account:** Investigation report found Omnibus accounts of ICB and merchant banks as another major reason behind the stock market debacle. Every branch of merchant bank operates only one omnibus account. There could be 3-

10 thousands BO Accounts under the omnibus account which are not under the surveillance of SEC. So, information of individual accounts and its transaction are kept only with merchant banks. As investigation reports shows that this kind of account made a lot of illegal transactions. It publishes name of 30 big players including ICB for a lot of suspicious transactions and says most manipulators traded from the omnibus accounts. It was also reported at least Taka 2.5 billion has been traded from hidden or omnibus accounts.

- **Asset revaluation & Rumor:** By taking chance of weak asset revaluation method companies have overvalued their asset. In this process dishonest auditors generated artificial audit reports. So, calculating of NAV on overvalued asset indicates wrong signal. Some companies issued Bonus shares against unrealized gain of revalued asset price which is a faulty accounting practice. There is rule to maintain provision against "deferred tax" during asset revaluation to pay tax in future, but companies are not following it. Investigation reports pointed some companies which got NAV more than 100% to 3,472% after asset revaluation.

- **Book building method:** It's a procedure of determining price of IPO at which it is offered. The fair price is determined by the demand of a security from institutional investors and their **indicative price**. The main aim of introducing this method in Bangladesh stock market was to attract more firms for enlisting in the stock exchanges through fair share pricing. However, it was found as an instrument of manipulating market prices. Investigation report reveals that during the price discovery/bidding stage investors manipulated share prices for placement with too high price. High price was maintained only for the lock-in period and then investors offloaded their shares. As a result, they pulled out a lot of profit within a short period and after that the share price did not increase. In this process corrupted Issuer and issue manager manipulated the price.

- **Serial and artificial trading:** Some manipulators created artificial active trading environment among themselves through bulk transaction and increased share prices. Moreover serial trading and price manipulation by many buy-sell orders through different accounts and broker houses which overheated the market.

- **Issue of Right and Preference share:** Right Share is issued at a discount price to existing shareholders. SEC took 4/5 months to take the decision of right issue proposal which is mysterious. Meanwhile companies inform the market about Right issuance and increased the share price. Moreover, issuance of Right share increase number of share which should decrease share price but it did not happen.

  Investing in Preference share is safe to get a fixed percentage of return. To make the share attractive companies keep an opportunity to convert it and in that case it is called *Convertible Preference Share*. Companies issued preference share for only 2-3 months even for 1 month which is not common in other countries. The faults with convertible preference share were its time period (short), convertible process and private placement. Investigation committee found that SEC did not have proper guidelines for Right and Preference Share issuance.

- **Suspicious transaction of top players:** Investigation report reveals some names of individual and institutional investors as top buyers and sellers during abnormal increase and decrease of index in different time periods. The transactions of these investors were suspicious and affected the market heavily and liable for abnormal rise and fall.

- **Block placement:** There was a lot of suspicious block trading of mutual funds. Some investors got enormous amount of placement time to time.

- **Direct listing:** With the approval of SEC, few companies have been directly listed in the stock exchange. These companies come to the market with inflated share prices. Investigation report mentioned that indicative prices of these companies were determined even 58 times more than EPS and 9 times of NAV. Though share prices of these types of directly listed companies have been artificially determined, but SEC or exchanges did not investigate the reason of abnormal price.

Mr. Khondhkar Ibrahim Khaled, chairman of the investigation committee has identified and mentioned all the above mentions factors that significantly contributed to the stock market crash in 2010. All these factors call for detailed monitoring and appropriate policy measures of the controlling authority of the stock market to avoid such a big disaster.

3.7 Reform of the Bangladesh Stock Market after the Debacles:

The stock market crash reveals structural weaknesses of the market. This leads to all concerned feeling the agenda for market reforms. Rules, laws and guidelines are framed and implemented to improve infrastructure and foundation on which the Stock Exchanges can operate effectively. Major notable features of capital market reforms implemented so far include:

a) Reorganizing SEC to strengthen infrastructure capabilities and build capacity

b) Updating rules, laws and guidelines to improve regulation framework:

- ✓ Amendment of the SEC Act 1993 to empower SEC a vetting power, financial penalty power with a view to monitoring and enforcing compliance of rules. SEC is also allowed to conduct special audit to detect window dressing in the accounts of the listed firms, if it suspects.
- ✓ Information disclosure rule specifying the requirements to comply with the International Accounting Standard (IAS) and International Standards of Auditing (ISA) for timely and quality information disclosure in the market.
- ✓ In the new issue rule, the pricing of IPOs has been delegated to the issue manager.
- ✓ In the merchant bank regulation, three activities, viz., issue management, underwriting and non-discretionary portfolio management, are restricted to merchant banks operating in Bangladesh.

c) Separation of the management from the ownership at both DSE and CSE

d) Inclusion of the representatives of the listed companies and the investors on the governing bodies of both DSE and CSE

e) Automation of trading at both DSE and CSE introducing order-driven system replacing out-cry system

f) Amendment of the Trust Act, 1882 enabling pension fund and insurance fund investing in securities market and thereby create demand for securities.

g) Enactment of the Central Depository Act enabling national securities ltd. company to establish CDS. The implementation of the on-line CDS will in fact avoid problems of "fake shares" and "short sale" to a great extent.

3.8 Obstacles of Bangladesh Stock Market:

Securities markets in Bangladesh encountered problems both from supply side issues and demand side issues. The status and development of Bangladesh stock market has to be examined when to diagnose the problems and perceive their causes. Some problems of the Capital Market of Bangladesh are mentioned below:

1. The Securities and Exchange Commission (SEC) and capital market participants are weak. The SEC lacks sufficient capacity to regulate, monitor, supervise, or enforce regulations effectively and has limited resources to devote to its development functions. As a result, the SEC's authority to oversee any structural changes at the two stock exchanges is being undermined. The managements of the two stock exchanges are unable to regulate and supervise their members' activities effectively: the exchanges are owned and dominated by brokers, so their businesses take precedence over the governance of their exchanges.

2. Neither the SEC nor the exchanges have effective automated surveillance systems that can detect, monitor, and prevent market abuses and malpractices. This has affected market confidence, which has often been cited by investors as the major constraint in the development of the capital market.

3. The limited number of listed securities has always been a constraint on improving the liquidity and market capitalization of the stock market. The main impediments include an inefficient pricing mechanism, issuer's concerns over poor corporate governance, and high listing costs. For primary market

development, the IPO approval process, pricing methods, and the capacity of merchant banks need to be improved. Mechanisms that facilitate securities transactions in the capital market, such as securities borrowing and lending, need to be introduced.

4. Market participants, including brokers, dealers, and merchant bankers, require license to trade from the SEC. However there are no professional standards and minimal qualification requirements (e.g., examinations and professional training) imposed by the SEC or the exchanges on any of the intermediaries. To strengthen governance and the quality of market intermediaries, an examination and minimum qualification standards need to be introduced as a prerequisite for licensing by the SEC. Only qualified and duly licensed personnel should be al-lowed to deal with the public in transactions involving securities. Currently, there are no institutions in Bangladesh which offer courses specifically related to the functions and regulation of financial intermediaries.

5. The majority Government-owned Investment Corporation of Bangladesh (ICB) remains the single largest integrated capital market operator. ICB and its subsidiaries accounted for 32% of total combined turnover on the DSE and CSE inFY2004. To address conflicts of interest in its combined operations, three separate subsidiaries were created at ICB in 2002. However, all the objectives of un-bundling ICB’s operations have yet to be achieved. Other problems include the followings:

- ✓ Lack of infrastructure and physical facilities
- ✓ Existence of only dealer-broker-members (no specialist/market maker)
- ✓ Market dominated largely by unsophisticated investors
- ✓ Lack of diversity in products' availability in the market
- ✓ Inefficient capital market—both operational and informational
- ✓ Lack of proper and adequate disclosures
- ✓ Certifiers of financial statements and property evaluators of the company are the same/identical
- ✓ Management and Owners (Councilors) of DSE are entwined

- ✓ Lack of enforcement with the compliance of rules and regulations
- ✓ Corporate governance—sponsor-owners are managing the firm. In al-most all cases, no professional managements are hired to run the affairs of the listed company.
- ✓ Lack of ethical orientation, education about capital & securities markets.
- ✓ Lack of trust, self-respect amongst interest groups. These are important preconditions for building up a healthy and investment friendly market atmosphere.
- ✓ Lack of potential securities and narrow options for the investors.
- ✓ Disclosure problem-inadequate disclosure, concealment of facts or some-times fabricated disclosures appear in the annual reports.
- ✓ Infusion of fake shares.
- ✓ Exaggerated projection in prospectuses.
- ✓ Credit facilities are inadequate and interest rates are exorbitant.
- ✓ Problem of rebuilding the image of presently depressed market.

3.9 Measures to be Taken to Resolve the Problems:

Capital market development is related with the financial deepening, which in turn, depends on effective financial intermediation as well as on the availability of a wide variety of financial instruments. In this context, merchant banks have yet to play due role in revitalizing the stock market. Measures can be initiated to remove the constraints that merchant banks are facing in order to make them effective are as follows:

1. Merchant banks (MBs) should be allowed to deal in secondary securities on their own account, which are not currently allowed.
2. Merchant banks should provide price support/stabilization of their under-written IPOs in the immediate aftermarket. They would be able to offer market-making activities in primary and secondary market and to extend loans to their clients for margin buying of securities, if they could access funds at softer rates.

3. Capital Market stabilization/Development fund should be established at the Bangladesh Bank (BB). The fund will counter finance merchant banks through commercial banks to finance their clients' investment activities. Otherwise, merchant banks should be able to obtain refinancing facilities from the BB on certain margin basis. This will make MBs active and inject fresh fund in the securities market.
4. MBs as wholesale banking are given more activities in order to be sustainable and viable ones.
5. Making the market information dissemination system perfect and pure.
6. Corrective measures to rumors and fake reports and thus making the trading of securities smooth and uninterrupted.
7. Prompt explanations to unusual market actions.
8. Refrain companies from misleading potential investors through fake reporting and forecasting.
9. Refrain sponsors from buying and selling own company securities without notifying the exchange through writing.
10. Making the sources of rumors ineffective in the trading floor by strengthening the market intelligence force.
11. Quick transformation to Central Depository System, which is expected to reduce workload of physical deposit and withdrawal of securities.
12. Enhancement of ethical standard of all the parties involved in trading.
13. Restoring of public confidence through application of educative programs like schooling on securities market and orientation program. The following other measures can be undertaken for the development of capital market:
14. The listed companies that pay regular dividend should be given tax incentives and tax rebates as well.
15. The mode of privatization of industries will be implemented through public issue of shares. This will deepen the securities market, diffuse ownership and bring in market disciplines.
16. The government should off-load its equity holdings in SOEs and MNCs through stock market. This will improve the supply of securities in the market.
17. Bond market needs to be developed. The implementation of government securities with medium-term and long-term maturities will also broaden the base of bond market.

18. Establishment of a separate judicial security tribunal for dealing with cases related to securities market.
19. Disclosure of information to the public in the fullest possible dissemination system can make the people aware about the latest situation.
20. Prompt clarification or confirmation of rumors and reports that may likely to have an effect on the trading of securities or would likely to have a bearing on investment decision.
21. The companies concerned must refrain from disclosure like exaggerated reports or predictions which exceeds what is necessary to enable the public to make informed investment decisions.
22. Insider must not trade on the basis of material information which is not known to investing public. Insider should refrain from trading on principle, even after material information has been released to the press or through other media.
23. Every director, promoter or person of authority from the sponsoring group should not involve in buying/selling of its own company's securities unless fulfilling requirement to report to the exchange in writing about their intention to buy or sell.
24. Ethical standard of all interest groups must be enhanced so that everybody understands the sanctity of this knowledge based securities industry.
25. Public confidence should be restored and confidence building activities must be carried out through educative programs. Education has no alternative and thus education about capital and securities market is one of the most important aspects that help investors taking investment decision. Education program, orientation program and inclusion of securities and non securities issues in the syllabus of the secondary and higher secondary levels can build awareness about the capital market and its operations. It is evident that all interested groups in the marketplace and the Government as well has to play their respective roles promptly in order to restore the gravity of the market. Government should play the role of a facilitator, partner in progress and growth foster in the revolutionary movement that is desired to occur in the market.

3.10 Recent Initiatives of DSE for Expansion of Securities Market:

1. Signing contract with Dubai-based Info-Tech Company for integrated software Book Building System has been introduced in Bangladesh Capital Market. Book Building System, modern and scientific system of price discovery, will be able to attract the entrepreneurs to get their profitable business ventures listed with the country's growing securities market.
2. MSA Plus is being up-graded time to time in collaboration with India-based Cambridge Solutions to start internet-based transaction soon. After the completion of up-gradation of this work and commencement of internet-based trading, transaction facilities of securities would reach the doorsteps of investors across the world.
3. DSE is upgrading its automated trading system time to time to meet up the demand of the capital market. As number of transactions increases, DSE took initiatives to tune up its trading Server in December 2009. Present Trading Server has capacity to handle around 6,00,000 trades/day and to support trader IDs up to 5,000. At present Trading activities are being operated by around 3200workstations from more than 1100 locations in 30 districts.
4. In November 2009, DSE Implemented Web-based Market Data Server (MDS) for providing necessary Market Data to different electronic and print media, Cell Phone Companies, Research Institutes, Brokerage houses etc. DSE signed an agreement with a number of TV channels to provide real time trade data for broadcasting continuously during trading hours. Besides, online Trade Data is also available.
5. Plans are already underway to spread trading activities across the country and to the doorsteps of investors across the world but demand and supply mismatch has been halting the process.
6. With the core intention of executing all the professional works and to build its existing manpower into truly efficient and highly qualified human resources DSE has been continuing its tireless efforts to send its staffs to different organizations and abroad for training.
7. For smooth and time-bound supervision of all the professional jobs Chief Operating Officer and GM (Finance and Accounts) have been recruited.

Recruitment at different levels has been being continued in tune with the growing volume of activities to accomplish all the activities.

8. To continue the present trend of securities market growth DSE Board of Directors has been maintaining strong communication with the relevant authorities including Finance Minister, SEC, Bangladesh Bank, National Board of Revenue, Bangladesh Institute of Capital Market and other relevant institutions, organizations, personalities and concerned authorities.
9. A Complaint Cell/Box has been set to listen to investors, relevant stakeholders including listed companies and others and necessary steps are taken to come out the crisis time to time.
10. For transparent and smooth settlement of securities and to also reduce time DSE has been trying to establish an Independent Settlement and Clearing Company.
11. Meetings of different committees are going on regularly and time to time suggestions and instructions of those committees are carried out to enhance the departmental activities.
12. All the divisions and departments have become prompt in carrying out day today activities and also assigned responsibilities in a far better and quicker way than those of past events.
13. DSE Board of Directors visited USA and show-cased Bangladesh capital market to Non-Resident Bangladeshis to draw their investments in the market.
14. DSE has been arranging investors' awareness program in different cities to make the investors aware of the real market situation. It has also been co-operating with Bangladesh Institute of Capital Market authority so that through this newly established institute, time-bound education and practical training on securities market related issues may be conducted.
15. Plans are also underway to arrange road-shows and investors' awareness program abroad to spread securities market related issues among the NRBs.
16. Members of Board of Directors, members of different committees and officers of DSE have been continuously visiting different related organizations and stock exchanges and trying to utilize the experience for the better development of DSE.

17. DSE has been requesting the relevant and concerned authorities of Government and other organizations to simplify the investment procedure of NRBs.
18. DSE has placed proposals and continued conversation and discussion with relevant Government authorities to attract shares of state-owned companies. In the backdrop of DSE's proposal recently Honorable Prime Minister has intervened in the issuance of off-loading shares of Government companies and Government shares in other companies in the country's capital market. Here it may be mentioned that Rupali Bank has sold nearly 30 lakhs share and Mobil Jamuna is coming with shares of Tk. 609 crore.
19. For more consciousness and real information of market DSE has signed agreement with different print, electronic media and news agency to provide them with market data which will also enhance market growth.

Because of efforts of DSE face value standardization process has been being implemented by listed companies gradually which helps investors compare the market price of shares. More dynamism has been put in ICT Division, Operations Division, Finance Division and Administration Division. All the officers under the leadership of CEO, COO, CTO, GM (Admin) and Secretary, GM (Finance and Accounts) and DGMs have been working in a team to carry out their responsibilities smoothly for further development. Discussions are also underway to attract shares of big business. DSE authorities have been continuing discussion with the entrepreneurs on regular basis which will further help increase the depth and dimension of the country's securities market.

3.11 Actions Required for Restoring Investors' Confidence on the Market:

Present situation of Bangladesh stock markets needs to be strengthened to provide greater investors' confidence and to improve market liquidity and competitiveness. The existing trading and settlement systems need to be addressed for reform. To this end, the issues that deserve immediate attention are as follows:

1. The membership of stock exchanges to institutions and corporate sector with adequate capital is required. Improvement of the flow of information,

introduction of a system of market-maker in addition to the prevailing order-driven system, credible quicker settlement and the development of over-the counter markets (OCT) for large green field projects and non-listed securities are the prerequisites.

2. To redress the problems of the stock markets in Bangladesh, policy prescription should aim at par to the favorable environment within which the flaws of the market could be mitigated, activities of hidden consortia would be ineffective and the likely exposure of investors to various market abuses including market manipulation should be reduced.
3. Due emphasis should be given to implement the existing rules and regulations;
4. Regulatory framework should be adequate for the prevention of un-bridled speculation, market-rigging and insider trading so that erosion in public confidence can be contained;
5. Attempts should be taken to make the present order-driven system of automation foolproof so as to eliminate the opportunity of manipulating the market.

Developing countries which accounts for 75% of the world's population, have an enduring need to attract capital and technology to improve their infrastructure and standard of living. Developing economies, thus, look forward to their capital markets as the engine for future growth as its existence ensures mobilization of surplus funds to the ones suffering from deficit. In Bangladesh, capital markets that are yet to be further nurtured to get the fruit out of it. Without doing this, it is not possible to undergo heavy industrialization and other capital based development. It is true that the market has been suffering from inadequacy of good scripts. Out of around three thousands public companies, only two hundred and twenty have issued securities keeping a large number away from the securities market. It is further observed that Government is still holding lion portion of many blue chip company shares. These problems must need to be resolved to strengthen the capital market. Various methods and policies may be adapted regarding this, but the investors' mindset is one of the most important things that must be changed to ensure the development of the market. If the market could be strengthened properly, it is only then we can have a sound economy in terms of capital and related developments in our country.

CHAPTER 4

MARKET EFFICIENCY AND EMERGING STOCK MARKET

4.1 Efficient Capital Markets - Concepts and Forms:

The purpose of capital markets is to transfer funds between lenders (savers) and borrowers (producers and entrepreneurs) efficiently. Individuals and firms may have access to productive investment opportunities with anticipated rates of return that exceed the market-determined borrowing rate but not enough funds to take advantage of all these opportunities. However, if capital market exists, they can borrow the needed funds. Lenders, who have excess after exhausting all their productive opportunities to funds with expected returns greater than the borrowing rate, will be willing to lend their excess funds because the borrowing/lending rate is higher than what they might otherwise earn. Therefore both borrowers and lenders are better off if efficient capital markets are used to facilitate the process of fund transfer. So efficient capital markets, which are considered to be an important prerequisite for facilitating the transfer of funds efficiently, are of three different forms:

(a) ***Operationally Efficient Capital Market:*** Operational efficiency refers to the cost that buyers and sellers face in transactions of securities in the capital market. It may be prompted by competition between underwriters for the primary market transactions, between market makers and brokers for secondary market transactions. It may also be prompted by competition between exchanges.

(b) ***Allocationally Efficient Capital Market:*** A capital market is said to be allocationally efficient when prices are determined in a way that equates the marginal rates of return (adjusted for risk) for all producers and savers. That means scarce funds are allocated to that investment opportunities that yield highest marginal rates of return and continues until it is equal to the rate of marginal cost. In an allocationally efficient capital market, scarce savings are optimally allocated to productive investments in a way that benefits everyone.

(c) ***Informationally Efficient Capital Market:*** A capital market is said to be informationally efficient when the price of stocks quickly and instantaneously

reflects all relevant information that is available about the intrinsic value of that asset. That means stock prices quickly absorb all available information about the past history, publicly announced information or any information which is privately disclosed and rapidly reflected in stock prices. When stocks are traded in an informationally efficient capital market, prices are accurate signals for capital allocation.

In general cases, market efficiency implies informational efficiency which consider the extent to which the price discovery process on a stock market is able to assign accurate relative values to the listed securities (Ahmed M .F., 2002). This is important because these value ranking ensure channeling the rational savings to their most efficient users. It is commonly believed that a stock market is said to be efficient if it speedily and correctly incorporates all available and pertinent information into its prices (Fama, 1991). The quick adjustment of prices to any new information about the fundamentals of the listed companies ensures that no single investors, or group of investors, can repeatedly make abnormal returns on a market by using the same information set. This is because such information will have already been incorporated into prices (Fama, 1995). The body of the knowledge that explains the way in which market traders incorporate new information into prices is called *Efficient Market Hypothesis* (EMH). Fama [1970, 1976] has done a great deal to operationalize the notion of capital efficiency and has made a significant contribution to make efficient market hypothesis testable. He defines three types of efficiency, each of which is based on a different notion of exactly what type of information is understood to be relevant in the phrase *"all prices fully reflect all relevant information"*.

(i)Weak-form Efficiency: In its weakest form, the efficient market hypothesis (EMH) assumes that all historical information are already incorporated into the pricing of assets. Therefore, no excess profits can be earned by basing investment strategies on past returns. This implies that technical analysis, which studies formations in past returns, is useless in predicting the future. Since past performance is already known to the market, the current situation remains unknown. This is where fundamental analysis gains attention and may be rewarding for those keen investors who do their homework on companies' financial statements.

Tests for the weak form of efficiency engage in historical data analysis using statistical and econometrical methods. Analyses concerning market value, P/E, DIV/P, and book-equity-to-market-equity influences on past data, as well as technical analysis are prevalent in such testing.

(ii) Semistrong-form Efficiency: The levels of efficiency gradually increase their restrictions, so it is natural for the next level to include the previously stated assumptions. In addition to historical data, the semi-strong form of efficiency incorporates publicly available new information rapidly into pricing; this insinuates that fundamental analysis will yield nothing.

Testing for semi-strong form of efficiency is similar to event studies. Emergence of new information usually takes the form of quarterly or annual reports or events such as mergers, acquisitions, purchase of treasury shares, new issuances or splits. The emergence of such news should induce markets to adapt quickly. We can measure the quickness and flow of the adaptation to new information.

(iii) Strong-form Efficiency*:* This level of efficiency constitutes the incorporation of all existing information, both public and private, into prices. In such a model no one can earn extra profits. Of course in reality laws prohibit trading using insider information.

Testing the strong form is a test for the existence of insider trading. We attempt to reveal the investment activity of interest groups with monopoly over key decisions in the companies. This can be observed in price adjustments taking place before important announcements are made public.

Later, Fama (1991) has reclassified the market efficiency studies into three categories. The first category consists of the test of return predictability, the second group contains the event-studies and the third group contains tests for private information.

Finance theory generally assumes that there are no transaction costs that all information is freely available and there is usual agreement on what that information means in describing market efficiency. Such a market does not exist in real world situation. However, they are relaxable in view of the realities and other conditions may be considered sufficient in order to enable the price of a security to fully reflect available information. The dominant necessary condition for an efficient market is the existence of investors, security analysts, brokers, financial journalists and market observers who are numerous, motivated and competent. They are supposed to discover which stocks are overvalued and which are undervalued. In their efforts to compete for information they make the current price to be at least close to the intrinsic price of securities. The absence of perfect conditions for efficiency in real world provides potential sources of inefficiency. Investors, therefore, try to find out overvalued and undervalued securities.

In an efficient capital market relevant information for pricing securities is rapidly reflected in the prices of those securities. The market price is a good estimate of intrinsic value and additional security analysis is not supposed to produce returns better than a buy and hold strategy. It is often said that an efficient market is a fair market. That is, investors are not expected to continuously over or under perform the market other than by the laws of chance. If a price is too high and thereby presses the price downward, the opposite will happen when price is too low. In an efficient capital market there is no reward for research. However, depending upon the type of information used by investors, efficient markets are divided into three levels mentions above.

4.2 Analyzing Emerging Stock Market:

An emerging market is defined by the International Finance Corporation (IFC) as a stock market that is in transition; increasing in size, activity, or level of sophistication. The term *'emerging market'* is applied to a country making an effort to change, and thereby improve its economy to reach the same level of sophistication as nations defined as *'developed'*. An emerging market is further characterized by IFC as meeting one of at least two criteria: it is located in a low-or-middle-income economy as defined by the World Bank and its investable market capitalization is low relative to its most recent gross domestic product (GDP). The World Bank defines emerging market as those that haven't reached the minimum gross national product (GNP) per capita of $9,656 associated with high-income (developed) economies.

Developing stock market is concerned with three different classes. These are:

- ***Emerging Markets:*** These markets belong to those countries that have growing economies and a growing middle-class. Some of these countries were once poor, and some still have high rates of poverty. Many are undergoing profound social and political change for the better.
- ***Frontier Markets**:* These markets belong to a very small nations with an early stage of economic development and nations that have a tiny stock market. These markets present immense opportunities for patient investors with an appetite for risk.
- ***Pre-emerging Markets:*** These markets belong to the poorest of the world's nations. These markets have few opportunities for investors now, but they could become really interesting in the years to come, so they were worth watching.

Emerging stock markets have become increasingly important in an international investment scene for their diversified role in individual, institutional and national development. Although each emerging market has its own idiosyncrasies, it is possible to offer a broad description of several phases common to all equity markets. These markets are found to be different stages of development associated with stages of economic development process and political stability of a particular country. According to Ahmed M. F. (2000), the different stages of development of emerging stock markets are:

(i) In the initial phase, stock prices tend to rise. With the implementing process of growth-oriented policies and attaining some degree of economic and political stability, the market stated to gain the confidence of domestic investors and become more widely accepted as an investment alternative to traditional bank deposits and often to short term government bonds.

(ii) The second phase relates to the deregulation of political markets for easy access by the international investors and for cheaper capital funding by the domestic investors since the equity markets have gained some degree of credibility at this phase. As market liquidity increases and risk-adjusted returns rise, international investors begin to reap the diversification benefits of investing in these markets.

(iii) The third phase is concerned with expansion. The markets offer prospect of high return with less volatility and the investors easily absorb new issues of stocks and corporate bonds. These lead to increased trading activity, more effective intermediation, while the growing need for a risk transfer mechanism spurs the development of equity and currency-hedging instruments such as derivatives and index products.

(iv) Finally, the market depicts the phase of maturity. As equity risk premium falls to internationally competitive levels relative to government Treasury bill rates or equivalent short term money market rates, the equity market begins to achieve the stable growth that marks a nature of developed state.

Previous literature indicates that the stock market development is a multi-dimensional concept. Measures that are normally considered include stock market size, volatility, concentration, integration with world capital markets, and the legal environments (regulation and supervision) governing a market. For example, Atje and Joavnovic (1993) test the hypothesis that the stock markets have a positive impact on economic performance. They find significant correlation between economic growth and their measure of stock market development. The measure they use is the ratio of the value of stocks to GDP. Levine (1997) uses indicators of stock market development such as stock market size, liquidity, and volatility. De Jong and Semenov (2006) use capitalization dividend by GDP as their measure of stock market development.

Now, it is very clear that there is no single measure of stock market development. Demirguc-Kunt and Levine (1996) show that different individual measures and indexes of stock market development are highly correlated. They also claim that greater volatility in market returns is not necessarily a sign of underdevelopment, as high volatility could actually be an indicator of development. Levine and Zervos (1998) found that stock market liquidity is positively and significantly correlated with current and future rates of economic growth, and they consider market liquidity to be a superior measure of market development. Levine (2002) uses market capitalization as the measure of stock market development. This author believed that market capitalization is a good proxy for general development because it is less arbitrary than other individual measures and indexes of stock market development. But the author, does however, suggest that there are conceptual problems with using market size to gauge market development.

A complete analysis of emerging stock market requires to identify the key characteristics of emerging stock market which is distinct from those of developed and less developed, or *frontier*, markets. Some distinguishing characteristics of emerging stock markets are discussed below:

1. Market Size: Emerging markets are distinct from both developed and frontier markets along two key dimensions: the overall size of their economies and the size of their financial markets in relation to their economies as a whole. Here emerging markets are far smaller than developed markets. Technical notes on the investigating emerging markets published by Darden Business Publishing, University of Virginia, states that developed and emerging stock markets have similar market capitalization on average. But the average GDP of 22 sample developed countries have more than six times the average of the emerging market countries. The difference in GNP per capita between two groups is greater still, with the average for the developed countries almost seven times larger than the average for the emerging market countries. On the other hand, market depth which is the ratio of market capitalization to GDP is another useful indicator of the level of development in an economy's financial market. In the same source (i.e. Technical notes on the investigating emerging markets published by Darden Business Publishing, University of Virginia) it has been found that average market depth of the developed countries is equal to one – which means the value of their market capitalization on average was roughly the same size as their GDP. But for emerging market countries, the market capitalization is roughly one-third of their GDP.

2. Market Openness: Market openness is another key dimension that distinguishes emerging markets from some other developed and frontier markets. We know that

Global Index of a market is created to be representative of that market. As such, it includes the most actively traded firms in the market and captures the bulk (e.g. a target of between 60% and 75%) of the total market capitalization of all listed stocks in the market. While a substantial majority of a developed country's publicly traded stocks will make the global index for that economy, on average, only about 18% of the listed stocks within an individual emerging market do so (R Burner el al., 2003). For instance, the emerging markets of Egypt, Korea, Pakistan, Slovakia and South Africa have a large number of listed firms but only a small number of firms traded actively enough to be included.

3. Market Transparency: Analyzing the amount of information available in emerging markets raises the notion of the accuracy of that information. The degree to which markets are transparent and competitive affects investors' ability to gain information and develop performance expectations. Though all markets may exhibit varying degrees of transparency, emerging markets are likely to be less transparent than developed markets. Two indicators have been developed to track the degree of transparency across countries.

- *Opacity Index:* PricewaterhouseCoopers has constructed an index to measure the transparency along a number of dimensions for 35 countries. This Opacity Index, also known as the "O-Factor", is constructed based on data from interviews with CFOs, bankers, equity analyst, and PricewaterhouseCoopers employees. It is composed of five dimensions: corruption, legal, economics, accounting, and regulatory. The O-factor itself is the simple average of the index values on each dimension. The index is useful, because the cost of doing business in countries that are not very transparent on these dimensions is higher, and external investment capital is more difficult to obtain. The index value tends to imply that, on average, emerging markets countries have larger scores than that of developed and frontier economies in all five dimensions mentioned above.

- *Corruption Perception Index (CPI):* Transparency International provides an annual index that ranks countries on the level of perceived corruption. Emerging markets account for the top 18 spots of the most corrupt countries on the list while 13 lowest corruption countries are developed nations (R Burner el al (2003).

4. Market Efficiency: Market efficiency refers to the degree to which the present price of a security reflects all the information that is known about the asset underlying the security. In an efficient capital market, new information is quickly reflected accurately in security prices. It is important when considering the efficiency of markets to break the concept into two constituent parts: accuracy and availability of information in one hand, the ease with which that information is employed to affect asset prices on the other. Empirical evidence indicates that most developed markets, with some exception, exhibit the *"weak form"* and *"semi strong"* forms of market efficiency. Past prices do not predict future returns, and asset prices adjust quickly to the release of new information. Given the relatively lower availability of market information and higher corruption, one could predict even lower levels of market efficiency in emerging markets. Empirical studies also support evidence of weak form of market efficiency in emerging market countries.

5. Market Liquidity: While all investors are concerned with their ability to get in and out of investment quickly and at low cost, investors in emerging markets are particularly concerned about the ease of capital movement owing to emerging markets' spotty liquidity. Developed markets tend to offer much greater depth of trading and hence the ability to make large trades in specific stocks without provoking a large change in the traded stock's price. Emerging markets vary considerably in their liquidity, crating a need for analytic tools that can provide insight into each market's liquidity. Several measures can be employed to this end:

- *Turnover Ratios: percent of Market:* turnover ratios are calculated as the ratio of value traded over one month to the total market capitalization. A high turnover ratio means that a large number of the shares outstanding were traded. Large turnover ratio should be associated with grater levels of liquidity, and thus it can be expected that the larger and more developed markets exhibit higher turnover ratios. On the other hand, with few exceptions, notably Korea, Taiwan, and Turkey, almost all of the emerging markets have turnover ratios lower than 5 percent.

- *Dollar Value of Share Trade:* It is also useful to examine the turnover ratio in dollar terms, as this metric gives some indication of relative volume of money moving in and out of a market during a trading day. It is found that, on average, daily dollar value of shares traded on the developed markets is significantly larger than daily dollar value of shares traded on emerging markets.

In a nut shell, it can be said that emerging markets are significantly different from those of developed stock markets. In the life cycle, developed stock market reaches at the maturity stage and from the part of the individual & institutional investors and national interest, developed stock market exhibits all performance indicators at its satisfactory level. On the other hand emerging stock markets belongs to growth stage of its life cycle and have the potential to grow and develop over time. Performance indicators of the emerging stock market are not as satisfactory as we found in every developed stock market. This less satisfactory or increasingly developing result may be due to weak regulatory framework, lack of active and literate investors, poor communication system, lack of information availability, huge amount of insider trading, lack of coordinated monetary and fiscal policy of the government in relation with stock market etc.

4.3 Dhaka Stock Exchange (DSE) as an Emerging Stock Market:

As the first stock exchange of Bangladesh, Dhaka Stock Exchange (DSE) was incorporated in April 28, 1954 which is far before the national independence of Bangladesh. After liberation war at 1971, DSE resumed its operation at the middle of 1976 with 9 listed securities, 13.61 millions of shares and debentures and Tk. 146.72 millions of Market capitalization. Right now DSE has a total of 486 listed securities with a total market capitalization of 2,668,330 million market capitalization that includes 230 equity securities, 33 mutual funds securities, 8 debentures, 212 treasury bonds, and 3 corporate bonds. Now, from emerging market perspective, DSE also exhibit certain key characteristics. These characteristics have been classified under three broad heading: *market depth, market liquidity, market activity, and market efficiency.*

4.3.1 Market Depth:

The depth of the market implies how large the market is in relation to certain macroeconomic measures like GDP. It is commonly expected that the depth of the emerging market is not as large as it is found in any developed stock market. The depth of DSE- as an emerging stock market has bees measured by four different estimates:

(i) Relative Depth of Market: One of the most important and widely used measures of emerging market characteristics is to calculate relative depth of market which is the estimates of market capitalization to GDP ratio. This estimate measures the growth of market capitalization with respect to the growth of GDP. The market capitalization to GDP ratio has been calculated for DSE from 1981 to 2010 and is presented in Table: 4.1.

It is clearly evident that with few exceptions, market capitalization to GDP ratios gradually increases with an average of 4.28 percent between 1981 and 2010. Table: 4.1 shows that market capitalization to GDP ratio is very insignificant (i.e. less than 5 percent of GDP) relative to the level of GDP. But the important findings here is that this ratio has an increasing trend. In the 1st 10 year (between 1981 and 1990) average ratio is 0.76 whereas in the 2nd 10 year (between 1991 and 2000) the average ratio is 3.01 and for the last 10 year (between 2001 and 2010) the average ratio is 9.12. Figure: 4.1 also display the rising trend of market capitalization to GDP ratio for DSE between 1981 and 2010. When market capitalization to GDP ratio is less than 5 percent for emerging markets and more than 10 percent for developed market, this result also supports the empirical evidence that Dhaka Stock Exchange belong to the category of emerging stock market.

Figure 4.1 Trend of Relative Depth in Dhaka Stock Exchange (DSE)

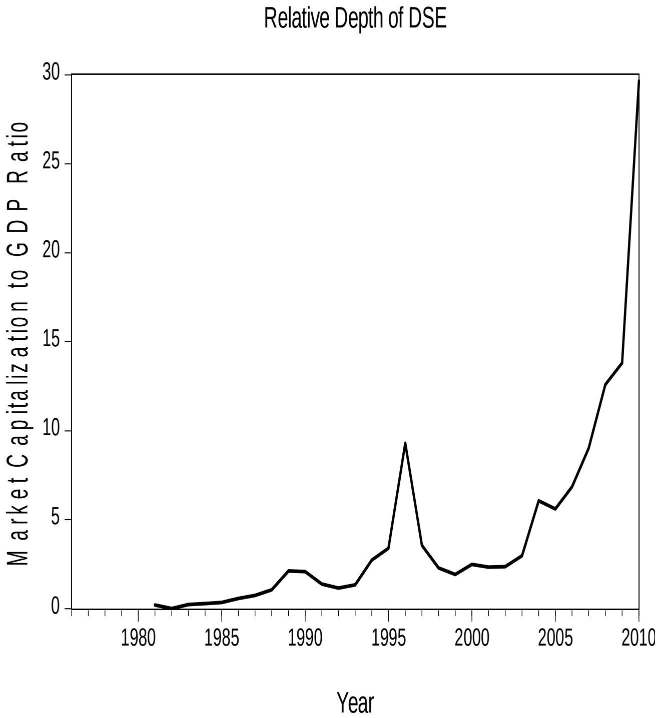
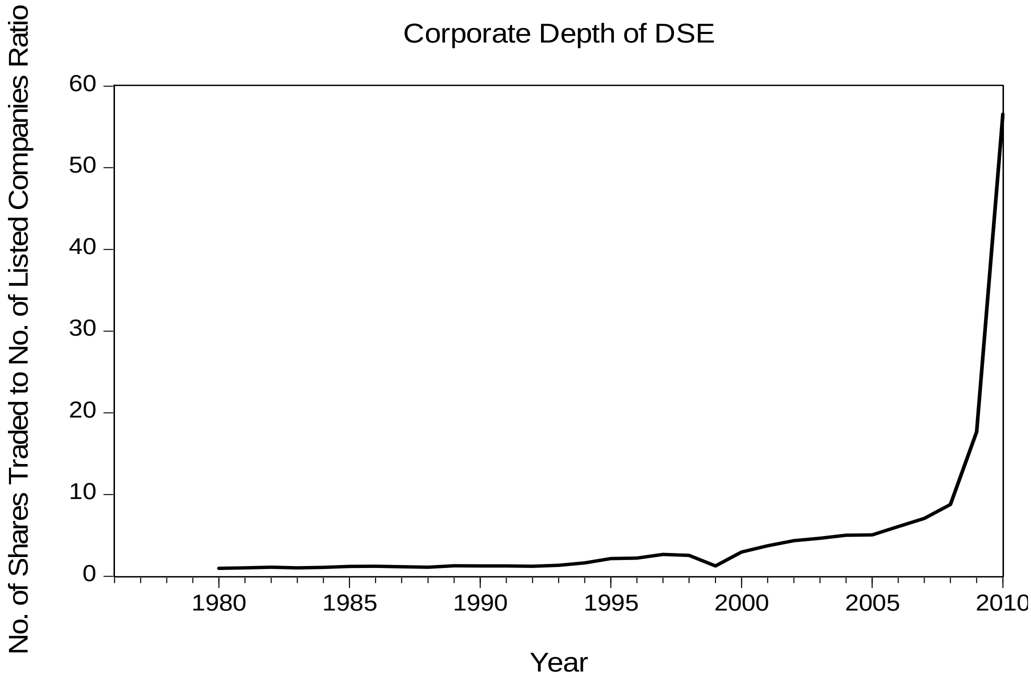


Table 4.1: Relative Depth of DSE

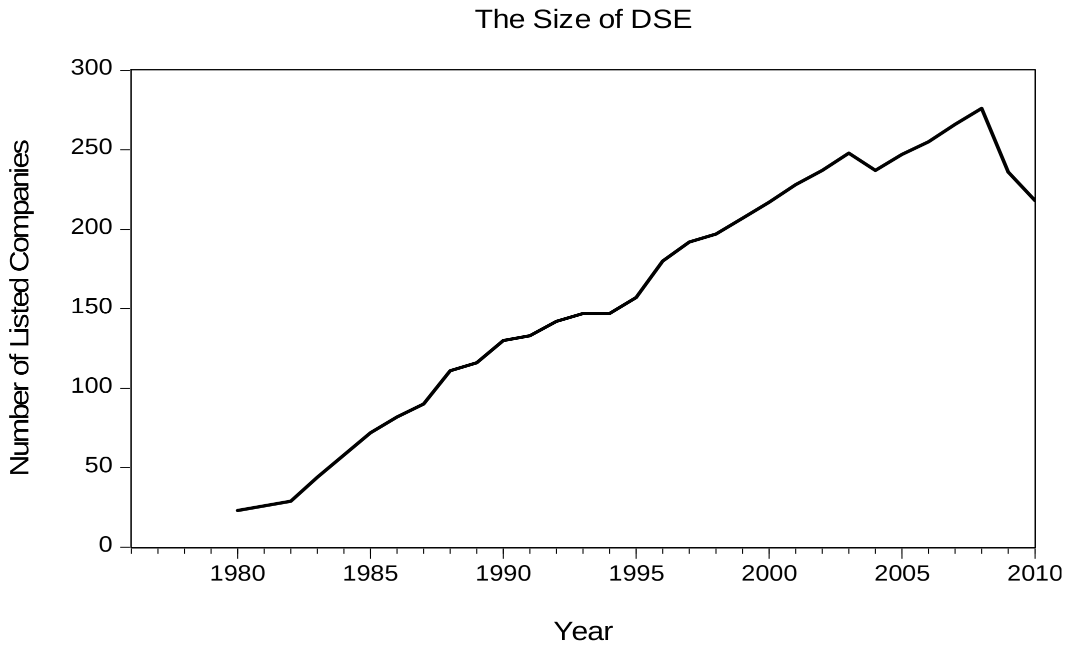
Year	Market capitalization to GDP ratio
1981	0.20
1982	0.01
1983	0.23
1984	0.28
1985	0.34
1986	0.56
1987	0.75
1988	1.06
1989	2.12
1990	2.08
1991	1.38
1992	1.15
1993	1.34
1994	2.74
1995	3.40
1996	9.30
1997	3.56
1998	2.29
1999	1.92
2000	2.48
2001	2.33
2002	2.37
2003	2.96
2004	6.07
2005	5.61
2006	6.84
2007	9.01
2008	12.58
2009	13.80
2010	29.66

Figure 4.2: Trend of Corporate Depth in Dhaka Stock Exchange (DSE)



(ii) Corporate Depth: Corporate depth is another important aspect that can be used to identify emerging stock markets. Corporate depth can be measured by estimating no. of shares traded to no. of listed companies' ratio. For emerging stock market, this ratio tends to increase over time representing on average, the active trading by the listed companies. On the other hand developed stock markets have a relatively large and stable ratio. The corporate depth of DSE has been estimated and presented in Figure: 4.2 to examine emerging market characteristics between 1980 and 2010. It has been found that, the ratio is very small and relatively stable between 1980 and 1995. After then the ratio tends to rise to the end of 2010. To identify the trend of this ratio, the total period has been sub-divided into three parts: between 1980 to 1900, between 1991 and 2000 and between 2001 to 2010. The average value of the 1st sub-period is 1.15, whereas for the 2nd and 3rd sub-period the average value is 1.81 and 11.89 respectively. Therefore, corporate depth has an increasing trend in DSE which is another important characteristic of emerging stock market.

Figure 4.3: Trend of Market Size in Dhaka Stock Exchange (DSE)



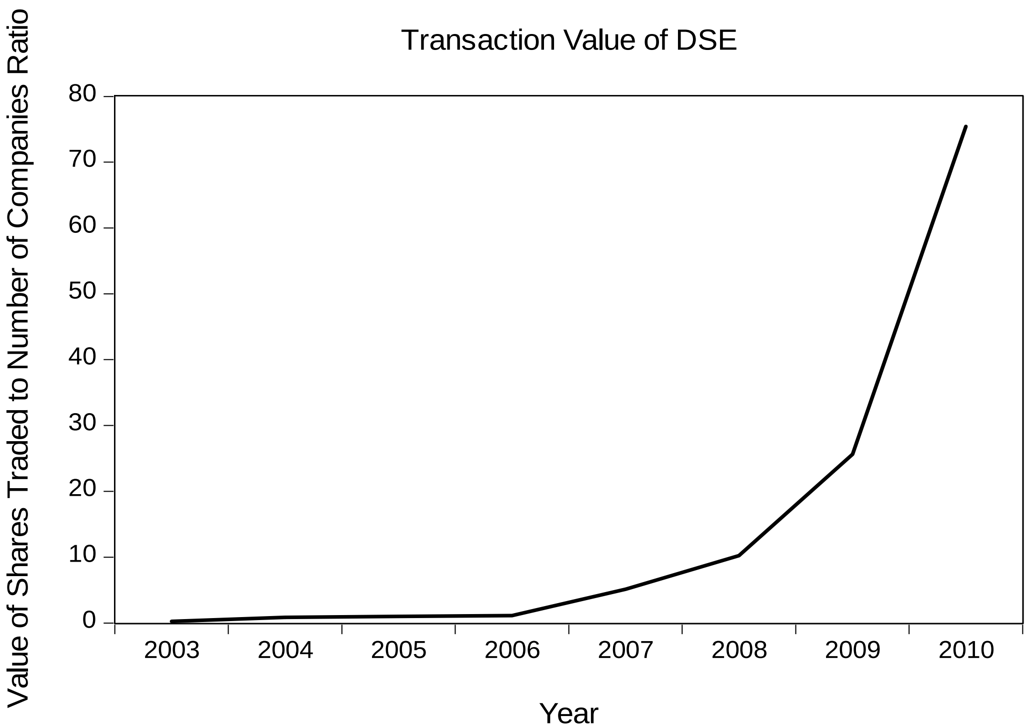
(iii) The Size of the Market: The size of the market implies the number of listed companies in the stock market. It is thought to be other important characteristics of emerging markets. A stack market is said to be emerging when its size is small but enlarging in terms of the number of listed companies. Yearly data between 1980 and 2010 has been used to estimate the market size of DSE. It is found in 1980 the number of listed companies in DSE is 23 and this number increases until 2008. But for the year 2009 and 2010 the number of listed companies decreases. The average growth rate of listed companies in DSE per year is 8.39 or 9. The rising trend of the number of listed companies in DSE also presented in Figure: 4.3. This increasing number of listed companies at DSE between 1980 an 2010 is another important indicator of emerging stock market.

4.3.2 **Market Liquidity:**

Liquidity of the stock market is another important area where emerging stock markets can be separated from developed stock markets. Here stock market liquidity means the extent of time within which stocks can be sold in the market place at a fair and reasonable price and without incurring any capital loss. In this area, from different research findings, developed stock markets are found to be very liquid because of having large number of market participants and fast transaction procedure and improved communication system, whereas this scenario is not same for emerging stock markets. Emerging markets are less liquid compared to developed stock market. But this liquidity feature tend to improve over time through appropriate reformation of stock exchange, presence of large number of buyers and sellers, integration with other parts of the financial system of a country. However, the measures of market liquidity can be estimated though calculating transaction value and transaction liquidity of the stock market.

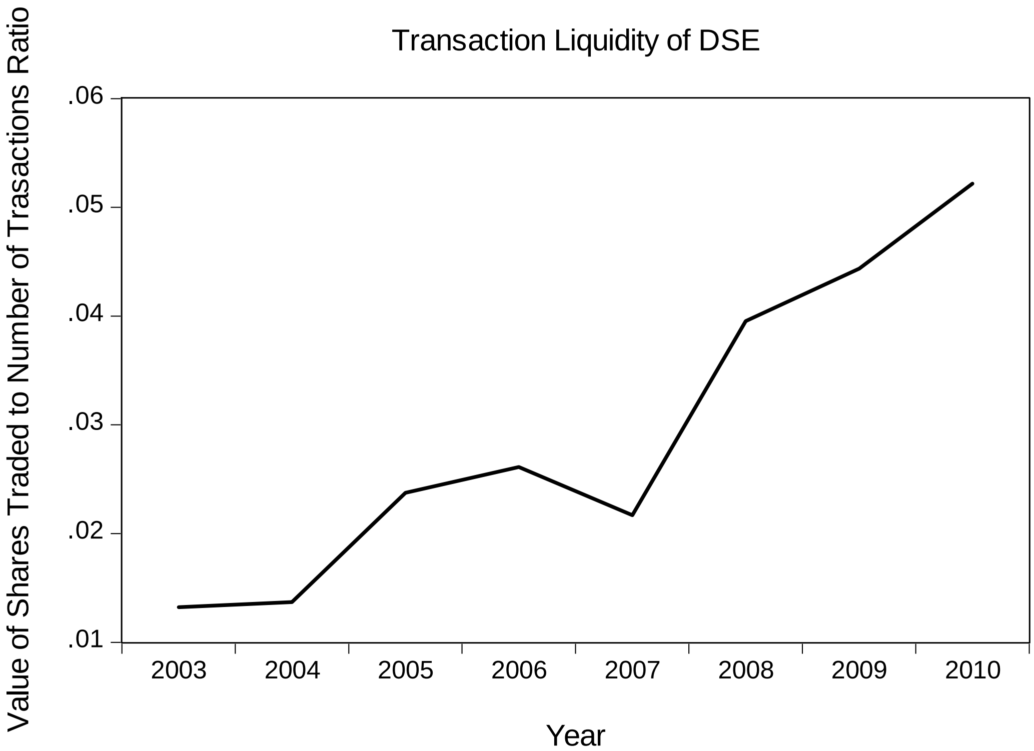
(i) Transaction Value: It is an important estimate to measure the liquidity of the stock market through calculating value of the shares traded to number of companies' ratio. This ratio actually identifies the value of the traded shares per one unit of the listed company. Here larger value of this ratio implies greater liquidity. Figure: 4.4 shows the status of the transaction value of DSE. Transaction value curve of DSE is very close to the horizontal axis at the beginning of 2003 but upward moving from the middle of 2006 to the end of 2010 which implies that value of share traded per unit of the listed companies have an increasing trend between 2003 and 2010 which is another important evident of emerging stock market.

Figure 4.4: Trend of Transaction Value in Dhaka Stock Exchange (DSE)



(ii) *Transaction Liquidity:* Another important measure of Market liquidity is estimating liquidity of the transaction held in Dhaka Stock Exchange (DSE). Liquidity of the transaction has been measured through estimating value of shares traded to number of transaction ratio. In this case larger value of the ratio implied greater liquidity, on average, for each transaction. This ratio has been estimated from 2003 to 2010 and is presented in Figure: 4.5 It has been found that the value of shares traded to number of transaction ratio value is very small but tends to increase over time and has a sharp rise from the middle of 2007 to the end of 2010- representing an increasing tendency of this ratio in different year. Although the trend line shows very small value for the transaction liquidity but has an improving move over time. This poor but rising tendency of the transaction liquidity measure also provide evidence that Dhaka Stock Exchange (DSE) belongs to emerging market category.

Figure 4.5: Trend of Transaction Liquidity in Dhaka Stock Exchange (DSE)

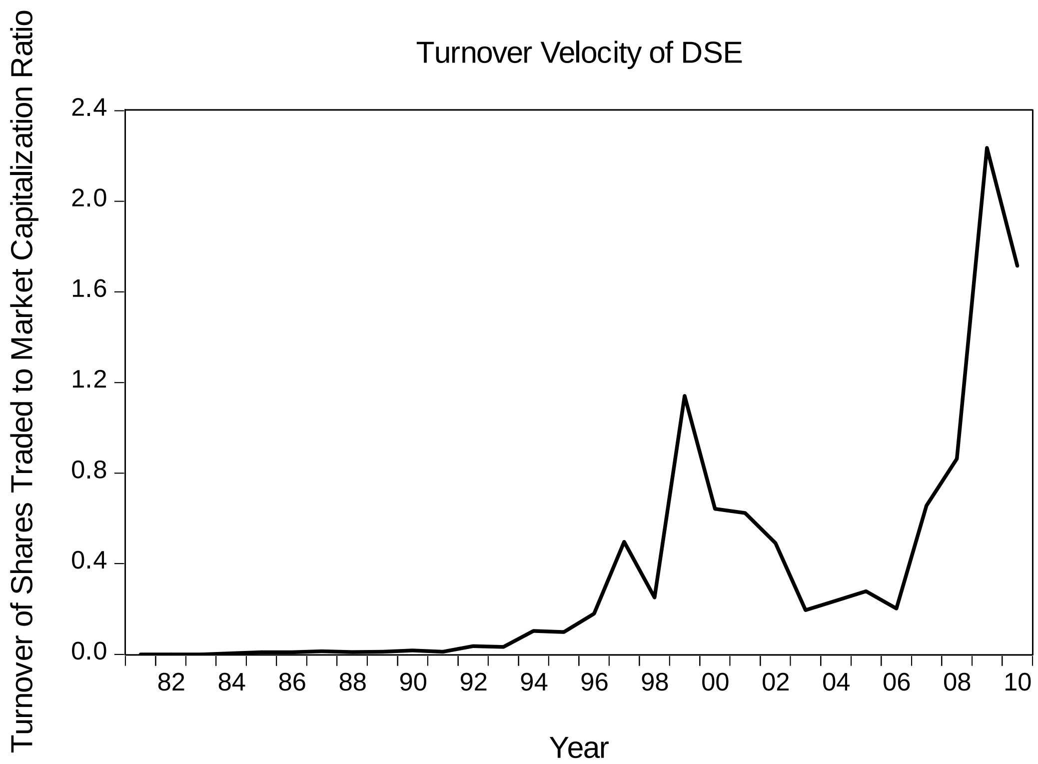


4.3.3 Market Activity:

Activity of the stock exchange is another important area that can be used to identify emerging stock market. Here, if the activity of the market is high, then that market is developed market. But if the activity is very poor but have a fair and satisfactory increasing trend, then that market can be defined as emerging market. In this case turnover velocity has been used as a measure of market activity in DSE.

(i) Turnover Velocity: Turnover velocity of DSE has been measured through estimating turnover of shares traded to market capitalization ratio. This ratio has been calculated between 1984 and 2010 and found to have a rising trend (Figure: 4.6)- indicating that, as the time passes, turnover increases with respect to market capitalization. Figure: 4.6 depict the velocity of the turnover with respect to market capitalization and provide evidence that except in year between 1998 and 2004, the ratio reveals an increasing trend. This rising trend of turnover velocity is important evidence that DSE belongs to the category of emerging stock market.

Figure 4.6: Trend of Turnover Velocity in Dhaka Stock Exchange (DSE)



4.3.4 Market Efficiency:

It is another important issue to measure the efficiency of Dhaka Stock Exchange (DSE) and to compare with the efficiency of some other emerging stock market. As DSE have not grown fully matured and the development in different aspects takes place over time, so it becomes an interesting queries about whether stock prices of DSE exhibit random walk characteristics that usually implies that stock prices are independent and moves identically in the stock exchange during the trading period. In such a situation past stock prices can not be used to predict future stock prices. Under "*Random Walk Hypothesis",* it is assumed that stock prices moves randomly in the efficient markets that usually found in the developed capital markets. Therefore, the test for the level of efficiency in DSE can be done through examining the randomness of the stock prices in the same market. DSE General Index (DSE Gen) from November 2001 to August 2010 has been taken as sample period and then daily, weekly, and monthly data have been collected to execute the test of randomness through the applications of Run test; Autocorrelation Test and Ljung-Box *Q*-statistics; Lo-Mackinlay (1988) Individual Lag Variance Ratio Test; and finally Chow-Denning (1993) Multiple Variance Ratio Test.

4.3.4.1 Basic concepts of Run Test:

In statistical analysis, it is commonly assumed that the observations in a sample are independent; in other words, that the order in which the data were collected is irrelevant. If the order does matter, then the sample is not random, and we cannot draw accurate conclusions about the population from which the sample was drawn. Therefore, it is prudent to check the data for a violation of this important assumption. In this case we can use the Runs Test procedure to test whether the order of values of a variable is random. The procedure first classifies each value of the variable as falling above or below a cut point and then tests to ensure that there is no order to the resulting sequence. In this study we have set mean value and the median value as the cut point to identify the number of runs which ultimately lead us to draw the conclusion about the randomness of the daily, weekly and monthly data series.

4.3.4.2 Result of the Run Test:

The estimated result of the run tests for daily. Weekly and monthly DSE Gen index has been presented in Table 4.2. In this case the number of runs has been calculated for daily, weekly and monthly data. Run test methodology provides that if the number of runs is less than one half of the entire sample size, *Z*-values will be negative and their associated *p-values* will be less than 0.05. All the test statistics reveals that daily, weekly and monthly DSE Gen index doesn't exhibit randomness. So, it can be said that the result of run test leads to a very precise decision that DSE Gen index is not a random variable.

Table 4.2: Estimates of Run Test for Daily, Weekly and Monthly Index

Lag	Daily Log DSE Gen Index			Weekly Log DSE Gen Index			Monthly Log DSE Gen Index		
	Total	1st Sub	2nd Sub	Total	1st Sub	2nd Sub	Total	1st Sub	2nd Sub
K=Mean	7.43	6.98	7.88	7.46	6.98	7.87	7.46	6.99	7.88
Cases <K	1179	675	524	219	111	100	57	29	27
Cases ≥K	1054	446	588	183	74	117	49	21	29
Total cases	2233	1121	1112	402	185	217	106	50	56
No. of Runs	24	2	22	10	2	8	8	2	6
Z-value	-46.2	-33.4	-33.0	-19.1	-13.4	-13.8	-8.97	-6.85	-6.20
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Author's own calculation estimates

4.3.4.3 Basic Concepts of Autocorrelation Test and Ljung-Box *Q*-statistics:

Autocorrelation is used to test the relationship between the time series of its own values at different lags. In this paper we have used Ljung- Box (L-B) *Q*-statistics (1978) which is widely used to test autocorrelation at different lags. This test is an improvement of Box-Pierce *Q*-statistic of 1970. The L-B Q-statistic sets out to investigate whether a set of correlation coefficients calculated at various lags for returns of time series may be deemed to be simultaneously equal to zero (Gujarati, 1995). Ljung-Box test also provides a superior fit to the chi-square ($\chi 2$) distribution for little samples. The L-B *Q*-statistic at lag *k* is a test statistic for the null hypothesis that there is not autocorrelation up to order *k* and is computed as

$$\boxed{Q_{LB} = T(T+2)\sum_{j=1}^{k}\frac{\tau_j^2}{T-j}}$$

Where τ is the *j*-th autocorrelation and T is the number of observations. If the series is not based upon the results of ARIMA estimation, then under the null hypothesis, *Q* is asymptotically distributed as a $\chi 2$ with degrees of freedom equal to the number of autocorrelations.

4.3.4.4 <u>Result of the Autocorrelation Test and Ljung-Box Q-Test:</u>

Table: 4.3 displays the estimates of autocorrelation coefficients, L-B *Q*-statistics and their associated *p*-values of 16 different lags for daily, weekly and monthly DSE Gen index. In case of daily total data, all the autocorrelation coefficients are found to be positive except in 2nd lag data and the *p*-values associated with each of the L-B *Q*-statistics are less than 0.05. This result implies that null hypothesis of no autocorrelation cannot be accepted at 5 percent significance level and therefore, daily DSE Gen index is not a random variable.

In case of weekly data, autocorrelation value is found to be negative for lag 3, 6, 11, & 16, and *p*-values associated with autocorrelation coefficients and L-B *Q*-statistics for different lags are less than 0.05 which lead to the conclusion that null hypothesis of no autocorrelation cannot be accepted at 5 percent significance level. That means, autocorrelation has been found in the residuals for weekly data. Finally, in the case of monthly data set, the departure of autocorrelation is clearly reported through the estimates autocorrelation coefficient, L-B *Q*-statistics with *p*-values more than 0.05. In a nut-shell, it can be concluded that randomness has not been found in case of daily and weekly data of DSE Gen index due to the presence of autocorrelation in the residuals. But this autocorrelation effect has been removed in monthly DSE Gen index. As a result, monthly DSE Gen index has been found to be a random variable and therefore, is not a good functional variable that could be used to predict future values for the same variable.

Table 4.3: Estimates of Ljung-Box *Q*-Test for Daily, Weekly and Monthly Index

Lag	Order of Estimates	Daily Log DSE Gen Index	Weekly Log DSE Gen Index	Monthly Log DSE Gen Index
1	AC Q-Stat Prob.	0.091 18.655 (0.000)	0.145 8.4994 (0.004)	0.050 0.2729 (0.601)
2	AC Q-Stat Prob.	-0.053 24.874 (0.000)	0.099 12.438 (0.002)	0.104 1.4529 (0.484)
3	AC Q-Stat Prob.	0.033 27.309 (0.000)	-0.003 12.442 (0.006)	0.137 3.5105 (0.319)
4	AC Q-Stat Prob.	0.032 29.638 (0.000)	0.084 15.282 (0.004)	0.083 4.2779 (0.370)
5	AC Q-Stat Prob.	0.054 36.104 (0.000)	0.084 18.138 (0.003)	0.146 6.6812 (0.245)
6	AC Q-Stat Prob.	0.016 36.702 (0.000)	-0.006 18.152 (0.006)	0.103 7.8890 (0.246)
7	AC Q-Stat Prob.	0.019 37.485 (0.000)	0.036 18.679 (0.009)	0.015 7.9142 (0.340)
8	AC Q-Stat Prob.	0.005 37.530 (0.000)	0.062 20.262 (0.009)	-0.205 12.804 (0.119)
9	AC Q-Stat Prob.	0.038 40.849 (0.000)	0.068 22.164 (0.008)	0.120 14.482 (0.106)
10	AC Q-Stat Prob.	0.003 40.871 (0.000)	0.070 24.200 (0.007)	-0.050 14.776 (0.140)
11	AC Q-Stat Prob.	0.039 44.270 (0.000)	-0.005 24.211 (0.012)	-0.006 14.780 (0.193)
12	AC Q-Stat Prob.	-0.017 44.932 (0.000)	0.032 24.624 (0.017)	-0.093 15.832 (0.199)
13	AC Q-Stat Prob.	0.020 45.793 (0.000)	0.054 25.826 (0.018)	-0.164 19.128 (0.119)
14	AC Q-Stat Prob.	0.005 45.850 (0.000)	0.067 27.691 (0.016)	-0.035 19.277 (0.155)
15	AC Q-Stat Prob.	0.019 46.680 (0.000)	0.018 27.828 (0.023)	-0.156 22.310 (0.100)
16	AC Q-Stat Prob.	0.025 48.087 (0.000)	-0.013 27.898 (0.033)	-0.141 24.824 (0.073)

Note: The value within parentheses represents *p*-value for Q-statistics.
This table has been prepared based on Author's own calculation estimates

4.3.4.5 Basic Concepts of Variance Ratio Test:

Variance ratio tests have been widely used and are particularly useful for examining the behavior of stock price indices in which returns are frequently not normally distributed. These tests are based on the variance of returns and have good size and power properties against interesting alternative hypotheses and in these respects are superior to many other tests (Campbell *et al.*, 1997). Consider the following random walk with drift process:

$$\boxed{p_t = p_{t-1} + \mu + \varepsilon_t} \ldots\ldots\ldots\ldots(1)$$

Or

$$\boxed{\Delta p_t = \mu + \varepsilon_t} \ldots\ldots\ldots\ldots(2)$$

In which p_t is the stock price index, μ is an arbitrary drift parameter and ε_t is a random disturbance term. The ε_t satisfy $E[\varepsilon_t] = 0$, and $E[\varepsilon_t, \varepsilon_{t-g}] = 0, g \neq 0$, for all t. the random walk hypothesis has two implications: uncorrelated residuals and a unit root. Variance ratio test focus on uncorrelated residuals and are preferable to unit root tests for two reasons: the latter focus on establishing whether a series is difference stationary or trend stationary (Campbell et all., 1997) and are known to have very low power and can not detect the departures from the random walk, Shiller and Perron (1985), Hakkio (1986) and Gonzalo and Lee (1996). This contrasts with the multiple variance ratio tests which has good size and power properties, Chow and Denning (1993).

With uncorrelated residuals and hence uncorrelated increments in p_t, the variance of these increments increases linearly in the observation interval,

$$\boxed{Var(p_t - p_{t-q}) = qVar(p_t - p_{t-1})} \ldots\ldots\ldots\ldots(3)$$

in which q is any positive integer. The variance ratio is given by

$$\boxed{VR(q) = \frac{\frac{1}{q} Var(p_{t-} p_{t-q})}{Var(p_{t-} p_{t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)}} \quad \ldots\ldots\ldots\ldots\ldots(4)$$

And under the null hypothesis VR(q) =1.

Lo and Mackinlay (1988) generates the asymptotic distribution of the estimated variance ratios and derive two test statistics Z(q) and Z*(q), under the null hypothesis of homoskedastic increments random walk and heteroskedastic increments random walk respectively. If the null is true then the associated test statistic has an asymptotic standard normal distribution. Their test statistics are both flexible and simple to compute. However, Lo and Mackinlay approach focuses on testing individual variance ratios for a specific aggregation interval, q, but the random walk hypothesis requires that VR(q)= 1 for all q. The multiple variance ratio (MVR) tests provide a joint test through controlling the size of the test.

Chow and Denning (1993) provide a procedure for the multiple comparison of the set of variance ratio estimates with unity. For a single variance ratio test, under the null hypothesis, VR(q)= 1 and hence $M_r(q) = VR(q) - 1 = 0.$ Now consider a set of m variance ratio tests $\{M_r(q) | i = 1,2,......m\}$ associated with the set of aggregation intervals $\{q | i = 1,2,......m\}$. Under the random walk null hypothesis there are multiple sub-hypotheses.

$$H_{oi} : M_r(qi) = 0 \qquad \text{for all } i = 1,2,\ldots\ldots\text{m}$$

$$H_{li} : M_r(qi) \neq 0 \qquad \text{for any } i = 1,2,\ldots\ldots\text{m} \quad \ldots\ldots\ldots(5)$$

Rejection of any one or more H_{oi} rejects the random walk null hypothesis. Consider a set of Lo and Mackinlay test statistics, say Z(q), $\{Z(q_i) | i = 1,2,......m\}$. Since the random walk null hypothesis is rejected if any of the estimated variance ratios is significantly different from one, it is only necessary to focus on the maximum absolute value in the set of test statistics. The core of Chow and Denning's MVR test is based on the result

$$\boxed{PR[\max(|Z(q_i)|,\ldots\ldots |Z(q_m)|) \leq SMM(\alpha;m;T)] \geq 1-\alpha} \ldots\ldots\ldots(6)$$

In which $SMM(\alpha;m;T)$ is the upper α point of the Studentized Maximum Modulus (SSM) distribution with parameter *m* and T (sample size) degrees of freedom. Asymptotically, when T is indefinite,

$$\boxed{SMM(\alpha;m;T) = Z_{\alpha^*/2}} \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

in which $\alpha^* = 1-(1-\alpha)^{\frac{1}{m}}$. Chow and Denning control the size of a MVR test by comparing the calculated values of the standardized test statistics, either $Z(qi)$ or *Z*(qi),* with the SSM critical values. If the maximum absolute value of, say, *Z*(*qi*), is greater than SSM critical value at a predetermined significance level then the random walk hypothesis is rejected.

Chow and Denning (1993) using a Monte Carlo experiment, examine the size and the power of their MVR test. Under both a homoskedastic *i.i.d.* null and a heteroskedastic *i.i.d.* null and using the asymptotic SSM critical values, the empirical test size is close to the nominal test size. Furthermore, it is much closer to the nominal test size than arise from testing individual variance ratios separately using the standard normal distribution. If the size of the joint test is not controlled, at the 5 percent significance level, empirical size is three times normal size for small samples of 64 observations rising to four times nominal size for large samples. The MVR test has comparable power to unit root tests against an AR(1) alternative and is much more powerful against ARIMA(1,1,1) and ARIMA(1,1,0) alternatives. The latter is especially interesting: an ARIMA(1,1,0) process of p_t is equivalent to an AR(1) process of Δp_t with positive autocorrelation parameter. Lo and Mackinlay (1988) report $V\hat{R}(1)$ for $q=2$ in the range 1.05 to 1.30. The ARIMA(1,1,0) process could be more relevant alternative.

4.3.4.6 Result of the Variance Ratio Test:

Table: 4.4 shows the Chow-Denning (1993) multiple variance ratio test result for daily, weekly and monthly the data series. The test result has been computed under the assumption of homoskedasticity increments random walk and heteroskedasticity increments random walk. Under homoskedasticity assumption, when we consider daily data for the total sample period, the Chow-Denning Max $|Z|$ joint test statistics is found to be 4.308242 with a *p*-value of 0.0001 which implies that we can not accept the null hypothesis of random walk. Under heteroskedasticity test assumption, the Chow-Denning Max $|Z|$ joint test statistics is 3.042146 with *p*-value equal to 0.0094 also reveals that the null hypothesis of random walk can not be accepted at 5 percent significance level in the daily data series. For weekly data set, under homoskedastic and heteroskedastic test assumption, the joint test statistics with their *p*-values explains that fact that weekly DSE Gen index doesn't comply with the norms of random walk. On the other hand, joint variance ratio test on monthly DSE Gen Index reports the evidence of random walk at 5 percent significance level under both homoskedasticity and heteroskedasticity test assumption.

Table 4.4: Chow-Denning Multiple Variance Ratio Test for Total Period (February 2004 and August 2010)

Stock Indexes	Test Estimates	Homoskedastic Assumption	Heteroskedastic Assumption
Daily DSE GEN	Studentized Max |z| Statistic @ 5 percent level	4.308242	3.042146
	Prob.	0.0001	0.0094
Weekly DSE GEN	Studentized Max |z| Statistic @ 5 percent level	4.149049	3.889733
	Prob.	0.0001	0.0004
Monthly DSE GEN	Studentized Max |z| Statistic @ 5 percent level	4.465103	2.088001
	Prob.	0.1181	0.1393

Note: Author's own calculation estimates

On the other hand, Lo-Mackinlay Individual Lag variance Ratio Test estimates has been presented in Table: 4.5. This table presents the estimates of variance ratio test, its Z-statistics and its associated *p-values* for lag 2, 4, 8, and 16. For the daily data, under homoskedastic and heteroskedastic test assumption, the individual test statistics for lag 2, 4, 8, and 16 with their associated *p*-values also reveals that daily DSE Gen

Index doesn't exhibit random walk characteristics. For weekly data, DSE Gen index are found to be non-random in both homoskedastic and heteroskedastic test assumption. For monthly data, variance ratio test for lag 2, 4, 16 are found to be random under both homoskedasticity and heteroskedasticity test assumption. But at lag 8 test statistics are found to be non-random in both assumptions. So it can be concluded that DSE Gen index doesn't follow random walk at 10 percent level in short horizon data (i.e. daily and weekly index) but for longer time horizon like monthly data, the same index is found to follow random walk. The presence of autocorrelation that is induced by to over shooting and under shooting of prices and non-synchronous or infrequent trading is very obvious in case of emerging stock market like DSE. According to Lo and Mackinlay (1988), small capitalization stocks trade less frequently than larger stocks. As a result, new information is impounded first into large capitalization stock prices and then into smaller capitalization stock prices with lag. This lag subsequently, induces a positive autocorrelation in short horizon stock price data. But the impact of new information gradually eliminates when the time horizon increases.

Table 4.5: Lo-Mackinlay Individual Lag Variance Ratio Test for the Total Period (February 2004 and August 2010)

Stock Indexes	Test Estimates	Homoskedastic Test Assumption				Heteroskedastic Test Assumption			
		2	4	8	16	2	4	8	16
Daily DSE GEN	Var. Ratio	1.091	1.100	1.206	1.362	1.091	1.100	1.206	1.362
	Z-Statistic	4.308	2.540	3.300	3.893	2.872	1.720	2.366	3.042
	Prob.	0.000	0.011	0.001	0.000	0.004	0.085	0.018	0.002
Weekly DSE GEN	Var. Ratio	1.144	1.314	1.546	1.912	1.144	1.314	1.546	1.912
	Z-Statistic	2.891	3.361	3.699	4.149	2.219	2.796	3.335	3.889
	Prob.	0.003	0.000	0.000	0.000	0.026	0.005	0.000	0.000
Monthly DSE GEN	Var. Ratio	1.049	1.231	1.622	1.384	1.049	1.231	1.622	1.384
	Z-Statistic	0.506	1.267	2.157	0.894	0.501	1.210	2.088	0.892
	Prob.	0.612	0.204	0.030	0.370	0.616	0.225	0.036	0.372

Note: Author's own Calculation estimates

However, stock index is theoretically expected to be random for efficient market and an efficient stock market implicitly assume that all market participants have the identical information and have homogenous expectation that they are using in their trading decision. But violation of the assumption of symmetrical distribution of information and homogenous expectation actually lead to the situation that all the market participants shows some sort of dependency with each in their daily trading decision which is ultimately reflected in non-random behavior of daily stock indexes. But reduction of this dependency is found when they spent some time to analyze each and every information and revise their own trading decision. So for a longer period DSE Gen index has been found to be independent and random.

Another important reason for non-randomness in short time horizon data (i.e. daily data) may be due to the practice of circuit breaker and trading halt by the stock exchanges in the different stock transactions which is found to be not comply with the upper and lower bounds. That's why daily data reports some sort of dependency with each other. But that dependency reduces with the passage of time.

Another reason may be the practice of insider trading in the stock market. Insider trader makes their trading decision based on information which is not supposed to be disclosed in the stock market. As a result price trend of stocks doesn't reflect the true picture of the market trend. In addition, noise trading; trading based on rumors also results identical trading decision by the market participants in the short time horizon. But they can revise their trading decision in longer time horizon that leads the stock price follow random walk. Finally, as Dhaka Stock Exchange (DSE) belongs to the category of a frontier market impacted by less liquidity, volatility, infrequent trading, political instability, poor regulation and endemic corruption, all these factors contribute to the stock index to follow random walk in the long run but non-random in the short run.

This chapter is intended to identify different distinguishing aspects of emerging capital markets from that of developed capital market and tries to examine emerging market characteristics to prove that Dhaka Stock Exchange (DSE) belongs to that category. In this case, different characteristics of the emerging market (like low but increasing trend of market depth, less market liquidity and market activity and weak-form efficiency) has been tested for Dhaka Stock Exchange (DSE) by applying different appropriate measures and the findings lead to the conclusion that within these selected emerging market characteristics Dhaka Stock Exchange (DSE) is an emerging capital market in the world.

CHAPTER 5

REVIEW OF LITERATURE & EMPIRICAL EVIDENCE

From more than sixty years ago, researchers and finance scholars have started extensive study on pricing behavior of stocks in the capital market. Most of the times, they have tried to identify unexplored anomalies that could be used to explain stock price movement in different stock market. As a result, we have found different models and theories (especially MPT, CAPM, APT etc.) relating to stock price behavior as well as efficiency of the stock market. But due to differences in geographic location, time, income level, taste, degree of risk averseness, govt. policy, stock market rules and regulations- a single model or theory is not found to be a perfect one which is universally fit for every stock market. That's why different researchers have incorporated different variables at different times and apply different methods to explain stock price behavior for their respect stock market. This research is another good initiated to find out stock price influencing factors both from the fundamental performance indicators of a firm as well as from the different macroeconomic variables. In this process, relevant literature has been examined and their summery has also been classified based on variables related to stock market and the overall macroeconomy.

5.1 Review of Literature between Stock Price and Micro Variables:

Numerous empirical studies have been carried out to determine the stock market reactions to dividend announcements. Aharony and Swary (1980), Kwan (1981), Eades (1982), and Woolridge (1982), have found a significant positive association between announcement of dividend changes and the stock return, using the dividend announcement made in isolation of other firm news report. Gordon (1962 and 1963) and Walter (1963) support the dividend relevance doctrine. They suggest that dividend policy and investment policy are inter-linked. Investment policy can not be separated from dividend policy and the choice of an appropriate dividend policy affects the value of the firm.

The leading proponents of the bird-in-the-hand theory (Gordon, 1962; and Lintner, 1962) found that stockholder value a dollar received in dividend more highly than dollar earnings retained. Therefore, dividend policy is relevant to the value of shares. Miller and Scholes (1981) have argued that the observed relationship between common stock returns and dividend yields as attributed to the favorable information contained in the knowledge that a firm will actually declare any dividend. Dhillon and Jhonson (1994) examine the stock and bond price reaction to dividend changes. The positive stock market response to dividend increases has several potential explanations, two of the more commonly discussed being information content and wealth redistribution between stockholders and bondholders. The evidence presented by Dhillon and Jhonson (1994) support the wealth redistribution hypothesis but does not rule out the information content hypothesis. Typically, Dhillon and Jhonson (1994) found that the bond price reaction to announcement of large dividend changes is opposite to the stock price reaction. Their result differs from those of Handjinicolaou and Kalay (1984) who analyzed bond returns around dividend changes, and reported that the bond prices are not affected by dividend increases but the bond prices react negatively to divided reductions. Dhillon and Jhonson (1994) argue that their data supports the information content hypothesis. In contrast, Jayaraman and Shastri (1988) find insignificantly negative bond price reactions to dividend announcement.

Black and Scholes (1974) have found that corporations that increase its dividend can expect this will have no definite effect on its stock price. The price may change temporarily in response to a change in the dividend, because the market may believe that the change indicates something about the probable future course of earnings. If it becomes clear that the change was not made because of any change in estimated future earnings; this temporary effects will disappear. Thus a corporation may want to choose its dividend policies under the assumption that changes in dividend policy will have no permanent effect on its stock price.

Other researchers made efforts to further understand the dividend controversy. Among them, Brennan (1970 and 1973), Litzenberger and Ramaswamy (1979 and 1980) showed that it is not optimal for the investors to receive dividends if their marginal tax rate is greater than zero and investors’ after-tax expected rate of return (discount rate) depends on the dividend yield and systematic risk. These lead to an idea that at least dividend might have some tax-induced effect on the stock prices. Average investors, subjects to their personal tax rates, would prefer to have less cash dividend if it is taxable: the size of optimal dividend inversely related to personal tax rates (Pye, 1972). Hence stock prices tend to decline after announcement of dividend increase.

The empirical studies however showed mixed evidence, using the data from US, Japan and Singapore markets. A number of studies found that stock price has a significant positive relationship with the dividend payment [Gordon (1959), Ogden (1994), Stevens and Jose (1989), Kato and Loewenstein (1995), Ariff and Finn (1986), and Lee (1995)] while other found a negative relationship [Loughlin (1989), and Eason and Sinclair (1989)]. A negative relationship between dividend announcement stock returns is expected due to tax effect, but researchers tended to relate the positive relationship between stock returns and dividend announcement with the information effect of dividend. The dividend information hypothesis postulates that cash dividend carries information regarding the future cash flows of firm that is to be reflected in the market price of stock after announcement of dividend, particularly when dividend increases [Bhattacharya (1979), Bar-Yosef and Huffman (1986) and Yoon and Starks (1995)].

Docking, Scott, Koch and Poul (2005) examined the sensitivity of the investor reactions to the recent direction or volatility of underlying market movements. They found that dividend change announcements elicit a greater change in stock price when the nature of the news (good or bad) goes against the grain of the recent market direction during volatile times. For example, announcements to lower dividends elicit a significantly greater decrease in stock price when market returns have been up and more volatile. Similarly, announcements to raise dividends tends to elicit a greater increase in stock price when market returns have been normal or down and more volatile, although this latter tendency lacks statistical significance. We suggest an explanation for these results that combines the implications of a dynamic rational expectations equilibrium model with behavioral considerations that link the responsiveness of investors to market direction and volatility.

Hamid and Chowdhury (2005) used two measures i.e. daily market- adjusted abnormal return (MARR) and daily cumulative abnormal return (CAR) to study the impact of dividend announcement on shareholders' value. They explained MARR as an indicator of the relative daily percentage price change in the dividend paying stocks compared to the change in average market price. Here, CAR has been defined as a measure of the investors' total return over a period starting from well before the announcement of dividend to well after the dividend announcement day. They have taken 137 samples of dividend paying companies listed on Dhaka Stock Exchange and found that MARR on the day of dividend announcement was not statistically significant which entails that the market reacts earlier than the actual announcement of dividend. On the other hand, the findings of CAR results that investors lost more value in the ex-dividend period than the value gained in the pre-dividend period. These findings also suggest that dividend announcement does not carry information about the future earnings and cash flows of the companies.

Ahmed, M. F., (2000) investigate the relative importance of dividend and retained earnings to explain the stock price variation in Bangladesh. The findings reveal that both dividend and retained earnings influence the stock price and they have their impact ignoring their usual expectation of stronger dividend impact on non-growth industries and retained earnings impact on growth industries. In most cases, dividend hypothesis appears to be stronger than the retained earnings hypothesis. Dividends convey valuable information to the investors and it has been documented that the managers' behavior also appears to be consistent with this view thus supporting Dividend Relevance Theory (Linter, 1956). Although other alternative exists through which managers can disseminate information but dividends are highly visible compared to other announcements in addition to its credibility of cash signals.

Ahmed, M. F., (1991) investigates the dividend policy of the enterprises listed on Dhaka Stock Exchange (DSE) and to draw an analogy between that of Japanese and Bangladeshi enterprises. He comment that both dividend and retained earnings convey a return to the stockholders but in Bangladesh dividend rate demonstrate a declining trend while that of Japanese enterprises appears to be somewhat stable. Thus lower dividend yield in Bangladesh is attributable to both lower dividend rate and higher market capitalization while it is mostly due to higher market capitalization in Japan. He also found that dividend rate and yield in Bangladesh is lower than time deposit interest rate whereas in Japan although dividend yield is lower than interest rate but dividend rate is higher than that of. It is also found that companies paying regular dividend have higher P/E ratio than those paying irregularly which ultimately implies that market regards regular dividend policy and regular dividend stimulate the price.

Pu Shen (2000) examines the historical relationship between price-earnings ratios and subsequent stock market performance. The author finds strong historical evidence that high price-earnings ratios have been followed by disappointing stock market performance in the short and long term. Specifically, high price-earnings ratios have been followed by slow *long-run* growth in stock prices. Moreover, when high price-earnings ratios have reduced the earnings yield on stocks relative to returns on other investments, *short-run* stock market performance has suffered as well.

Rahman, Z. and Rahman, L. (2008) in their study of stock price behavior around ex-dividend date from DSE found an increase of stock prices. They have made a conclusion that ex-dividend price increased instead of dropped in DSE that implies a clear preference for capital gains without having any focus of dividends by the stockholders.

Vorek, M. (2009) examines that the investments into stocks with low price to earnings ratio achieved higher than average returns. This paper focuses on the other side of that relation, whether the high price to earning ratio predicts the future falls in stock prices and whether the price to earnings ratio could act as an indicator of the coming bear market. The Author concluded that P/E ratio in a role of an indicator of the future stock markets falls does not result in clear conclusion.

Ali, M.B. and Chowdhury, T.A, (2010) examined the impact of dividend announcement on stock market prices of 25 listed commercial banks in Dhaka Stock Exchange (DSE). They have employed an standard even study methodology to analyze the stock price reaction for dividend announcement and found 11 out of 25 banks' stock price declines, 6 bank's stock price raises and no change in 8 banks. Finally they agreed with the dividend irrelevance theory and conclude that dividend announcement itself has no influence on share price.

Ong, T.S., Yichen, Y.N., Teh, B.H., (2010) examine the capability of the average PE ratio to forecast future stock market returns. They also test whether PE ratio can be used to predict future stock market declines and whether PE ratio can serve as a parameter of the coming bear market in the Malaysian Equity Market. Their investigation reveals that the null hypothesis of PE ratio as not a useful predictor of KLCI index was rejected. A linear positive slope exists between the annualized return of the KLCI and PE ratio, thus suggesting that an increase in PE ratio could have led to a subsequent rise in the KLCI. In this case, a decline in PE ratio could have resulted in a subsequent fall in the KLCI, henceforth, serving as an indicator of the coming bear market in Malaysia.

Ali, M. B. (2011) investigates the impact of changes in selected microeconomic and macroeconomic variables on stock returns at Dhaka Stock Exchange (DSE). A Multivariate Regression Model computed on Standard OLS Formula has been used to estimate the relationship. Regression coefficient reveals that inflation and foreign remittance have negative influence and industrial production index; market P/Es and monthly percent average growth in market capitalization have positive influence on stock returns. All the independent variables can jointly explain 44.48 percent variation in DSE all share price index. No unidirectional Granger Causality is found between stock prices and all the predictor variables except one unidirectional causal relation from stock price and market P/Es. Finally, lack of Granger causality between stock price and selected micro and macro variables ultimately reveals the evidence of informationally inefficient market.

Aga, M. and Kocaman, B. (2006) have studied the relationship between P/E ratio with the stock index of Istanbul (ISE National-30) and found that for each of the stocks price earning ratio appears to be a significant explanatory variable for the stock returns.

5.2 Review of Literature between Stock Price and Macro Variables:

The literature of the effects of macroeconomic variables on stock returns dates back to the late 1970s. Studies were focused on developed, emerging and both developed and emerging capital markets context and the extant literature reveals strong relationships between the macroeconomic variables and stock returns.

Nelson (1976) examined the relationship between monthly stock returns and inflation in the post-war period from 1953 to 1974 using US data, and found a negative relationship between stock returns, in both expected and unexpected inflation. The paper presented by Bodie (1976) defines the effectiveness of common stocks as an inflation hedge to the extent of which they can be used to reduce the risk of an investor’s real return which stems from uncertainty about the future level of the price of consumption goods.

Fama (1981, 1982), Fama and Schwert (1977), Gallagher and Taylor (2002), Geske and Roll (1983) empirically find that stock returns are negatively affected by both expected and unexpected inflation. Based on the money demand and the quantity theory of money, Fama (1981) and Geske and Roll (1983) explain the negative linkage among stock returns and inflation. Using post-war data for the US, Canada, Germany and the UK, Kaul (1990) explains the relationship between stock returns and unanticipated changes in expected inflation under alternative monetary policy regimes. He finds that in countries where there is no change in the policy regime there exists a negative relation between stock returns and changes in expected inflation. Marshall (1992) finds that negative effect of inflation on stock return is generated by real economic fluctuations, by monetary fluctuations or changes in both real and monetary variables. Tanggaard (2002) finds a moderately positive relationship between expected stock returns and expected inflation for the US and a strong positive relationship for Denmark. Sharfe (2002) suggests that rise in expected inflation reduces equity prices in the US. The negative relationship between inflation and stock returns is supported by Chatrath *et al.* (1997)-India, Najandand and Noronhal (1998)-Japan, Zhao (1999) –China, Crosby (2001)-Australia and Adrangi *et al.* (1999) – Korea and Mexico. Further, Omran and Pointon (2001) – Egypt, Apergis and Eleftheriou (2002)-Greece.

Contrary to these studies Choudhry (2001) finds a positive relationship between stock returns and inflation in four high inflation countries. Boudoukh and Richardson (1993), Solnik and Solnik (1997), Engsted and Tanggaard (2002), Kim and In (2005) and Schotman and Schweitzer (2000) examined the relationship between stock returns and inflation over long-horizons and their results support the Fisher Hypothesis as the horizon widens. Samarakoon (1996) finds that nominal stock returns are positively related to expected inflation in a one-to-one correspondence in Sri Lanka.

Studies on money-stock market relationship centered on the question of whether money is a leading indicator of stock prices or not. Study by Homa and Jaffee (1971) supported the view that past increases in money leads to increase in equity returns. Cooper (1974) examined the money- stock market relationship using US data and found that the lead/ lag and cross spectra of stock returns and changes in money supply are consistent with the Efficient Market model and the Monetary Portfolio models in that stock returns anticipate changes in monetary returns. Rogalski and Vinso (1977) examined the reaction of stock prices to unanticipated changes in money and found results inconsistent with Sprinkel (1964), Homa and Jaffe (1971), and Hamburger and Kochin (1977) which has shown that past money changes do not contain predictive information on stock prices, upholding the Efficient Markets view. Pearce and Roley (1983) investigates whether the response of common stock prices to weekly money announcements is consistent with the Efficient Market Hypothesis. Chen *et al.* (2005), Bulmash and Trivoli (1991) and Barrows and Naka (1994) find a positive relation between money supply and stock returns. Rozeff (1984), Campbell (1987), Kaul (1987) and Booth and Booth (1997), confirmed the theory that an expansionary monetary policy increases stock returns.

The relations among stock returns, real activity, inflation and money supply changes were investigated by James *et al.* (1985), and their empirical results strongly support Geske and Roll's (1983) reversed causality model, which brings similar results with Solnik (1984) for other industrialized countries. Kaneko and Lee (1995) have re-examined the US and the Japanese markets and they employed the Chen *et al.* (1986) factors to evaluate the effects of systematic economic news on stock market returns.

Using eight variable Vector Auto Regressive (VAR) system, they found that both the term and risk premiums, as well as the growth rate of industrial production, are significantly priced in the US.

Asprem (1989) examines the relationship between macroeconomic variables and stock prices in European countries and finds a positive relation between Industrial production, money supply and stock prices and a negative effect between inflation, interest rate and stock prices. Bulmash and Trivoli (1991) found that interest rates influenced stock prices negatively, since higher interest rates attract another investment alternative. Abdullah and Hayworth (1993) find that stock returns are positively related with money growth and inflation rate while interest rates react negatively on stock returns.

The existing finance literature is inconclusive on the relations between exchange rate movements and macroeconomic variables {Aggarwal, (1981); Edison, (1991); Frenkel, (1983); Gandolfo *et al.*, (1990); Wasserfallen, (1989)}. Solnik (1987) employs monthly and quarterly data for eight industrial countries from 1973-1983 to examine the relation between real stock returns, exchange rates and reports a negative relation among variables. Soenen and Aggarwal (1989) re-assess this Solnik model using 1980-1987 data for the same industrial countries and report a positive correlation between stock returns and exchange rates for three countries and negative correlation for five. Employing monthly data, Aggarwal (1981) examines the relation between US stock market indexes and a trade weighted value of the dollar for the period 1974-1978 and finds that the stock prices and exchange rates are positively correlated. In contrast, Soenen and Hernigar (1988), also using monthly data, report a strong negative relation between US stock indexes and a fifteen currency weighted value of the dollar for the period 1980-1986.

The relationship between stock returns and interest rates in Sri Lanka studied by Premawardane (1997) found a negative relationship while in contrast Hasan *et al.* (2000) found a positive relationship. Bilson *et al.* (2001) tested whether local macroeconomic variables (money supply, goods prices and real activity) have explanatory power over stock returns in 20 exchange emerging markets for the period 1985-1997. The results indicate that the exchange rate variable is clearly the most influential macroeconomic variable, and money supply has greater importance.

Panayotis *et al.* (1996) examined the impact of inflation uncertainty on stock prices in developed as well as in emerging capital markets for 20 countries and find a negative association between inflation uncertainty and stock prices. All the studies cited above represent various strong relationships between macroeconomic variables and stock returns in numerous countries. In this study the researcher is interested in documenting the effects of macroeconomic variables on stock prices in the Colombo Stock Exchange.

Hardouvelis (1987), Keim (1985), Litzenberger and Ramaswamy (1982) empirically investigated whether the main economic indicators (e.g., inflation, interest rates, treasury bond's returns, trade balance, dividend returns, exchange rates, money supply, and crude oil prices) are effective to explain the share returns. If there were a co-integration relation between macroeconomic indicators and share returns, there would be a causal relation between these variables, too. Otherwise, share returns cannot be explained by main macroeconomic variables.

In an informationally efficient market, stock prices immediately reflect changes in monetary policy and correctly anticipate future monetary growth. Cornelius (1994) examined the relationship between money supply changes and stock prices in six of the most active emerging markets - India, Korea, Malaysia, Mexico, Taiwan and Thailand. However, findings are not uniform across countries. Results from Granger-causality tests suggest that at least four of these markets - India, Korea, Malaysia, and Mexico appear informationally inefficient.

Using cointegration techniques, Chowdhury A.R. (1995) explains the lack of efficiency in the emerging stock markets by investigating the issue of informational efficiency in the Dhaka Stock Exchange in Bangladesh. He argued that in an efficient market the prices of the securities fully reflect all available information i.e. stock market participants incorporate the information contained in money supply changes into stock prices. Initially he tested the bivariate relationship models between stock prices and money supply changes. Results from bivariate models suggest independence between the stock price and monetary aggregates. In other words Dhaka stock market is informationally inefficient. However, it is well known that bivariate models fail to address the obvious possibility that the relationship may be driven by another variable acting on both stock price and money supply. Hence multivariate models were estimated which shows the presence of a unidirectional causality from the money (both narrow and broad) to stock price. But the findings are insensitive to the functional form of the variables employed. Thus the stock prices do not immediately reflect changes in monetary policy and the market in inefficient. One important limitation of this study is that the cointegration test conducted only for bivariate model.

Naka, A., Mukherjee T. and Tufte, D. (1998) explained the relationships among selected macroeconomic variables and the Indian Stock market. By employing a vector error correction model, they find that three long term equilibrium relationships exist among these variables. Results suggest that domestic inflation is the most severe deterrent to Indian stock market performance and domestic output growth is its predominant driving force. After accounting for macroeconomic factors, the Indian market still appears to be drawn downward of a residual negative trend.

Ahmed, M.F. (2000) examines the causal relation between DSE stock index and a couple of macroeconomic variables like consumption expenditure, investment expenditures, real economic activity measured by GDP and industrial production index. The author employed Granger (1988) causality test and found a causal relation from stock price to consumption expenditures. He also found a unidirectional causality from investment to stock prices; weak relationship between stock price and GDP and no causal relation between stock price and industrial production index. Finally he concluded in that study that stock market is not informationally efficient in Bangladesh.

Karamustafa, O. and Kucukkale, Y. (2003) investigated whether current economic activities in Turkey have- explanatory power over stock returns, or not- They considered monthly data of stock price indexes of lstanbul Stock Exchange and a set of macroeconomic variables, including money supply, exchange rate of us Do1ar, trade balance, and the industrial production index. Engle-Granger and Johansen-Juselius cointegration tests and Granger Causality test were used in the study to explain the long-run relations among variables questioned. Obtained results illustrate that stock return is co-integrated with a set of macroeconomic variables by providing a direct long-run equilibrium relation. However, the macroeconomic variables are not the leading indicators for the stock returns, because any causal relation from macroeconomic variables to the stock returns cannot be determined in sample period. In contrast, stock return is the leading indicator for the macroeconomic performance for the Turkish case.

Bhattacharya, B. and Mukherjee, J. (2003), investigates the nature of the causal relationship between stock returns and macroeconomic aggregates in India. By applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995), we test the causal relationships between the BSE Sensitive Index and the seven macroeconomic variables, viz., money supply, index of industrial production, national income, rate of inflation, real effective exchange rate, foreign exchange reserves and trade balance using monthly data for the period 1992-93 to 2000-01. The major findings are that here is no causal linkage between (i) stock returns and money supply, index of industrial production and national income for the domestic sector and (ii) stock returns and real effective exchange rate, foreign exchange reserves and trade balance for the external sector. However, a bi-directional causality exists between stock return and rate of inflation.

Khan, K.N. (2004) used the Theory of Cointegration and ECM to examine the relationship between inflation and stock market development (through market capitalization and stock turnover index). At first the existence of stationarity property is checked by applying ADF and PP test. When the variables are found to be integrated of the same order then cointegration test is conducted by using Johansen Maximum likelihood procedure to find out the presence of long run relationship between inflation and MCAP and inflation and stock turnover index. The estimated test result implies that the series moves together in the long run, negatively related and a potential link exist between them. This means inflation matters to stock market performance. ECM test result showed that 65 percent of the adjustment towards equilibrium occurs within a year.

Maysami *et al.* (2004) examined the long term equilibrium relationships between selected macroeconomic variables like interest rate, inflation, exchange rate, industrial production, money supply, and SES All-S Equity Finance Index. This study revealed that Singapore’s stock market and the property index form cointegrating relationship with change in the short and long term interest rate, industrial production, price levels, exchange rate and money supply.

L.M.C.S. Menike, (2006) used multifactor regression model for investigating relationship between Stock prices and eight selected macroeconomic variables i.e. money supply, exchange rate, inflation rate, interest rate, lagged money supply and lagged inflation rate. The result indicates that more than 37 out of 34 companies have higher explanatory power to explain stock return. All the variables are significant at 5 percent level rejecting the null hypothesis of no significant relation between dependent and independent variables. Further, the macroeconomic variables representing lagged inflation rate and lagged money supply have only limited ability to explain the variation in equity prices. Money supply, interest rate and inflation rate have greater importance, while the most influential variable is the exchange rate. Negative relationship of macroeconomic variables is higher than positive relations. The signs of the coefficients on the exchange rate, contemporaneous inflation rate and interest rate variables are mainly negative.

Ahmed, M. N. and Imam M. Osman, (2007) examines the long run equilibrium and short tern dynamics between DSE stock index and a set of macroeconomic variables. In the macroeconomic variables they use money supply, 91 day T-bill rate, interest rate GDP and Industrial production index. They applied Johansen and Juselius (1990) maximum likelihood Cointegration test, Vector Error Correction Model (VECM) and also employed Granger Causality test. In the cointegration test, they found two cointegrating vectors but between them one is statistically significant. In the VECM test, they found that the lagged stock index was adjusted to long run equilibrium by percent by 43.82 percent by the combined lagged influence of all the selected macroeconomic variables. Granger causality test provides a unidirectional causality from interest rate change to stock market return.

Uddin, M.G.S, Alam, M.M., and Alam, K.A. (2008) have attempted to trace the relationship between interest rates and rates of inflation in the economy of Bangladesh. In view of this, a time series approach was considered to examine the empirical evidence of Fisher’s effect in the country. By applying OLS and Unit Root test, the estimated value is used to determine the casual relationship between interest rates and inflation for the monthly sample period of August 1996 to December 2003. The empirical results suggest that there exist no co-movement of inflation with interest rates and the relationship between the variables is also not significant for Bangladesh. Further, the trends advocate that the inflation premium, equal to expected inflation that investors add to real-risk free rate of return, is ineffective in the country.

Kandir, S. Yilmaz, (2008) used OLS multiple regression model was used to estimate the relationship between stock portfolio return and seven selected macroeconomic variables covering the period from July 1997 to June 2005. Three stock portfolios was constructed based on the ranks of the firms by the firm's market equity (ME), Book to Market Equity (BE), Earnings to Price Ratio (EP), and finally Leverage Ratio (LEV) criteria. The result showed that exchange rate, interest rate, and world market return seem to affect all the portfolio returns. On the other hand industrial production, money supply, and oil prices do not appear to have significant affects on stock returns. Inflation gives complex results, since it is significant for only three of the twelve portfolio returns. The relationship between interest rate and stock return was found to be negative. Although turkey is a net importer of oil but oil prices was not a significant factor with respect to stock portfolio return.

Robert, D. H. Jr., (2008) examined the relationship between stock prices and macroeconomic variables among four emerging economies like Brazil, Russia, India and China commonly known as BRIC country. He has applied Box-Jenkins ARIMA model to establish the relationship. He found no significant relationship between exchange arte and oil price with stock market index prices of either BRIC country. He also found no significant relationship between present and past stock market returns and concludes that the BRIC country's stock market exhibit weak-form of market efficiency.

Shahid, S. (2008) investigates the causal relationships between stock prices and key macroeconomic variables like index of industrial production, exports, foreign direct investment, money supply exchange rate, interest rate, NSE Nifty and BSE Sensex in India. He used quarterly data between March 1995 to March 2007 and applied Johansen's approach of cointegration and Toda and Yamamoto Granger Causality Test to explore the long run relationship while BNAR model for variance decomposition and impulse response function to examine short run relationships. Cointegration regressions indicate the presence of a long run relationship between stock prices and FDI, stock prices and MS and stock prices and IIP. Toda Yamamoto Granger causality test reveals that Nifty-Index granger cause to export, money supply. On the other hand, FDI, interest rate and Sensex granger cause Nifty-Index.

Banerjee & Adhikary (2009) have studied on the dynamic effects of deposit interest rate and Taka-US Dollar exchange rate changes on Dhaka Stock Exchange (DSE) return a well known cointegration methodology has been applied using monthly data from January 1983 through December 2006. A change in deposit interest rate was found to have positive relation with stock price and exchange rate was found to have negative relation with stock price. A long run equilibrium and causal relationship was found between stock return and interest rate and exchange rate. However, they did not found nay short run effects between stock return and two other independent variables.

Alam, M.H. and Uddin, G.S., (2009) has examined the relationship between interest rate and stock price in developed and developing countries between January 1988 and March 2003. Bank deposit rate has been used as a representative of interest rates and fifteen different countries (i.e. Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, Philippines, South Africa, Spain, and Venezuela) have been selected to conduct this investigation. In has been found that except Japan and Malaysia, all the countries deposit interest rate have negative association with their respective countries' stock price.

Christopher *et al.* (2009), examined the extent to which some information factors or market indices affect stock price. He applied a model which was defined by Al-Tamimi (2007) to regress the dependent variable by a group of few independent variables (i.e. EPS, GDP, lending interest rate, and foreign exchange rate). The independent variables are found to have positive correlation with dependent variable (Stock price) except lending interest rate and foreign exchange rate.

Tunah, H. (2010) examines the relationship between macroeconomic factors and stock returns of Turkish stock market index (SRISEI-100) from the period from January 2002 to August 2008. A good number macroeconomic factors i.e. Dow Jones Industrial Avearge (DJIA), foreign exchange rate (USD), one month time deposit rates(1-TIDR), gold prices (GP), industrial production index (IPI) producer price index (PPI) industrial crude oil prices (ICOP), total credit volumes (TCV) broad money supply (M2Y) net foreign exchange reserve (NFER) and import (IMP) were incorporated to examine Johansen and Juselius (1990) co9integration test, bi-directional Granger Causality test and finally Vector Autoregressive (VAR) test to examine their relationship. Cointegration test provides 9 cointegrating vectors among the variables. Granger causality test provides bi-directional causality from SRISEI-100 to DJIA and IPI and unidirectional causality from USD to SRISEI-100, from SRISEI-100 to PPI, from ICOP to SRISEI-100, from M2Y to SRISEI-100, from IMP to SRISEI-100, from TCV to SRISEI-100. Finally, a VAR model test were executed and the test results showed a negative relationship between US dollar, gold prices, 1 month time depot rates, and stock returns. And there is a positive relationship between industrial production index, total credit volume, import, money supply, net foreign exchange reserve, international crude oil prices, Dow Jones Industrial Average and stock returns.

Rahman, J. , Iqbal, A. and Siddiqi, M., (2010) examines the nature and the direction of causality in Pakistan between public expenditure and national income along with various selected components of public expenditure by applying Toda-Yamamoto causality test to Pakistan for the period of 1971 to 2006. This study finds that there is a unidirectional causality running from GDP to government expenditure.

Absalom, T.O. and Ogunmuyiwa, M.S. (2010) investigates the impacts of macroeconomic variables on share price of Nigeria. He used average share price of the Nigerian Stock Exchange as dependent variables and External Debt, Inflation rate, Fiscal Deficit, Exchange rate, Foreign Capital Inflow, Investment, Industrial output as independent variables. The findings of Granger Causality test indicated that Average Share Price (ASP) does not Granger cause any of the nine (9) macroeconomic variables in Nigeria in the sample period. Only exchange rate granger causes average share price when considered in pairs. The Johansen co-integration test and showed a long run relationship between share price and the macroeconomic variables. Error correction method also showed a weak relationship between share price and macroeconomic variables. That means stock price is not a leading indicator of macroeconomic variables in Nigeria and R-square value indicated that about 60 percent of the variation in stock prices in accounted for by macroeconomic variables in Nigeria.

Ali, M. B. (2011) investigates the impact of changes in selected microeconomic and macroeconomic variables on stock returns at Dhaka Stock Exchange (DSE). A Multivariate Regression Model computed on Standard OLS Formula has been used to estimate the relationship. Regression coefficient reveals that inflation and foreign remittance have negative influence and industrial production index; market P/Es and monthly percent average growth in market capitalization have positive influence on stock returns. All the independent variables can jointly explain 44.48 percent variation in DSE all share price index. No unidirectional Granger Causality is found between stock prices and all the predictor variables except one unidirectional causal relation from stock price and market P/Es. Finally, lack of Granger causality between stock price and selected micro and macro variables ultimately reveals the evidence of informationally inefficient market.

Afzal, N. and Hossain, S.S. (2011) examined the relationship between macroeconomic variables and stock prices in Bangladesh. Monthly data series has been used between July 2003 and October 2011 to test the relationship between DSE general index and four macroeconomic variables viz. exchange rate, M1, M2 and inflation. They have found long run equilibrium relationship between stock price and M1, M2 and inflation rate. Bivariate causality has been found from M1, M2 to stock price and from stock price to inflation.

Abu-Libdeh, H. and Harasheh, M., (2011) have examined the relationship between stock price and macro variables in Palestine Securities Exchange. Based on quarterly data between March 2000 and June 2010 (40 observations) it was found that except balance of trade, other macro variables like GDP, inflation, exchange rate and LIBOR rate have positive regression coefficients with stock price. But they have found no granger causal relation between stock price and all the selected macro variables.

Hussain, Mohd., (2012) have examined the relationship between the development of Islamic Stock Market and macroeconomic variables in Malaysia. Monthly data between April 1999 and October 2007 have been used to perform Cointegration test and Granger Causality test among the variables. They found that Islamic Stock prices (KLSI) are cointegrated with selected macroeconomic variables in which stock price is related positively and significantly with industrial production index (IPI) and consumer price index (CPI) and related negatively and significantly with M3 and exchange rate (MYR). However, its relation with Islamic inter-bank rate is found negative and significant. From the aspect of Granger causal relationship, it is found that CPI, M3 and MYR granger causes KLSI and KLSI granger cause for IPI, CPI and MYR.

This chapter is intended to incorporate the review of findings and empirical evidences of the relationship between stock price & micro variables and stock price & macro variables in different research cases. At the end, it can be concluded that the findings and research evidences are not same for every cases. This dissimilarity in different research findings may be due to the fact that different methodology and data set have been used in different cases. Moreover, all these research are concerned with different stock market with different levels of market efficiency, different investment psychology of the market participants, different macroeconomic conditions of the economy, monetary and fiscal decisions, political stability etc. So, it is beyond any doubt that stock prices of any stock market are influenced by both the micro factors as well as macro factors of that economy. Therefore, this research has included both the micro as well as macro factors to analyze the behavior and long run relationship of the stock price in Dhaka Stock Exchange (DSE).

CHAPTER 6

RESEARCH DESIGN AND METHODOLOGY

In the absence of any definite and appropriate guidelines and instructions for incorporating factor variables for building stock pricing model, different researchers, academicians as well as financial analysts have used different factor variables as the function of stock price. Empirical studies have suggested that, stock price changes are associated with changes in fundamental variables (i.e. payout ratio, dividend yield, price earnings multiples, stock splits, capital structure, earnings size of the firm and its growth, market to book value ratios, trading volume, market capitalization etc.) that are relevant in the valuation of stocks. Empirical testing also provide sufficient evidence that stock prices are influenced by macroeconomic aggregates like inflation, board money supply, GDP, interest rate, foreign exchange rate, international crude oil price, foreign exchange reserve, level of export and import, industrial productive activity etc. Very few evidence have been found that includes both the fundamental factors and macroeconomic factors as a function of stock prices. On the Other hand, the evidence supporting the use of significant fundamental factors or macroeconomic factors to helps to explain the changes in stock prices are found to provide different results based on developed economy and emerging economy.

Although satisfactory number of research related to price behavior in stock market has been documented in developed economies but this number is not satisfactory for the emerging economies. As emerging markets exhibit few important characteristics which is not same for developed markets, that’s why it is important to find the result for the emerging markets. This research is an attempt to develop a model that incorporates both the fundamental factors and macroeconomic indicators to explain the changes in stock prices as well as their causal relationships for an important emerging capital market like Dhaka Stock Exchange (DSE). This attempt will try to focus on the pattern and degrees of relationship DSI and all the selected independent variables.

6.1 <u>Introducing Independent Micro-Variables:</u>

1. <u>Weighted Market Capitalization (WMKTCAP):</u>

A market capitalization calculation is a critical part of any stock valuation process. Market capitalization (sometimes called market cap) is the total market value of all the companies' outstanding shares. This represents the value the market has placed on the value of the company's equity. In this research, weighted market capitalization has been measured in terms of proportional weight between market capitalization of financial organization and manufacturing organization. *In this research it is assumed that weighted market capitalization have positive influence over share price*. The formula to calculate market capitalization and weighted market capitalization are:

Market Capitalization= Number of Shares Outstanding X Closing Price.

Weighted Market Capitalization= Proportionate capitalization of financial firms+ Proportionate capitalization of manufacturing firms

2. <u>Weighted Market Dividend Yield (WMKTDY):</u>

A percentage of how much a company pays out in dividends each year relative to its share price has been defined as dividend yield. If the stock price goes down then the yield increases and if the stock price goes up the yield decreases. However, weighted market dividend yield has been measured as a sum of proportional dividend yield from financial organization and manufacturing organization. *In this research, it is assumed that weighted market dividend yield constitute negative influence over share price.* The formula to calculate dividend yield and weighted market dividend yield are is:

Dividend Yield= (Dividend Per Share / Closing Price) X 100

Weighted Market Dividend Yield= Proportionate Dividend Yield of financial firms+ Proportionate Dividend Yield of manufacturing firms

3. ***Weighted Market Earnings Per Share (WMKTEPS):***

Earnings per Share (EPS) can be defined as the portion of a company's profit allocated to each outstanding share of common stock. Earnings per share serve as an important indicator of a company's profitability. Here weighted market earnings per share have been calculated based on proportional contribution from financial organization and manufacturing organization. In this research, *earning per share is assumed to have positive effect on share price*. The formula to calculate earning per share and weighted market earnings per share is:

Earnings per Share= (Net Income – Dividends on Preferred Stock)/Average Outstanding Shares

Weighted Market Earnings Per Share= Proportionate EPS of financial firms+ Proportionate EPS of manufacturing firms

4. ***Weighted Market Price/Earnings Multiples (WMKTPE):***

Price to earnings is an indicator which indicates current mood of investors how much they are willing to pay per unit of company earnings. The stock price and the earnings per share determine the value of the ratio. P/E increases when investors are willing to pay more per unit of earnings while the earnings remain stable. P/E also grows when both the stock price and the earnings per share increase, however, the increase of stock price must be sharper than the increase in the earnings per share. Another scenario of increasing P/E take place, when stock price remain stable despite there is a decrease in the earnings per share. The price earnings ratio does not change when there is a balance between the growth of the stock price and the earnings per share. On contrary, P/E declines when the willingness of investors to pay price per unit falls as well as when the price paid per stock by investors' increases in slower pace than the earnings per shares etc. Here weighted market price to earnings multiples have been measured in the same way as it is explained above. *This research assumes that market price-earning multiples have positive influence over share price*. The formula to calculate price to earnings multiples and weighted market price to earnings multiples are is:

Price/Earnings Multiples: Closing Price / Earnings Per Share

Weighted Market Price to Earnings Multiples= Proportionate P/E ratio of financial firms+ Proportionate P/E ratio of manufacturing firms

5. <u>Weighted Market Trading Volume (MTV):</u>

The number of shares or contracts traded in a security or an entire market during a given period of time. It is simply the amount of shares that trade hands from sellers to buyers as a measure of activity. If a buyer of a stock purchases 100 shares from a seller, then the volume for that period increases by 100 shares based on that transaction.

Volume is an important indicator in technical analysis as it is used to measure the worth of a market move. If the markets have made strong price move either up or down, the perceived strength of that move depends on the volume for that period. The higher the volume during that price move the more significant the move. *Here it is assumed that market trading volume have positive influence over share price within out sample data.*

6.2 <u>Introducing Independent Macro-Variables</u>

<u>1. Consumer Price Index (CPI):</u>

Consumer Price Index (CPI) is a measure that examines the weighted average of the price of a basket of consumer goods and services. It is very common to use the growth rate of consumer price index as a measure of inflation. In Bangladesh, CPI is calculated by adding CPI from Food Item and CPI from Non-food Item. CPI from Food Item constitutes 58.84 percent and CPI from Non-food Item Constitute 41.16 percent. The relative weight of each item in the on-food category is clothing and footwear 6.85%, Gross rent fuel and lighting 16.87%, Furniture, furnishing and others 2.67%, Medical care and health expenses 2.84%, Transport and communications 4.17%, Recreation, entertainment, Educations and cultural services 4.13%, Miscellaneous goods and services 3.63%. Inflation can affect the volatility in stock prices positively and negatively. Gultekin (1983) studied in multiple countries, Choundry (2001) studied in multiple-inflation subsistence economies, and Firth (1979) studied the relationship between inflation and stock price and found that stock prices are positively related. Defina (1991) argued that inflation can be positively related to stock prices if equities can be considered as hedge against inflation. According to Fisher (1930), stock markets are not dependent on inflation expectations; thus stock prices and inflation should move in the same direction.

However, Nishat and Shaheen (2004) studied in Pakistan, Maysami, and Koh (2000) studied in Singapore, Eita (2011) studied in Namibia, Mohammed and Shaheen (2004) studied in Pakistan, Wongbangpo and Sharma (2002) studied in ASEAN 5 countries, and Osei (2006) studied in Ghana on the relationship between stock prices and inflation. They found that stock prices are negatively related to inflation in their studied economies. The results of studies by Fama and Schwert (1977), Chen, Roll and Ross (1986), Nelson (1976) and Jaffe and Mandelker (1976) pointed to a negative relation between inflation and stock prices. *In this research it has been hypothesize similarly: an increase in the rate of inflation is likely to lead economic tightening policies, which in turn increases the nominal risk-free rate and hence raises the discount rate in the valuation model that ultimately results a decrease in the price of stock in the market.*

2. Deposit Interest Rates (DIR):

Deposit interest rate means the rate of interest that is given to the depositor for the deposit of an amount in their bank account. In this research I have taken monthly weighted average deposit interest rates for the amount of deposit for 3 to less than 6 months. In the days when deposit interest rate changes were announced without warning, we could see some of the most dramatic share prices movements immediately following them as the markets responded to the new interest rate environment. This is because investment in bank account and investment in stocks in the capital market are two attractive investment opportunities for the investors. In this case investors usually depend on the rate of return from their investment. An increase in deposit interest rates also makes equity relatively less attractive as an asset class. So after considering cost of transaction and the volatility of the stock prices, investors may not like to hold their investment in stocks in the capital market if they found an increased rate of return in the form of deposit interest rate is available in the bank account. That means at the presence of attractive deposit interest rate investors may like to liquidate their investment from the capital market and reinvest the same in the bank account that lead to a downward shift in the stock prices. In the same way stock prices will be increased when the deposit interest rate is less attractive compared to the return from stock investment that results a supply of funds from bank account to equity market. This additional supply of funds actually leads the stock prices go up.

That's why, in this research deposit interest rate is assumed to have negative relationship with share price.

<u>3. Foreign Exchange Rate (EXR):</u>

Foreign exchange rate can be defined as the price of one country's currency expressed in another country's currency. In other words, the rate at which one currency can be exchanged for another. In this research I have taken the exchange rate data of 1 USD with respect to BDT at different time period without considering the differences in the exchange rate system.

There is no theoretical consensus neither on the existence of relationship between stock prices and exchange rates nor on the direction of the relationship. However, in the literature, two approaches have been asserted to establish a relationship between exchange rate and stock prices: The goods market model (also known as flow-oriented model) and the portfolio balance model (also known as stock oriented model).

First approach is referred to Dornbusch and Fisher (1980) focusing on the association between the current account and the exchange rate. Dornbusch and Fisher (1980) developed a model of exchange rate determination that integrates the roles of relative prices, expectations, and the assets markets, and emphasis the relationship between the behavior of the exchange rate and the current account. Dornbusch and Fisher (1980) argue that there is an association between the current account and the behavior of the exchange rate. It is assumed that the exchange rate is determined largely by a country's current account or trade balance performance. These models posit that changes in exchange rates affect international competitiveness and trade balance, thereby influencing real economic variables such as real income and output. That is, goods market model suggests that changes in exchange rates affect the competitiveness of a firm, which in turn influence the firm's earnings or its cost of funds and hence its stock price. On a macro level, then, the impact of exchange rate fluctuations on stock market would depend on both the degree of openness of domestic economy and the degree of the trade imbalance. Thus, goods market models represent a positive relationship between stock prices and exchanges rates with direction of causation running from exchange rates to stock prices. The conclusion of a positive relationship stems from the assumption of using direct exchange rate quotation (Stavarek, 2004).

On the other hand, portfolio balance models put much more stress on the role of capital account transactions (Tahir and Ghani, 2004). Portfolio balance model assumes a negative relationship between stock prices and exchange rates. A rise in domestic stocks prices would attract capital flows, which increase the demand for domestic currency and cause exchange rate to appreciate. A rising stock market leads to the appreciation of domestic currency through direct and indirect channels. A rise in prices encourages investors to buy more domestic assets simultaneously selling foreign assets to obtain domestic currency indispensable for buying new domestic stocks. The described shifts in demand and supply of currencies cause domestic currency appreciation. The indirect channel grounds in the following causality chain. An increase in domestic assets prices results in growth of wealth that leads investors to increase their demand for money, which in turn raises domestic interest rates. Higher interest rates attract foreign capital and initiate an increase in foreign demand for domestic currency and its subsequent appreciation (Stavarek, 2004).

Actually, changes in exchange rate affect exporter and importer firms conversely. In case of a depreciation of the domestic currency, imported products suddenly become more expensive in terms of the home currency. If this price increase can be passed through to customers, earnings will not suffer from the currency adjustment. But this is often not the case. First, the price increase will tend to reduce demand for these imported products. Second, locally produced goods will become more attractive than important goods, and some substitution will take place (Solnik and McLeavey 2009, p. 244). Therefore, the shares of importer firms will decrease, whereas the shares of exporter become more valuable. *However, in this research, it has been assumed that foreign exchange rate have negative influence over share price.*

4. Export Receipt (EXRPT):

It is total amount of money receipt from the export of goods to foreign countries where the selling price of exported products includes all costs associated with producing that product plus the cost of loading on the vessel. The payment received from the export of goods to foreign country is considered to be an important macroeconomic indicator that is believed to have significant influence over different sectors of the economy. Export-led growth hypothesis in this regard suggests that export is a key to promote economic growth and thus raises the rewards of factors of production. Furthermore, it opens investment opportunity in the economies due to the higher level of income and saving, thus leads to the sectoral growth. Export earnings are the most important source of foreign exchange that can be used to ease the pressure of balance of payment and reduce the impact of external shocks on domestic economy. It is generally accepted that economies having high export performance also perform well in their GDP growth and vice versa. This raises an important question about the nature of the link between exports and GDP. Whether the co-movement between exports and GDP is in accordance with growth accounting identity in which exports is one of the components of GDP; or whether there exists a causal relationship between the two. The existence of such nexus between export and economic growth, therefore, has been the focus of many researchers. *In this research, it is assumed that export receipt have positive influence over share price.*

5. Foreign Exchange Reserve (FXRES):

Any country is marked as rich or poor country usually by having a look at its foreign reserves which is nothing but the country's holdings of internationally acceptable means of payments for the purpose of covering short to medium term deficits on its external balance of payments, and the related purpose of exerting control over the movement of the exchange rate of its currency. These reserves are principally held in gold and US dollars due to their world wide acceptance. Foreign exchange reserves can be enhanced by storing more and more foreign currency and this can be done in three ways: by increasing export, by foreign remittances, and by taking official grants or loans. If foreign exchange reserves are increasing due to export and remittances then the growth of reserves is positive but if it is increasing with the help of loans then growth will be negative. This research is not concerned with the positive or negative growth rather it examines only the foreign exchange reserves held by central bank and their impact on stock prices. Foreign exchange reserves (also called forex reserves or FX reserves) in a strict sense are 'only' the foreign currency deposits and bonds held by central banks and monetary authorities that include foreign exchange and gold, Special Drawing Rights (SDR) and International Monetary Fund (IMF) reserve positions. This broader figure is more readily available but it is more accurately termed as official international reserves or international reserves. *In this research, foreign exchange reserve is assumed to have positive influence over share price.*

6. Per Capita Gross Domestic Product (PCAPGDP):

Per capita gross domestic product (PCAPGDP) is a measure of the total output of a country that takes the gross domestic product (GDP) and divides it by the number of people in the country. The per capita GDP is especially useful when comparing one country to another because it shows the relative performance of the countries. It is one of the significant indicators of a country's economic performance. A rise in per capita GDP signals growth in the economy and tends to translate as increase in productivity. On the other hand, per capita GDP is sometimes used as an indicator of the standard of living as well, with higher per capital GDP being interpreted as having higher standard of living. A lot of empirical evidence demonstrates the fact that the association between economic growth represented by growth in per capita GDP and stock price is negative, although very weak theoretical support has been found in different literature. Ritter J. R. (2004) examined cross-country correlation of real stock returns and per capita GDP growth over 1900-2002 and found to have correlation coefficient of -0.37 with a *p*-value of 0.16. The author argued that, there is ample evidence that people who live in countries with higher incomes have longer life spans, lower infant mortality, etc. Real wages are higher. But although consumers and workers may benefit from economic growth, the owners of capital do not necessarily benefit. Unless technological change comes from existing firms with monopoly power, improvements in productivity raise the per capital income of consumers. Furthermore, a country can grow rapidly by applying more capital and labor without the owners of capital earning higher returns. Krugman (1994) and Young (1995) has argued that much of the real economic growth in emerging markets comes from high savings rates and the more efficient utilization of labor, neither of which necessarily translates into higher profits accruing to the shareholders of the existing firms. Siegel (2002) has pointed out that, for valuing markets, aggregate earnings growth does not matter. Investors are concerned about the growth in the earnings per share (EPS).

Economic growth requires increased capital expenditures, and this requires both reinvesting more earnings (and paying out fewer dividends in the short term) or higher personal savings that is invested in firms that issue shares. Thus, higher future earnings from the higher investment either are traded off for lower present dividends, or else they accrue to other shareholders, which is of no benefit to current shareholders. In addition, Warren Buffet (1999) and Jeremy Siegel (1999, 2000) have pointed out that in a competitive economy technological change largely benefits consumers through a higher standard of living, rather than benefiting the owners of capital. And if individuals save more and invest their savings, the increased amount of capital per worker will result in higher real wage rate, which is of no benefit to the owners of shares in existing corporations. The point is that economic growth does result in a higher standard of living for consumers, but it does not necessarily translate into higher present value of dividends per share for the owners of the existing capital stock. Thus, whether future economic growth is high or low in a given country has little to do with future equity returns in that country. Considering all these empirical evidence, *this research hypothesizes that per capita GDP have negative influence over stock price.*

7. Import Payments (IMPMT):

It is total amount of money paid for the import of goods from foreign countries where the import price of the products includes all costs associated with purchasing that product plus the cost of loading on the vessel. It is also considers as an influential macroeconomic variable especially in any emerging economy like Bangladesh. When the payment against import of goods is gradually rising, it reduces the reserves of foreign currency and induces a negative signal in the economy which is also expected to have similar impact in the stock market. *That's why it is assumed that import payment have negative influence over share price.*

8. Investment at Current Market Price (INVMP):

Aggregate investment at current market price both in public and private sector is another macroeconomic variable. Firms invest in anticipation of profits and stock market activities represent the investment effect for valuing the magnitude of their stream of profits implying a close relationship between the stock markets and investment behavior (Ahmed, M.F. 2000). The heightened stock price fluctuations or excessive stock market volatility in especially emerging economies over the past decades has attracted wide attention especially on its relation to the macro-economy. Since 1950s the neoclassical view of finance has been dominated by the irrelevance theorem of Modigliany and Millar (M-M) (1958, 1961). According to them,, in fully developed markets, under neoclassical assumption of perfect competition, absence of transaction costs and taxation, the stock market valuation of the firms is independent of its financing and dividend payout decisions even in a world of uncertainty. M-M theorem suggested a dichotomy between finance and real economy. Corporate growth and investment decisions are dictated completely by 'real' variables like productivity, demand for output, technological progress and related factor prices of capital and labor. Finance in this paradigm is always permissive and simply facilitates the investment process. On the other hand, Keynesian view suggests that investment is essentially determined by 'animal spirit', businessmen's confidence and expected demand and it does not accept perfect capital market assumptions. Thus Keynesian view is not consistent with M-M the theorem. These neoclassical irrelevance theorems also do not support the concepts of investment and financing decisions of the firms offered by a theory popularly known as 'pecking order' theory (Myers 1984, 1985 and Fazzari *et al.*, 1988). Pecking order theory suggest that firms always prefer internal to external finance, and if they have to use external finance, they would prefer debt finance, and only as last resort, equity finance. In brief, stock price changes signal future economic prospects, influence the costs of capital replacement via the well-known Tobin's *q* (1969), and have important bearings on firms and bank balance sheets. Accordingly, by affecting confidence of future economic conditions and external financing costs' of the firms, stock price changes have positive impact on aggregate investment (see Laopodis and Sawhney, 2007). It is very rational that aggregate investment both at public and private sector will boost the economic activity which will contribute to increased productivity, improved earnings, increased demand of the economy for goods and services, better living standard of the general people, and strengthen economic condition of the country. This entire enhancement due to amplified economic activity is expected to have significant relation with respect to stock market of the economy. *In this research it has been assumed that investment at current market price exhibit positive influence over change in DSE all share price index.*

9. Industrial Production Index (IPD):

This indicator measures the amount of output from the manufacturing, mining, electric and gas industries but excluding constructions. The data published includes the total capacity utilization rate and month-over–month and year-over-year changes for the industrial production and manufacturing output. In this case, changes in industrial production affect the opportunities facing investors and the real value of cash flows. Trainer (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 i.e. a rise in industrial production would signal economic growth. Fama (1990) and Geske and Roll (1983) hypothesized a similar positive relationship through the effects of industrial production on expected future cash flows. The productive capacity of an economy indeed depends on the accumulation of real assets, which in turns contributes to the ability of firms to generate cash flows. Chen, Roll and Ross's (1986) findings based on a US stock portfolio, indicated that future growth in industrial production was a significant factor in explaining stock returns. Hence, suggesting a positive relationship between real economic activity and stock prices, this research hypothesize that *industrial production index have positive relation over share price.*

10. Broad Money Supply (M2):

Money supply is another fundamental macroeconomic variable which is widely used in the literature to determine stock prices. Besides extensive investigation, the relationship between money supply and stock price is still ambiguous. According to the *'Portfolio Theory'*, an increase in the money supply may result in a portfolio change from non-interest bearing assets to financial assets like stocks. Moreover as Mukherjee and Naka (1995) pointed out, if money supply brings economic stimulus, then the resulting corporate earnings in turn increases the stock prices. on the other hand, when increased money supply causes the inflation to be increased, then an increase in the money supply raise the discount rate and therefore reduce the stock prices.

Monetary policy influences the general economy through a transmission mechanism. Both a restrictive and an expansionary monetary policy might have bilateral effects. In case of expansionary monetary policy, the government creates excess liquidity by engaging in open market operation, which results in an increase in bond price and lower interest rates. The lower interest rate would lead to the lower required rate of return and thus, the higher stock price.

Additionally, an increase in monetary growth indicates excess liquidity available for buying stocks, eventually resulting in higher stock prices due to an increase of demand to both common stocks and the real good markets. However, monetary growth might result in higher inflation and hence, higher nominal interest rate according to Fisher equation. The higher interest rate leads to the higher required rate of return, which will result in the lower stock price.

In case of a restrictive monetary policy, to reduce the growth rate of money supply would result in a decrease in the supply of funds for working capital and expansion for all business. Additionally, a restrictive monetary policy would raise market interest rate and hence firm's cost of capital. Furthermore, an increase in interest rate would make it more expensive for individuals to invest and the purchase of other durable goods. However, a decrease in money supply might result in the lower inflation, hence the lower required rate of return via the lower nominal interest rate. Thus, this would lead to the higher stock prices.

In literature, the initial studies generally imply that changes in the growth rate of the money supply could serve as a leading indicator of stock price changes, while subsequent studies questioned these findings (Reilly and Brown 2006, p. 362). The formula for estimating broad money supply is:

Broad Money= Time deposit + M1

Where,

Narrow money (M1) = Demand deposit + Currency outside banks

= demand deposit + BB notes and coins + Govt. notes and coins

In this research, it is assumed that Broad money supply have positive influence over share price.

11. National Income Deflator (NID):

National Income Deflator (NID) is the measure of average level of prices of all goods and services included in the Gross Domestic Product (GDP). It is considered as a broader index than Consumers' Price Index (CPI) and Producers' Price Index (PPI). In this case National Income Deflator is calculated by the following formula:

$$GDP\ Deflator = (Nominal\ GDP/Real\ GDP)*100$$

Here Nominal GDP is the value of the current period production of goods and services at current market prices and Real GDP is the measure of the current period production of goods and services at base period prices. NID is a much broader, more comprehensive price index reflecting all goods and services in GDP (thousands of items) including consumer, business and government spending. In addition to being more comprehensive than the CPI, the NID is also different from CPI because it is not nor based on a fixed basket of goods – it updates the typical bundle each year to reflect what people, businesses and government actually buy. *In this research, it is assumed that national income deflator exhibit positive influence over share price.*

12. Foreign Remittance (REMIT):

Foreign remittances can be defined as the transfer of foreign currency by local nationals located at some foreign country. It is considered as the key driver to economic growth and poverty reduction in any emerging economy like Bangladesh. In addition foreign remittances also strengthen the foreign currency reserve and increase the ability of import financing, reduce the unemployment pressure and contribute to consumptions, savings and investment both at micro and macro level of the economy. According to Bangladesh bank study report 2011, the amount of foreign remittance constitute 9.11 percent of GDP, 67.80 percent of export, 51.37 percent of import financing in 2009-10. Based on foreign remittance generation, Bangladesh holds the 7th position in the world. Study Report also identified that, 42 percent of the beneficiary of foreign remittances use it directly or indirectly in financial sector of the country (i.e. purchase of savings certificate 13%, term deposit at banks or insurance company 21%, and capital market investment 8%). That's why it is my assumption that the inflow of foreign remittances has positive influence over the increase in stock prices at DSE. *In this research, it is assumed that foreign remittances have positive influence over share price.*

13. Total Domestic Credit (TDC):

Total domestic credit can be defined as the total amount of credit given by the banking system to both the public and private sector. It seems to be very rational that the more and more credit banking systems extend to public or private sector, part of this credit amount will enter in to the capital market that lead to an upward pressure in the stock price. In the same way, a decrease in total domestic credit results a downward pressure in the stock price. The formula for estimating total domestic credit is:

Total Domestic Credit through Banking System= Total credit to public sector+ Gross credit to private sector.

However, it is assumed that total domestic credit have positive influence over share price.

6.3 Sample Time Frame:

This research initially incorporates monthly secondary data from July 1986 to December 2010 (total 294 months). However DSE-all share price index data have been trimmed for the total of 12 months (i.e. 9 months from August 1996 to April 1997 and 3 months from October to December 2010) due to abnormal stock market behavior during this period. The independent variables (i.e. both micro and macro) data for the same period have been excluded to ensure data equality and chronological consistency. Finally, I have decided to select a total of 283 months as my sample time frame for this research.

6.4 Sample Data and Data Sources:

In this research DSE all Share Price Index (DSI) has been taken as dependent variable and a group of stock market oriented (micro) variables and aggregate economy oriented (macro) variables as independent variables. The list of independent variables, their acronyms and relevant information have been presented in the following way:

Table: 6.1 Micro Variables at a Glance

SL No.	Name of the Microeconomic Variables	Basic concept	Units of Measurement	Acronyms
1.	Financial Capitalization	Average share capitalization from Financial Institutions	Million Taka	FINCAP
2.	Financial Dividend Yield	Average dividend yield from Financial Institutions	Percent	FINDY
3.	Financial Earnings Per Share	Average EPS from Financial Institutions	Unit Taka	FINEPS
4.	Financial Price Earnings Multiples	Average price earnings multiples from Financial Institutions	Unit Times	FINPE
5.	Manufacturing Capitalization	Average share capitalization from Manufacturing Institutions	Million Taka	MFCCAP
6.	Manufacturing Dividend Yield	Average dividend yield from Manufacturing Institutions	Percent	MFCDY
7.	Manufacturing Earnings Per Share	Average EPS from Manufacturing Institutions	Unit Taka	MFCEPS
8.	Manufacturing Price Earnings Multiples	Average price earnings multiples from Manufacturing Institutions	Unit Times	MFCPE
9.	Weighted Market Capitalization	Total market capitalization	Million Taka	WMKTCAP
10.	Weighted Market Dividend Yield	Weighted average market dividend yield	Percent	WMKTDY
11.	Weighted Market Earnings Per Share	Weighted average market EPS	Unit Taka	WMKTEPS
12.	Weighted Market Price Earnings Multiples	Weighted average market PE Multiples	Unit Times	WMKTPE
13.	Market Trading Volume	Total number of securities traded in the entire market during a given period of time.	Unit volume	MTV

Table: 6.2 Macro Variables at a Glance

SL No.	Name of the Macroeconomic Variables	Basic Concept	Units of Measurement	Acronyms
1.	Consumer Price Index	The scale of general price level in Bangladesh	Base Year 1985-86 as 100	CPI
2.	Deposit Interest Rate	Monthly weighted average deposit interest rate	Percent	DIR
3.	Foreign Exchange Rate	Period average official rate of exchange as per 1 USD	Unit taka	EXR
4.	Export Receipt	Amount received from export of commodities based on f.o.b. basis	million USD	EXRPT
5.	Foreign Exchange Reserve	Regular maintenance of foreign currencies by Bangladesh Bank	million USD	FXRES
6.	Per Capita Gross Domestic Product	A measure of the total output of a country that takes the gross domestic product (GDP) and divides it by the number of people in the country.	unit Taka	PCAPGDP
7.	Import Payment	Amount paid against import of commodities based on f.o.b. basis.	million USD	IMPMT
8.	Investment at Current Market Price	The aggregate of all public and private investment held in Bangladesh	Crore Taka	INVMP
9.	Industrial Production Index	The scale of productive activity in Bangladesh	Base Year 1973-74 as 100	IPD
10.	Broad Money Supply	The sum of Currency Outside Banks, Demand Deposit and Time Deposit held in Bangladesh	Crore Taka	M2
11.	National Income Deflator	A typical measurement of national economic activity	Base Year 1995-96 as 100	NID
12.	Foreign Remittance	The inflow of foreign currency into Bangladesh from some other foreign countries earned by Bangladeshi nationals	Crore Taka	REMIT
13.	Total Domestic credit	Domestic credit through banking system in Bangladesh which is the sum of net credit to govt., gross credit to other public sector and gross credit to private sector	Crore Taka	TDC

Data Sources:

The dependent variable (DSE-all share price index) as well as the micro-variables data has been collected from the following three sources:

(i) *'Monthly Review'* Publication issued by Dhaka Stock Exchange (DSE) Research and Publication Division.

(ii) *Soft Data Set* from DSE Research and Publication Division and

(iii) DSE Official Website: www.dsebd.org.

The macro-economic monthly variables data has been collected from the following sources:

i. *'Monthly Economic Trends'* issued by Statistics Division of Bangladesh Bank;

ii. *'Statistical Year Book- 2010 and 2011'* issued by Bangladesh Bureau of Statistics;

iii. *'Bangladesh Economic Review-2010 and 2011'* published by The Ministry of Finance, Bangladesh;

iv. Different publications issued by Dhaka Stock Exchange (DSE) and

v. Different web sites link such as: http://www.mof.gov.bd; http://www.bbs.gov.bd/Home.aspx; and http://www.banbeis.gov.bd/webnew/ etc.

6.5 Data Generation Process:

This research has been designed to estimate whether DSE all share price index is influenced by a selected group of independent variables in Bangladesh. Independent variables have been selected partly from microeconomic variables and the remaining variables have been selected from macroeconomic aggregates. In order to collect microeconomic data, a strategy has been designed to segregate the data on the basis of nature of doing business of a company within the industry. In this case, out of 18 different industries listed at DSE, it has been divided in to two groups: one that involves in financial activities and they are classified as financial sector that includes all the banking, financial institutions and insurance industry (i.e. no. of 3 industries). And those who do not belongs to financial sector, they are defined as manufacturing sectors that includes Engineering, Food and Allied Product, Fuel and Power, Jute, Textile, Pharmaceuticals and Chemicals, Paper and Printing, Services and Real Estate, Cement, IT, Tannery, Ceramics, Telecommunications Travel and Leisure and Miscellaneous Industries (i.e. no of 14 industries). Mutual Funds Industry data has not yet incorporated because their inclusions will produce the problems of double consideration of the same data. This segregation has been done due to my strong believe that financial sector and manufacturing sector involves with different operational activities, different types of financing and investment structure, different dividend policies, different customer base, different suppliers and competitors that results different levels of operational efficiency which is ultimately reflected through the volatility of stock prices in different manner. That's why it is my belief that both the financial sector and manufacturing sector have different contributions in the movement in stock prices.

The microeconomic data like dividend yield, earnings per share, price earnings multiples for each month has been calculated by averaging all the data available in the *'Monthly Review'* based on financial sector and manufacturing sector. But the proportion of market capitalization has been used as a basis to calculate weighted market value for dividend yield, earnings per share, and price earnings multiples. That's means at first the proportion of financial and manufacturing capitalization has been identified and then that proportion has been used to estimate weighted market value for the micro variables i.e. dividend yield, EPS and PE multiples. However, due to non-availability of segmented trading volume data, it is not possible to classify market trading volume into financial and manufacturing sector.

For the macroeconomic data generation strategy, I have included monthly data for each and every variable if they are calculated monthly by appropriate authority. But for some years at the beginning of my sample time frame, some of the variables are found to have calculated either by quarterly or yearly basis. In addition, there are some variables like per capita GDP, aggregate investment, national income deflator, foreign exchange reserve are found to have calculated on a yearly basis. But according general convention and practice of conducting research and for the sake of carry on this research, the above mentioned variables of yearly data have been converted in to monthly data either by averaging or using the same yearly data for the 12 months in the respective year, whichever is believed to be logically appropriate.

6.6 Research Hypothecation:

This research is intended to identify the short and long run relationship between stock price and a group of independent micro and macro variables. As a result different independent variables have been identified and based of different economic and financial theory and empirical findings, hypothecation between each of these independent variables and stock price have been assumed. Table: 6.3 and Table: 6.4 provide a list of hypothetical relationship between stock price and each of the independent variables.

Table: 6.3 Summery of Hypothetical relationship between Stock Price and Micro Variables

Sl. No.	Independent Micro Variables	Hypothetical Relationship with DSI
1	Weighted Market Capitalization (WMKTCAP)	+
2	Weighted Market Dividend Yield (WMKTDY)	-
3	Weighted Market Earnings Per Share (WMKTEPS)	+
4	Weighted Price to Earnings Multiples (WMKTPE)	+
5	Market Trading Volume (MTV)	+

Table: 6.4 Summery of Hypothetical relationship between Stock Price and Macro Variables

Sl. No.	Independent Macro Variables	Hypothetical Relationship with DSI
1	Consumer Price Index (CPI)	+
2	Deposit Interest Rate (DIR)	-
3	Foreign Exchange Rate (EXR)	-
4	Export Receipt (EXRPT)	+
5	Foreign Exchange Reserve (FXRES)	+
6	Per Capita Gross Domestic Product (PCAPGDP)	-
7	Import Payment (IMPMT)	-
8	Investment at Current Market Price (INVMP)	+
9	Industrial Production Index (IPD)	+
10	Broad Money Supply (M2)	+
11	National Income Deflator (NID)	+
12	Foreign Remittance (REMIT)	+
13	Total Domestic Credit (TDC)	+

6.7 Research Methods:

The basic objectives of this research are to identify micro and macro factors that have long run equilibrium as well as long run causal relationship with Dhaka Stock Exchange (DSE) All Share Price Index (DSI). That's why dependent and independent micro and macro variables data series has been chronologically organized and their relative association has been identified through the estimates of correlation coefficients (Table: 6.2; Table: 6.3; and Table: 6.4). When all the independent variables are found have statistically significant correlation with DSI then these data series has been finally selected to employ in three different types of econometric tools in three different sections:

(i) ***Section: A*** *is concerned with the application of Multivariate Time Series Regression Model;*

(ii) ***Section: B*** *is concerned with the application of Johansen's Cointegration Test and Vector Error Correction Model (VECM); and*

(iii) ***Section: C*** *is concerned with the application of Granger Causality Test based on Toda-Yamamoto (T-Y) methodology.* A brief discussion of the of the research methods in all the above three types of econometric tools are presented below:

6.7.1 Multivariate Time Series Regression Analysis:

Multivariate time series regression model is considered to be an important econometric tool that can be used to estimate absolute relationship between dependent and a set of independent variables. This model also calculates the explanatory power of all the independent variables in explaining the changes in dependent variables. However, the following steps have been followed for the application of multivariate time series regression model between DSI and the listed independent variables:

(i) It is important for any time series data to be stationary before they are used in any regression estimates. That's why all the variables are tested for their stationarity and if they are found to be non-stationary, steps have to be make it stationary either by de-trending (i.e. by taking the log value of the variable) or by taking the first difference of the variable data. In this case, two most

popular and widely used unit root test i.e. *Augmented-Dickey Fuller (ADF) Test* and *Phillips- Parron (PP) Test* have been employed to identify the stationarity of the data series. *If the variables are found to be I(0) then it reveals that data series of the variable is stationary and it can used directly into the regression model. But if they are found to be I(1) which implies non-stationary data and that requires to estimate the first difference value of the same variable to make it stationary.*

(ii) Then *3 different multivariate time series regression model* has been designed according to best suited specification between dependent and independent micro-variables *(model 1)*; dependent and independent macro variables *(model 2)*, and dependent and the joint micro-macro variables *(model 3)*.

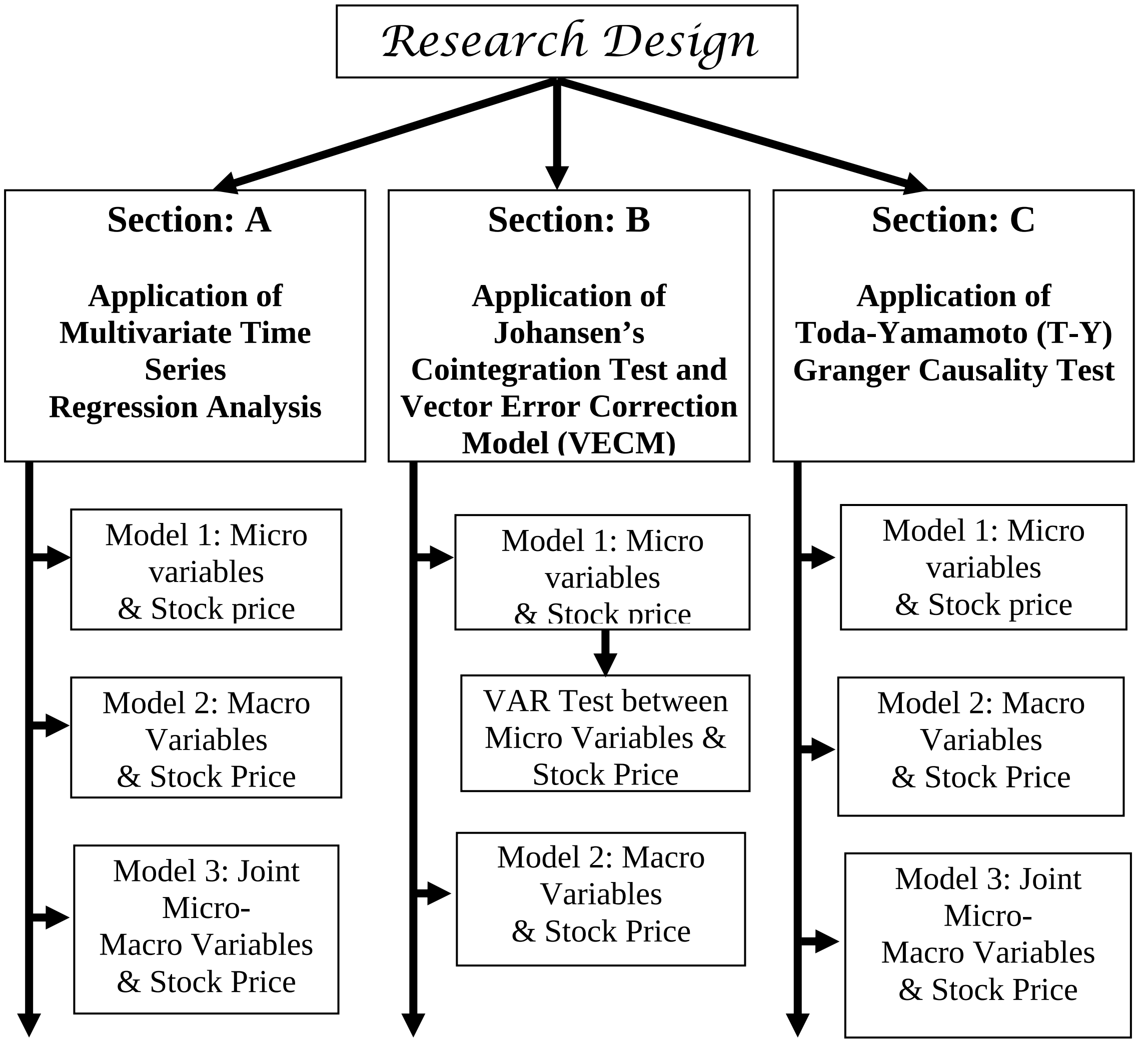
(iii) Then the presence of serial correlation in each of the regression model has been tested by *Breusch-Godfrey Serial Correlation LM Test*. Here null hypothesis has been assumed that residuals of the regression models are not serially correlated.

(iv) The *WALD Test* has been employed to test the statistical significance of the regression coefficients in each of the regression model. Here, null hypothesis has been assumed that regression coefficients are jointly statistically significant.

(v) The *White's General Heteroskedasticity (WGH) Test* has been applied to test the assumption of homoskedasticity in the regression model. here, null hypothesis has been assumed that residuals of the regression model are homoskedastic.

(vi) Finally, *Ramsey's RESET test* has been used to identify whether there is any specification error in the multivariate time series regression models. Here, null hypothesis has been assumed that the regression models have no specification error.

Figure 6.1: Diagram of Research Methods



6.7.2 Soren Johansen's Cointegration Test and Vector Error Correction Model (VECM):

The analysis of multivariate time series regression is often done by making the non-stationary variables into stationary simply by first differencing that throws away lots of potential valuable information about long run equilibrium relationship upon which economic theories have a great concern.

The ***Theory of Cointegration*** is developed by *Granger (1981)* and elaborated in *Engle and Granger (1987)* addresses this issue of integrating short run dynamics with long run equilibrium. They pointed out that a linear combination of two or more non-stationary time series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be *cointegrated*. This stationary linear combination is called the *cointegrating relationship* and may be interpreted as a *long-run equilibrium relationship* among the variables. As we are using a group object to establish equilibrium relationship, so a *VAR based cointegration methodology developed by Soren Johansen (1991, 1995)* is most appropriate. However the following steps have been followed to apply Johansen's Cointegration test

(i) In Model: 1, Johansen's cointegration test has been done between stock price and all the independent micro variables to identify the lung run equilibrium relationship among the variables. After then vector error correction model has been applied to identify the state of the short run disequilibrium that will be correction each period.

(ii) In Model: 2, Johansen's cointegration test has been employed between stock price and all the independent macro variables. After then, vector error correction model has been used to identify the state of the short run disequilibrium that will be correction each period.

6.7.3 Toda-Yamamoto (T-Y) Granger Causality Analysis:

The causal relationship can be identified through the application of Granger Causality test (1969). But only two variables can be used to test the causal relationship between them. As we have multiples independent variables, so VAR based Granger Causality which has been developed by Toda and Yamamoto (1995) is more appropriate. In this situation the following steps have been followed to apply Toda-Yamamoto (T-Y) Granger Causality test:

(i) In Model: 1, T-Y Granger causality has been tested between stock price and all the independent micro variables.

(ii) In Model: 2, T-Y Granger causality has been tested between stock price and all the independent macro variables.

(iii) In Model: 3, T-Y Granger causality has been tested between stock price and the joint micro-macro variables.

PART II

APPLICATION OF

ECONOMETRIC DATA ANALYSIS

CHAPTER 7

MULTIVARIATE TIME SERIES REGRESSION ANALYSIS

7.1 Basic Data Analysis and Descriptive Statistics:

It is important for every analytical research is to analyze the dependent and independent data series and estimate their descriptive statistics. This research has conducted sufficient examination and test to analyze sample data, their descriptive statistics and trend, and also estimates their interrelationship among each other. A brief discussion of basic data analysis and descriptive statistics is given below:

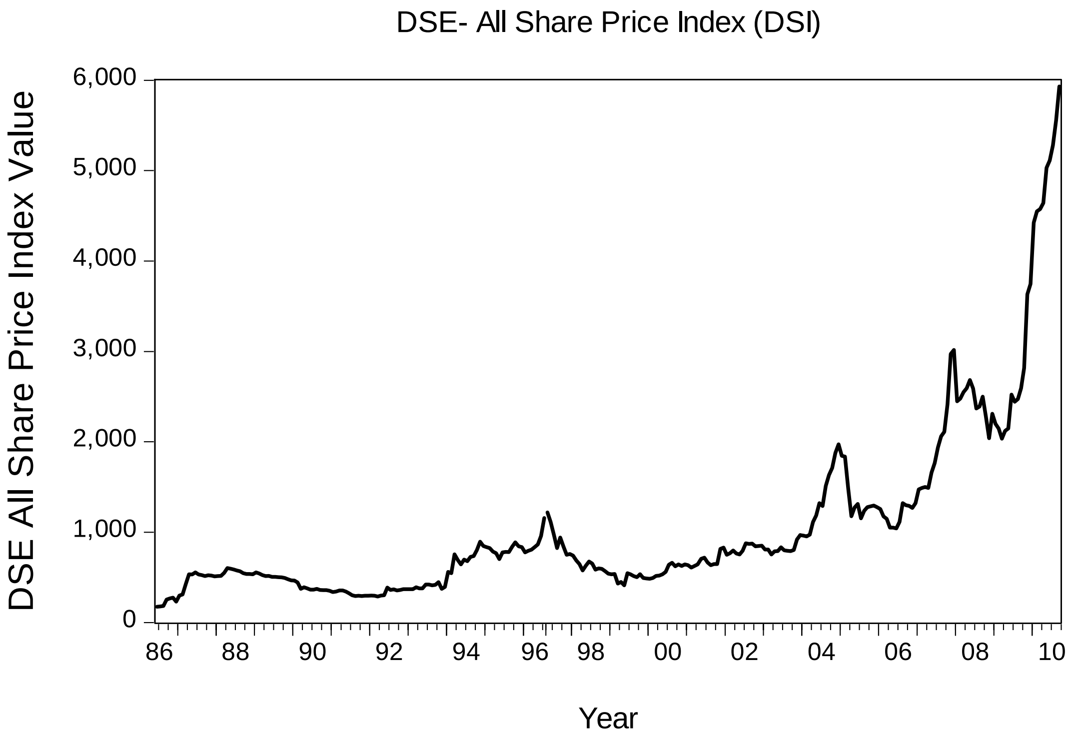
DSE- All Share Price Index (DSI): Independent Variable

The independent variable- DSE all share price index (DSI) has been analyzed based on their descriptive statistics and presented in Table: 7.1. The estimates of mean have been found to be 1037.701 which represent the average value of the sample DSI data series within our sample time frame. The median implies the middle value (705.6900) which is found to be below than the mean value. The maximum and minimum values (i.e. 5930.900 and 175.0700 respectively) represent the largest and smallest value of the DSI data series which is found to be far away from each other. At the same time standard deviation which explains the deviation of the distributed data from the mean is found to be 977.9118. This value explains that the distribution of DSI data from its mean value is considerably large. The skewness measures whether the distribution of the data is symmetrical or asymmetrical. Here, the positive skewness value (i.e. 2.587669) indicates that the distribution of the data series has long right tail. Kurtosis measures the peakedness and flatness of the distribution of the data set. If the kurtosis value is greater than 3, the curve is more peaked than normal curve, i.e. leptokurtic and when the value is less than 3, it is less peaked then normal curve i.e. platykurtic. When the kurtosis value is equal to 3 then the series is perfectly symmetrical and the curve is normal. Here kurtosis value is 10.48437 which imply that the distribution is leptokurtic. However, normality of the data series has been measured in terms of Jarque-Bera statistics and its *p*-value implies that the distribution of the data is not normal. On the other hand, the trend line of DSI from July 1986 to September 2010 depicted in Figure 7.1 shows that the curve rises in year 1996 and then rise at the beginning of 2004 and 2006 and a very sharp rise begins at the beginning of 2010. In brief, the trend of DSE- all share price index within our sample data series is found to have an increasing trend.

Table 7.1: Descriptive Statistics for DSE all Share Price Index

	DSI
Mean	1037.701
Median	705.6900
Maximum	5930.900
Minimum	175.0700
Std. Dev.	977.9118
Skewness	2.587669
Kurtosis	10.48437
Jarque-Bera	976.3498
Probability	0.000000
Observations	283

Figure 7.1: Trend of DSE all Share Price Index



However, the descriptive statistics and trend of all the dependent (i.e. micro and macro data series) variables has been presented in appendixes.

7.2 Estimating the Degrees of Association between Dependent and Independent Variables:

It is very important to identify the relative degrees of association between dependent and independent variables before they are used in the regression model. It is also an important pre-requisite to identify and incorporate variables in the regression model where the test of dependent and independent variables will exhibit strong relative association and their association will also expected to be statistically significant. For the same reason, relative degrees of association among the dependent and independent variables in this research has been examined by estimating correlation coefficient. All these correlation coefficients are then tested for their statistical significance where null hypothesis has been assumed to have no statistically significant association between dependent and independent variables. These estimates of correlation coefficient and *p*-values for their t-statistics also provide relative assurance that the independent variables which have been incorporated to estimate their explanatory power in explaining the change in dependent variables have strong statistical association. This work of estimating correlation coefficients between dependent and independent variables have been done in different phases. Table: 7.2 show the values of the correlation coefficients between stock price and weighted market micro variables. It is clearly evident that the correlation coefficient values between DSI and weighted market micro variables exhibit different degrees of association but when they are tested for their statistical significance, null hypothesis of no statistically significant association has not been accepted at 5 percent significance level.

Table 7.2: Estimating Correlation Coefficient between Stock Price and Weighted Market Micro variables

Variables	DSI		
	Correlation	t-Statistic	Probability
DSI	1.000000	-----	-----
WMKTCAP	0.961517	58.66517	0.0000
WMKTDY	-0.260285	-4.518923	0.0000
WMKTEPS	0.156178	2.650554	0.0085
WMKTPE	0.146445	2.481613	0.0137
MTV	0.891597	33.00562	0.0000

Source: Author’s own calculation estimates

Table 7.3: Estimating Correlation Coefficient between Stock Price and Segmented Micro Variables

Variables	DSI		
	Correlation	t-Statistic	Probability
DSI	1.000000	-----	-----
FINCAP	0.971661	68.90602	0.0000
MFCCAP	0.938392	45.51952	0.0000
FINDY	-0.472901	-8.996855	0.0000
MFCDY	-0.178760	-3.045624	0.0025
FINEPS	0.212463	2.726678	0.0253
MFCEPS	0.130851	2.212489	0.0277
FINPE	0.186747	1.616411	0.0381
MFCPE	0.159703	2.711926	0.0071

Source: Author's own calculation estimates

Table: 7.3 presents the correlation coefficient values between stock price and segmented micro variables. It is found that except FINTDY and MFCDY, all the independent variables have positive association with the stock price. Their degrees of association are also found to be very different. But the *p*-values for each of the t-statistics explain that null hypothesis of no statistically significant correlation can not be accepted at 5 percent significant level. As a result, it can be concluded that the interrelationship between stock price and each of the segmented micro variables is statistically significant.

On the other hand, Table: 7.4 present the correlation coefficient value between stock price and all the selected macro variables. It is found that except DIR and LIR, all the impendent macro variables have positive correlation with dependent variable stock price. Some of the independent variables (i.e. CPI, EXRPT, FXRES, GDPMP, IMPMT, M2, TDC, and REMIT) show highly positive correlation with stock price. Here null hypothesis of no statistically significant correlation has been tested by t-statistic and found that null hypothesis can not be accepted at the conventional 5 percent significant level.

Table 7.4: Estimating Correlation Coefficient between Stock Price and Macro Variables

Variables	DSI		
	Correlation	t-Statistic	Probability
DSI	1.000000	-----	-----
CPI	0.820666	24.07537	0.0000
DIR	-0.276595	-4.824806	0.0000
EXR	0.693490	16.13541	0.0000
EXRPT	0.859097	28.13736	0.0000
FXRES	0.918748	39.00525	0.0000
PCAPGDP	0.868695	29.39746	0.0000
IMPMT	0.877003	30.59676	0.0000
INVMP	0.870352	29.62810	0.0000
IPD	0.822525	24.24358	0.0000
LIR	-0.384379	-6.979574	0.0000
M2	0.908099	36.35181	0.0000
NID	0.810233	23.17321	0.0000
TDC	0.888412	32.44223	0.0000
REMIT	0.893512	33.35561	0.0000

Source: Author's own calculation estimates

7.3 An Overview of Multivariate Regression Analysis:

Multivariate regression analysis is commonly and widely used to estimate the absolute short run relationship between dependent variable and a series of independent variables. The model can be expressed as,

$$\boxed{Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots + \beta_k X_{ki} + u_i}$$

Where Y is dependent variable, α indicates constant or intercept term; the series of X are different independent variables, beta coefficients (β) represents a series of regression coefficients associated with a given independent variables and the error term (u_i) is residuals or disturbance terms which is assumed to be independently and identically distributed (IID).

However, in order to apply this multivariate regression model, we have to be very careful about the following assumptions:

- ✓ Zero Mean Value of u_i, or $E(u_i | X_{1i,} X_{ki}) = 0$ for each i.
- ✓ No serial correlation, or $\text{cov}(u_{i,} u_j) = 0$ where $u_{i,} \neq u_j$.
- ✓ Homoskedasticity, or $\text{var}(u_i) = \sigma^2$.
- ✓ Zero covariance between $u_{i,}$ and each X variables, or $\text{cov}(u_{i,} X_{1i}) = \text{cov}(u_{i,} X_{ki}) = 0$.
- ✓ No specification bias i.e. the model is correctly specified.
- ✓ No exact collinearity among the X variables (independent variables).

7.4 <u>Precautions for Estimating Multivariate Time Series Regression Analysis:</u>

In addition to the assumptions required for developing a ***Classical Linear Regression Model (CLRM)***, multivariate time series regression analysis requires to consider few more assumptions. However, in this research, some specific steps and precautions has been followed sequentially for the construction of multivariate time series regression model which is explained in the following way:

1. It is important for any time series data to be stationary before they are used in any regression model. That's why, all the variables are required to be tested for their stationarity and if they are found to be non-stationary, steps need to be taken to make it stationary either by de-trending (i.e. by taking the log value of the variable) or by taking the first difference of the data series. In this case, two most popular and widely used unit root test i.e. ***<u>Augmented-Dickey Fuller (ADF) Test</u>*** and ***<u>Phillips- Perron (P-P) Test</u>*** have been applied to identify the stationarity of the data series. *If the variables are found to be integrated of order zero i.e. I(0) process, then it reveals that data series of the variables are stationary and they could be used directly into the regression model. But if they are found to be integrated of order one or I(1) process, which implies non-stationary data, then they are required to estimate the first differenced value of the same variables to make it stationary.*

2. Then ***<u>multivariate time series regression model</u>*** will be designed according to reasonably best suited specification between dependent and independent variables.

3. Then the presences of serial correlation in the residuals of the regression model are required to be tested. In this case, ***Breusch-Godfrey Serial Correlation LM Test*** has been used to identify the presence of serial correlations in the residuals.

4. It is also important to examine the joint statistical significance of the regression coefficients in the regression model. In this case, the ***WALD Test*** has been applied to test the joint statistical significance of the regression coefficients in the regression model.

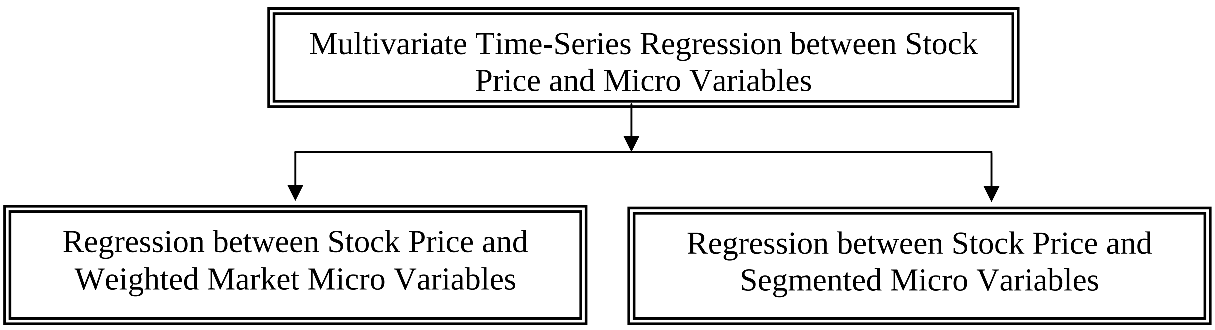
5. Then the assumptions of homoskedasticity in the regression model must need to be examined. In this case, ***White's General Heteroskedasticity (WGH) Test*** has been applied to test the assumption of homoskedasticity in the regression model.

6. Finally, it is also essential to examine that whether the regression model is associated with any specification errors. In this case, ***Ramsey's RESET Test*** has been applied to identify specification errors in the multivariate time series regression model.

7.5 Regression between Stock Price and Micro Variables:

Multivariate time series regression analysis between DSI and all the independent micro variables have been done in two phases: (i) regression between DSI and weighted market micro variables; (ii) regression between DSI and segmented micro variables. Each of these two regression model has been discussed in the following way:

Figure 7.2: Time-Series Regression Analysis between Stock Price and Micro Variables



7.5.1 Regression between Stock Price and Weighted Market Micro Variables:

The sequential steps which are discussed above have been followed to estimate multivariate times series regression model between stock price and weighted market micro variables. At first, ADF and P-P unit root test has been applied to examine the stationarity of both stock price and weighted market micro variables and found that DSI, WMKTCAP and MTV are integrated of order one i.e. I(1) process; and WMKTDY, WMKTEPS and WMKTPE are integration of order zero i.e. I(0) process. In such a stationary test result, I(1) variables must be transformed in to first differenced value of the said variables to make it stationary. On the other hand I(0) variables can be used directly without taking their first differenced value. The test result of the ADF and P-P unit root test has been presented in Table: 7.5.

Table 7.5: Test of Stationarity between Stock Price and Weighted Market Micro Variables

Variables	Augmented Dickey Fuller (ADF) Test				Phillips-Parron (P-P)Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob	t-stat	Prob	Adj. t stat	Prob	Adj. t stat	Prob	ADF	PP
DSI	3.02	1.0	-13.0	0.00	2.95	1.0	-13.7	0.0	I(1)	I(1)
WMKTCAP	7.34	1.0	-1.5	0.80	9.92	1.0	-16.7	0.0	I(1)	I(1)
WMKTDY	-14.8	0.0	----	----	-14.9	0.0	----	----	I(0)	I(0)
WMKTEPS	-6.42	0.0	-----	----	-12.2	0.0	----	----	I(0)	I(0)
WMKTTPE	-9.30	0.0	----	----	-13.6	0.0	----	----	I(0)	I(0)
MTV	7.22	1.0	-17.3	0.00	0.09	0.9	-27.5	0.0	I(1)	I(1)

Source: Author's own calculation estimates

After examining the test of stationarity of each of the weighted market micro variables then the multivariate time series regression model between stock price and weighted market micro variables has been designed according to the following specification:

$$D\log(DSI) = \alpha + \beta_1 D\log(WMKTCAP) + \beta_2 WMKTDY(-2)$$
$$+ \beta_3 WMKTEPS(-2) + \beta_4 WMKTPE(-2) + + \beta_5 D(MTV(-2)) +$$
$$\beta_6 D(DSI(-1)) + u$$

Software generated specification has been presented below:

DLOG(DSI) = C(1) + C(2)*DLOG(WMKTCAP) + C(3)*WMKTDY(-2) + C(4)*WMKTEPS(-2) + C(5)*WMKTPE(-2) + C(6)*DLOG(MTV(-2)) + C(7)*DLOG(DSI(-1))

Table 7.6: Estimates of Regression Coefficients between Stock Price and Weighted Market Micro Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.016091	0.010215	1.575246	0.1164
DLOG(WMKTCAP)	0.144859	0.038409	3.771435	0.0002*
WMKTDY(-2)	0.001056	0.000436	2.421752	0.0161**
WMKTEPS(-2)	-0.000241	0.000306	-0.789034	0.4308
WMKTPE(-2)	-0.000586	0.000283	-2.071953	0.0392**
DLOG(MTV(-2))	0.007209	0.010225	0.705009	0.4814
DLOG(DSI(-1))	0.051326	0.062755	0.817884	0.4141

Note: * and **indicates statistical significance at 1 percent and 5 percent respectively.

Source: Author's own calculation estimates

Discussion of the Regression Model

According to the best suited specification presented above, the estimates of regression model have been presented in Table: 7.6. This table presents the regression coefficients of each independent variable and their individual *t*-statistics representing the statistical significance of each of the individual regression coefficients and their associated *p*-values. It has been found that weighted market capitalization

D(WMKTCAP) have low but positive regression coefficients and its t-statistics and *p*-value indicates that the coefficient of weighted market capitalization is statistically significant at 1 percent level. Weighted market dividend yield at lag 2 i.e. WMKTDY(-2) provides a very small but positive regression coefficient (0.001056) but the *p*-value associated with its t-statistics is found to be significant at 5 percent level. Weighted market earnings per share at lag 2 i.e. WMKTEPS(-2) provides very small but negative regression coefficient in this model. This regression coefficient is found to be not statistically significant for having *p*-value of the t-statistics greater than 0.05. On the other hand, weighted market price to earnings multiples at lag 2 i.e. WMKTPE(-2) provides very small negative regression coefficient but its *p*-value associated with t-statistics is found to be significant at 5 percent level. Market trading volume at lag 2 i.e. DLOG(MTV(-2)) which is a non-stationary variable provides a small positive but not statistically significant regression coefficient. Finally, this research incorporates first lagged value of DSI which also provides insignificant regression coefficient in this regression model.

According to the methodology explained earlier, each regression model must be examined for the presence of serial correlation in the residuals. In this case, *Breusch-Godfrey Serial Correlation LM Test* has been applied and the test result has been presented in Table: 7.7. This test assumes under null hypothesis that there is no serial correlation in the residuals. Here *p*-value of F-statistics and Obs*R-squared are 0.0772 and 0.0642 respectively which implies that null hypothesis of no serial correlation in the regression residuals can not be rejected at 5 percent significance level. So it can be concluded that, this regression model is free from serial correlation in the residuals.

Table 7.7: Breusch-Godfrey Serial Correlation LM Test for Regression Model between Stock Price and Weighted Market Micro Variables

F-statistic	3.087259	Prob. F(2,271)	0.0772
Obs*R-squared	6.237459	Prob. Chi-Square(2)	0.0642

Source: Author’s own calculation estimates

Table 7.8: Test of Multicollinearity in the Regression Model between Stock Price and Weighted Market Micro Variables

Model	Collinearity Statistics		
	Tolerance Value	VIF	Condition Index
(Constant)	--------	------	1.000
D(WMKTCAP)	0.942	1.062	1.626
WMKTDY	0.991	1.010	1.805
WMKTEPS	0.974	1.027	2.171
WMKTPE	0.977	1.024	2.485
D(MTV)	0.987	1.013	4.828

Source: Author's own calculation estimates

Another important task for the viability of the regression model is to examine for the existence of multicollinearity in the regression model. Multicollinearity implies that the independent variables in the multivariate regression model is highly intercorrelated which generate spurious result in the regression estimates. The presence of multicollinearity has been examined through estimating and reviewing Tolerance Value, Variance Inflation Factor (VIF) and Condition Index. In this case, if tolerance value is greater than 0.20; variance inflation factor is less than 4.0 and condition index is less than 30, it can be said that the independent variables are not strongly associated among each other which lead to the conclusion that regression model is free from multicollinearity problem. Table: 7.8 shows that all the three conditions have been met to have a multivariate regression model free from multicollinearity problem.

Table: 7.9 presents the estimates of Wald Test which is generally applied to test the joint statistical significance of all regression coefficients in the regression model. This test assumes under null hypothesis that all the regression coefficients are jointly not different from zero. Here, the test estimates of F-statistics and Chi-square statistics with their associated *p*-values have been presented. Here the *p*-values for both of these statistics are equal to 0.0014 and 0.0010 respectively which implies the fact that null hypothesis of joint regression coefficients are not different from zero can not be accepted at 5 percent significance level.

Table 7.9: Wald Test for Regression Model between Stock Price and Weighted Market Micro Variables

Test Statistic	Value	df	Probability
F-statistic	3.738188	(6, 273)	0.0014
Chi-square	22.42913	6	0.0010

Source: Author's own calculation estimates

The assumptions of homoskedasticity has been tested by White's General Heteroskedasticity Test which assumes that residuals in the regression model have constant variances i.e. homoskedastic. The test result has been presented in Table: 7.10 where the *p*-value of the F-statistics and Obs*R-squared statistics are 0.0720 and 0.0728 respectively which implies that null hypothesis of homoskedastic residuals can not be rejected at 5 percent significant level.

Table 7.10: White's Heteroskedasticity Test for Regression Model between Stock Price and Weighted Market Micro Variables

F-statistic	1.957393	Prob. F(6,273)	0.0720
Obs*R-squared	11.54867	Prob. Chi-Square(6)	0.0728
Scaled explained SS	26.76184	Prob. Chi-Square(6)	0.0002

Source: Author's own calculation estimates

At the end, the presence of specification error in the regression model has been examined through the application of Ramsey's RESET test where null hypothesis has been assumed that error terms in the regression model will produce a zero mean and identical variances i.e. residuals are individually and identically (IID) distributed. In that case, the regression model will be considered as free from any specification error. On the other hand, alternative hypothesis assumes that the presence of specification error will produce non-zero mean and different variances for the error terms. The estimates of the Ramsey RESET test have been presented in Table: 7.11. It is clearly observed that the value of F-statistic is 1.192303 with a *p*-value of 0.2758 which accepts the null hypothesis of having no specification error in the multivariate regression model.

Table 7.11: Ramsey RESET Test for Regression Model between Stock Price and Weighted Market Micro Variables

	Value	df	Probability
t-statistic	1.091926	272	0.2758
F-statistic	1.192303	(1, 272)	0.2758
Likelihood ratio	1.224688	1	0.2684

Source: Author's own calculation estimates

7.5.2 <u>Regression between Stock Price and Segmented Micro Variables:</u>

In the process of applying multivariate time series regression model, both the independent and dependent variables have been tested for their stationarity by using *Augmented-Dickey Fuller (ADF) Test* and *Phillips- Perron (P-P) Test*. Table: 7.12 shows the estimates of the test of stationarity between stock price and segmented market micro variables. The test estimates reveal that all the independent segmented micro variables except FINCAP, MFCCAP have I(0) process which means they are stationary at its level data. According to above explained methodology, they could be used directly in the regression model without any adjustment or modifications.

Table 7.12: Test of Stationarity between Stock Price and Segmented Micro Variables

Variables	Augmented Dickey Fuller (ADF) Test				Phillips-Parron (PP) Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	**ADF**	**PP**
DSI	3.02	1.00	-13.02	0.00	2.95	1.00	-13.74	0.00	I(1)	I(1)
FINCAP	4.30	1.00	-3.03	0.124	4.89	1.00	-14.30	0.00	I(2)	I(1)
FINDY	4.84	0.00	-----	-----	-11.41	0.00	----	----	I(0)	I(0)
FINEPS	-3.33	0.00	------	-----	-11.95	0.00	-----	----	I(0)	I(0)
FINPE	-6.28	0.00	-----	-----	-8.52	0.00	-----	----	I(0)	I(0)
MFCCAP	7.60	1.00	-1.02	0.938	8.27	1.00	-16.94	0.00	I(2)	I(1)
MFCDY	-15.70	0.00	-----	-----	-15.70	0.00	-----	----	I(0)	I(0)
MFCEPS	-13.18	0.00	-----	-----	-13.95	0.00	-----	----	I(0)	I(0)
MFCPE	-10.92	0.00	----	-----	-10.92	0.00	-----	------	I(0)	I(0)
MTV	7.22	1.00	-17.38	0.00	0.094	0.99	-27.56	0.00	I(1)	I(1)

Source: Author's own calculation estimates

According to ADF and P-P unit root test FINCAP and MFCCAP are I(2) process and has been transformed in to 1st differenced of log value to incorporate it in the regression model. The dependent variable DSI is found to be I(1) process that means non-stationary data. That's why the 1st differenced value of log DSI has been taken to make it stationary and then used it in the regression model. Reasonably best suited specification of the regression model has been designed in the following way:

$$
\begin{aligned}
&D\log(DSI) = \alpha + \beta_1 D\log(FINCAP) + \beta_2(FINDY(-1)) + \beta_3(FINDY(-2)) \\
&+ \beta_4(FINDY(-3)) + \beta_5(FINEPS(-1)) + \beta_6(FINEPS(-2)) + \beta_7(FINEPS(-3)) \\
&+ \beta_8(FINPE(-1)) + \beta_9(FINPE(-2)) + \beta_{10}(FINPE(-3)) + \beta_{11} D\log(MFCCAP) \\
&+ \beta_{12}(MFCDY(-1)) + \beta_{13}(MFCDY(-2)) + \beta_{14}(MFCDY(-3)) + \beta_{15}(MFCEPS(-1)) \\
&+ \beta_{16}(MFCEPS(-2)) + \beta_{17}(MFCEPS(-3)) + \beta_{18}(MFCPE(-1)) + \beta_{19}(MFCPE(-2)) \\
&+ \beta_{20}(MFCPE(-2)) + \beta_{21} D(MTV(-2)) + \beta_{22} D(DSI(-1)) + u
\end{aligned}
$$

On the other hand software generated specification is

DLOG(DSI) = C(1) + C(2)*DLOG(FINCAP) + C(3)*FINDY(-1) + C(4)*FINDY(-2) + C(5)*FINDY(-3) + C(6)*FINEPS(-1) + C(7)*FINEPS(-2) + C(8)*FINEPS(-3) + C(9)*FINPE(-1) + C(10)*FINPE(-2) + C(11)*FINPE(-3) + C(12)*DLOG(MFCCAP) + C(13)*MFCDY(-1) + C(14)*MFCDY(-2) + C(15)*MFCDY(-3) + C(16)*MFCEPS(-1) + C(17)*MFCEPS(-2) + C(18)*MFCEPS(-3) + C(19)*MFCPE(-1) + C(20)*MFCPE(-2) + C(21)*MFCPE(-3) + C(22)*DLOG(DSI(-1))

Discussion of the Regression Model

According to the above mentioned specification, the estimates of regression model have been presented in Table: 7.13. The table shows the regression coefficients of each independent segmented micro variable along with their standard errors, t-statistics and *p*-values. Here *p*-value shows the chance of accepting null hypothesis that each of the regression coefficients is not different from zero. In this case *p*-value less then 0.05 implies that null hypothesis can not be accepted at 5 percent level and the respective coefficient is statistically significant. On the other hand, standard error column includes the estimated standard errors of the coefficient estimates. The standard errors measures the statistical reliability of the coefficient estimates- the larger the standard errors, the more statistical noise in the estimates.

Table 7.13: Estimates of Regression Coefficients between Stock Price and Segmented Micro Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005638	0.015860	0.355487	0.7225
DLOG(FINCAP)	0.245985	0.044567	5.519427	0.0000*
FINDY(-1)	-0.002759	0.002103	-1.311943	0.1907
FINDY(-2)	0.000322	0.001141	0.282528	0.7778
FINDY(-3)	0.005059	0.001611	3.141115	0.0019*
FINEPS(-1)	-0.000176	0.000221	-0.797369	0.4260
FINEPS(-2)	-0.000103	0.000168	-0.613215	0.5403
FINEPS(-3)	4.24E-05	0.000128	0.331129	0.7408
FINPE(-1)	-0.000108	0.000224	-0.485086	0.6280
FINPE(-2)	-1.75E-05	0.000229	-0.076442	0.9391
FINPE(-3)	-0.000159	0.000191	-0.835437	0.4042
DLOG(MFCCAP)	0.056596	0.019605	2.886839	0.0042*
MFCDY(-1)	7.25E-05	0.000247	0.293306	0.7695
MFCDY(-2)	0.000963	0.000313	3.072193	0.0024*
MFCDY(-3)	-0.000419	0.000228	-1.838634	0.0671***
MFCEPS(-1)	0.000255	0.000168	1.518081	0.1302
MFCEPS(-2)	-7.95E-05	0.000192	-0.414740	0.6787
MFCEPS(-3)	0.000391	0.000179	2.180893	0.0301**
MFCPE(-1)	-6.44E-05	0.000258	-0.250093	0.8027
MFCPE(-2)	-0.000373	0.000211	-1.772005	0.0776***
MFCPE(-3)	-0.000169	0.000200	-0.847450	0.3975
DLOG(DSI(-1))	0.044567	0.059458	0.749541	0.4542

Note: *, **, and *** indicates statistical significance at 1 percent, 5 percent, and 10 percent respectively.

Source: Author's own calculation estimates

Now Table: 7.13 reveals that DLOG(FINCAP(-1)) produces a positive coefficient value (i.e. 0.245985) which is found to be statistically significant at 1 percent level. FINDY (-1) has negative relation (i.e. -0.002759) but the FINDY (-2) and FINDY (-3) has positive regression coefficients (i.e. 0.000322 & 0.005059) respectively. But only FINDY(-3) is found to be statistically significant with DLOG(DSI) at 1 percent level. However, the regression coefficients associated with FINEPS (-1), FINEPS (-2) and FINEPS(-3) are not found to be statistically significant with DLOG(DSI) at 5 percent level. Similarly, the *p*-values associated with the regressions coefficients of FINPE(-1), FINPE(-2) and FINPE(-3) are also found to be statistically insignificant at 5 percent level.

On the other hand, DLOG(MFCCAP) produces regression coefficients equal to 0.056596 and for having *p*-value less than 0.05 implies that the coefficient is statistically significant at 5 percent level. MFCDY(-1) and MFCDY(-2) have positive regression coefficients equal to 7.25E-05 and 0.000963 respectively but MFCDY(-3) provides a negative coefficient i.e. -0.000419. In this case, MFCDY(-2) and MFCDY(-3) is found to be statistically significant at 1 percent and 10 percent level respectively. Except MFCEPS(-2), MFCEPS(-1) and MFCEPS(-3) have positive regression coefficients but only MFCEPS(-3) is found to be statistically significant at 1 percent level. On the other hand, MFCPE(-1), MFCPE(-2) and MFCPE(-3) produces positive regression coefficients but only MFCPE(-2) is found to be statistically significant at 10 percent level. However, D(DSI(-1)) has positive and statistically insignificant coefficient. The model also produces R-squared value of 0.272620 and adj. R-squared value of 0.213415 which explains the explanatory power of the regression model in explaining the variations in the dependent variable i.e. first difference of DSE all share price index i.e. D(DSI).

Table 7.14: Breusch-Godfrey Serial Correlation LM Test for Regression Model between Stock Price and Segmented Micro Variables

F-statistic	0.365703	Prob. F(2,256)	0.6941
Obs*R-squared	0.797696	Prob. Chi-Square(2)	0.6711

Source: Author's own calculation estimates

After estimating the regression coefficients based on the above mentioned specification, the model has been examined for the presence of serial correlation in the residuals. Here, *Breusch-Godfrey Serial Correlation LM Test* has been applied and the test estimates has been presented in Table: 7.14. It is found that *p*-value of F-statistics and Obs*R-squared are 0.6941 and 0.6711 respectively which implies that null hypothesis of no serial correlation in the residuals can not be rejected at 5 percent level of significance.

Test for the presence of multicollinearity is another important issue to be examined. The term '*multicollinearity*' refers to the situation where the independent or explanatory variables in the multiple regression equation are highly intercorrelated. In the situation when independent variables are highly intercorrelated, it becomes difficult to estimate the true separate effect of each of the independent variables on the dependent variable. There is also a high chance to get wrong regression coefficient values when independent variables are highly correlated with each other in the regression model. That's why, it is very important to examine the existence of multicollinearity in the multivariate regression model. Here, one of the three estimates i.e. Tolerance Value, Variance Inflation Factor (VIF) and Condition Index can be used to detect the existence of multicollinearity among the independent variables in the regression model. In this situation, the following three conditions can ensure that the multivariate regression model involves no multicollinearity problems:

- ✓ The Tolerance Value must be greater than 0.20 i.e. Tolerance Value > 0.20
- ✓ Variance Inflation Factor must be less than 4 i.e. VIF < 4
- ✓ The Condition Index value must be less than 30 i.e. Condition Index < 30

Table 7.15: Test of Multicollinearity in the Regression Model between Stock Price and Segmented Micro Variables

Model	Collinearity Statistics		
	Tolerance Value	VIF	Condition Index
(Constant)	----	---	1.000
D(FINCAP)	0.792	1.263	1.544
FINDY	0.884	1.132	1.970
FINEPS	0.977	1.023	2.127
FINPE	0.931	1.074	2.518
D(MFCCAP)	0.772	1.296	2.569
MFCDY	0.945	1.059	2.838
MFCEPS	0.925	1.081	3.563

Source: Author's own calculation estimates

Table: 7.15 presents the three estimates of the test of multicollinearity in the regression model between stock price and segmented micro variables. It is clearly evident that all the tolerance value associated with different independent variables are greater than 0.20. Variance Inflation Factors (VIF) are also less than 4 and condition indices are less than 30. So, it can be concluded that the multivariate regression model between stock price and segmented micro variables is free from multicollinearity issue.

In this position, it is important to test that the joint statistical significance of the regression coefficients in the regression model. Here, Wald Test has been employed to test the null hypothesis that all the regression coefficients are jointly not different from zero. The estimates of Wald Test have been presented in Table: 7.16. This table presents both the estimates of F-statistics as well as Chi-square statistics with their associated *p*-values. Here the *p*-value for both of these statistics is equal to 0.0000 which implies the fact that null hypothesis of all the regression coefficients jointly are not different from zero is rejected at 5 percent significance level. Finally, it can be said that all the coefficients of the independent variables have joint influence over the change in dependent variable DSI.

Table 7.16: Wald Test for Regression Model between DSI and Segmented Micro Variables

Test Statistic	Value	df	Probability
F-statistic	6.093175	(21, 258)	0.0000
Chi-square	127.9567	21	0.0000

Source: Author's own calculation estimates

Then, the assumption of homoskedasticity in the residual has been examined by the application of White's General Heteroskedasticity (WGH) Test which assumes under null hypothesis that residuals in the model are homoskedastic. In Table: 7.17, the *p*-value of the F-statistics and Obs*R-squared statistics are 0.9321 and 0.9234 respectively which implies that null hypothesis of homoskedastic residuals can not be rejected at 5 percent significant level.

Table 7.17: White's Heteroskedasticity Test for Regression Model between Stock Price and Segmented Micro Variables

F-statistic	0.576750	Prob. F(21,258)	0.9321
Obs*R-squared	12.55514	Prob. Chi-Square(21)	0.9234
Scaled explained SS	26.13263	Prob. Chi-Square(21)	0.2014

Source: Author's own calculation estimates

At the end, the presence of specification error in the regression model has been examined through Ramsey's RESET test where null hypothesis has been assumed that error terms in the regression model will produce a zero mean and identical variances. That means, residuals of the regression model are normally distributed. In that case, the regression model will be considered as free from any specification error. On the other hand, alternative hypothesis assumes that the presence of specification error will produce non-zero mean and different variances for the error terms. The estimates of the Ramsey RESET test have been presented in Table: 7.18. It is clearly observed that the value of F-statistic is 1.844289 with a *p*-value of 0.0910 which accepts the null hypothesis of having no specification error in the multivariate regression model.

Table 7.18: Ramsey RESET Test for Regression Model between Stock Price and Segmented Micro Variables

	Value	df	Probability
F-statistic	1.844289	(6, 252)	0.0910
Likelihood ratio	12.03296	6	0.0612

Source: Author's own calculation estimates

At this stage, an important conclusion can be drawn that the regression estimates for the weighted market micro variables are not so different from segmented micro variables. In case of weighted market micro variables, weighted market capitalization, weighted market dividend yield and weighted market price to earnings multiples has been found to be significantly associated with DSE-all share price index (DSI). In the same way, when weighted market micro variables have been classified into financial and manufacturing segments, the same significant variables are found to be significant here. The only exception is that, weighted market earnings per share (WMKTEPS) are not found to be significant but unlike WMKTEPS, manufacturing earnings per share (MFCEPS) at lag 3 is found to be significant with DSI at 5 percent significant level. However, the regression coefficients associated with financial earnings per share (FINEPS) are from lag 1 to lag 3 are not found to be significant with stock price at 5 percent level, so the poor effect of MFCEPS(-3) doesn't make WMKTEPS(-2) to become significant to stock price at 5 percent level. .

7.6 Regression between Stock Price and Macro Variables:

Multivariate time series regression analysis between stock price (DSI) and a set of 13 independent macro variables have been conducted in accordance with the methodology described earlier. At first, all the variables are tested for their stationarity by using ADF and P-P unit root test and it has been found that all the variables are (i.e. DSI and all the macro variables) are non-stationary at their level form. But when they are transformed into 1st differenced data, they are all found to be stationary which is presented in Table: 7.19. As it is important for the all the variables to be stationary before they are used in the regression model, that's why 1st differenced log value of the variables have been taken for the development of the appropriate multivariate time series regression model.

Table 7.19: Test of Stationarity between Stock Price and Macro Variables

Variables	Augmented Dickey Fuller (ADF) Test				Phillips-Parron (PP)Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.020	1.00	-13.02	0.00	2.9513	1.00	-13.742	0.00	I(1)	I(1)
CPI	1.604	1.00	-3.873	0.01	-1.039	0.935	-28.038	0.00	I(1)	I(1)
DIR	-1.550	0.809	-19.656	0.00	-1.8160	0.695	-19.427	0.00	I(1)	I(1)
EXR	-2.044	0.574	-16.579	0.00	-2.040	0.576	-16.580	0.00	I(1)	I(1)
EXRPT	0.114	0.997	-5.5354	0.00	-5.3673	0.00	-59.679	0.00	I(1)	I(1)
FXRES	-0.1604	0.994	-3.3750	0.057	1.1527	0.999	-18.13	0.00	I(1)	I(1)
PCAPGDP	3.649	1.00	-3.07	0.11	1.37	1.00	-20.20	0.00	I(1)	I(1)
IMPMT	0.0264	0.996	-6.890	0.00	-3.107	0.106	-59.937	0.00	I(1)	I(1)
INVMP	-0.4046	0.987	-14.829	0.00	-0.3512	0.988	-19.266	0.00	I(1)	I(1)
IPD	-0.2407	0.9919	-12.285	0.00	-4.389	0.002	-44.603	0.00	I(1)	I(1)
M2	4.1033	1.00	-1.3184	1.00	22.237	1.00	-18.589	0.00	I(1)	I(1)
NID	-0.6239	0.9756	-3.169	0.093	-0.6593	0.9743	-20.954	0.00	I(2)	I(1)
REMIT	-0.2400	0.9919	-18959	0.00	-1.210	0.9057	-39.655	0.00	I(1)	I(1)
TDC	1.2746	1.00	-2.4381	0.359	2.4165	1.00	-21.368	0.00	I(1)	I(1)

Source: Author's own calculation estimates

Then the regression model has been designed between stock price and all the independent macro variables according to best suited specification presented below:

$$D\log(DSI) = \alpha + \beta_1 D\log(CPI(-2)) + \beta_2 D\log(DIR(-2)) + \beta_3 \log(EXR(-1)) + \beta_4 D\log(EXRPT(-3)) + \beta_5 D\log(FXRES(-4)) + \beta_6 D\log(PCAPGDP(-2)) + \beta_7 D\log(IMPMT(-2)) + \beta_8 D\log(INVMP(-3)) + \beta_9 D\log(IPD(-5)) + \beta_{10} D\log(M2(-3)) + \beta_{11} D\log(NID(-6)) + \beta_{12} D\log(REMIT(-4)) + \beta_{13} D\log(TDC(-2)) + \beta_{14} D\log(DSI(-1)) + u$$

On the other hand software generated specification is

DLOG(DSI) = C(1) + C(2)*DLOG(CPI(-2)) + C(3)*DLOG(DIR(-2)) + C(4)*DLOG(EXR(-1)) + C(5)*DLOG(EXRPT(-3)) + C(6)*DLOG(FXRES(-4)) + C(7)*DLOG(PCAPGDP(-2)) + C(8)*DLOG(IMPMT(-2)) + C(9)*DLOG(INVMP(-3)) + C(10)*DLOG(IPD(-5)) + C(11)*DLOG(M2(-3)) + C(12)*DLOG(NID(-6)) + C(13)*DLOG(REMIT(-4)) + C(14)*DLOG(TDC(-2)) + C(15)*DLOG(DSI(-1))

Table 7.20: Estimates of Regression Coefficients between Stock Price and Macro Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021645	0.006709	3.226179	0.0014*
DLOG(CPI(-2))	0.626292	0.518613	1.207628	0.2283
DLOG(DIR(-2))	-0.267402	0.142064	-1.882259	0.0609***
DLOG(EXR(-1))	-1.396525	0.487976	-2.861872	0.0046*
DLOG(EXRPT(-3))	0.007951	0.042191	0.188444	0.8507
DLOG(FXRES(-4))	0.075705	0.063132	1.199157	0.2316
DLOG(PCAPGDP(-2))	-0.842423	0.405749	-2.076218	0.0389**
DLOG(IMPMT(-2))	-0.017434	0.027488	-0.634226	0.5265
DLOG(INVMP(-3))	-0.087735	0.022030	-3.982486	0.0001*
DLOG(IPD(-5))	0.052985	0.108397	0.488801	0.6254
DLOG(M2(-3))	-0.056458	0.167885	-0.336289	0.7369
DLOG(NID(-6))	-0.649419	0.288916	-2.247778	0.0254**
DLOG(REMIT(-4))	-0.096108	0.041982	-2.289261	0.0229**
DLOG(TDC(-2))	0.039575	0.078736	0.502632	0.6156
DLOG(DSI(-1))	0.068593	0.069515	0.986736	0.3247

Source: Author's own calculation estimates
Note:*, **, and *** indicates statistical significance of 1%, 5% and 10% respectively.

Discussion of the Regression Model

According to above mentioned specification, multivariate time series regression model has been run and regression coefficients along with their std. error, t-statistics and *p*-values are presented in Table: 7.20. From this table, it is found that intercept or constant term is 0.021645 with t-value 3.226179 which is significant at 1 percent level. The consumer price index (CPI) at lag 2 generates positive regression coefficient (i.e. 0.626292). This coefficient has been found to be partially consistent with the null hypothesis of positive relation with stock price but this coefficient is not statistically significant at 5 percent level. The deposit interest rate (DIR) at lag 2 provides a negative regression coefficient (i.e. -0.267402) and it is also found to be statistically significant at 10 percent level. This result indicates that DIR has significant negative relationship with stock price in the short run. The foreign exchange rate (EXR) at lag 1 also provides significant negative regression coefficient (i.e. -1.396525). This result consistently complied with the null hypothesis of negative relationship with stock price. The export receipt (EXRPT) at lag 3 provides small positive but insignificant regression coefficient (i.e. 0.007951). So, this results also partially consistent with the null hypothesis of positive relation with the stock price in the short run. The foreign exchange reserve (FXRES) at lag 4 generates a positive regression coefficient (i.e. 0.075705) but it is found to be statistically insignificant. The per capita GDP (PCAPGDP) at lag 2 provides a negative regression coefficient (i.e. -0.842423) and it is also found to be statistically significant at 5 percent level. The import payment (IMPMT) at lag 2 generates a negative but insignificant regression coefficient (i.e. -0.017434). The aggregate investment (INVMP) at lag 3 provides a significant negative regression coefficient (i.e. -0.087735). This negative relationship between stock price and aggregate investment is not consistent with the null hypothesis of positive association between them. The industrial production index (IPD) at lag 5 and broad money supply (M2) at lag 3 generates positive and negative regression coefficients respectively (0.052985 and -0.056458) but they are all found to be statistically insignificant. Both the national income deflator (NID) at lag 6 and foreign remittances (REMIT) at lag 4 generates negative regression coefficients (i.e. -0.649419 and -0.096108 respectively) and these coefficients are found to be statistically significant at 5 percent level. Finally, total domestic credit (TDC) at lag 2 and stock price at lag 1 generates positive but insignificant regression coefficient in this research. This model also produced R-squared value of 0.140674 and adj. R-squared value of 0.094580 which explains the power of the regression model in explaining the variations in the dependent variable i.e. first difference stock price.

After estimating the regression coefficients based on the above mentioned specification, *Breusch-Godfrey Serial Correlation LM Test* has been applied and the test result has been presented in Table: 7.21. It is found that *p*-value of F-statistics and Obs*R-squared are 0.9752 and 0.9736 respectively which indicates that null hypothesis of no serial correlation in the residuals can not be rejected at 5 percent significance level which is presented above.

Table 7.21: Breusch-Godfrey Serial Correlation LM Test for Regression Model between DSI and Macro Variables

F-statistic	0.025097	Prob. F(2,258)	0.9752
Obs*R-squared	0.053478	Prob. Chi-Square(2)	0.9736

Source: Author's own calculation estimates

The test of multicollinearity has been presented in Table: 7.22 as the 1st differenced value has been taken for designing the multivariate regression model that's why the identical data set has been taken to test for the multicollinearity test among the independent variables. According to the instructions, the chance of multicollinearity in the regression model arises when independent variables are highly intercorrelated among each other; consequently regression model will produce an abnormally high R-square value and at the same time standard error of the regression coefficient will be sufficiently large. The existence of multicollinearity in the model can be identified by estimating and analyzing Tolerance Value, Variance Inflation Factor (VIF) as well as Condition Index. In short, if the model is to get free from multicollinearity problem, the following three conditions must be met:

- ✓ The Tolerance Value must be greater than 0.20 i.e. Tolerance Value > 0.20
- ✓ Variance Inflation Factor must be less than 4 i.e. VIF < 4
- ✓ The Condition Index value must be less than 30 i.e. Condition Index < 30.

Table: 7.22 presents the summery estimates of Tolerance Value, Variance Inflation Factor and Condition Index which could be used to explain that the regression model with the above mention specification is free from multicollinearity issues. It has been identified that all the three essential conditions have been successfully met. That's why, it can be concluded that the estimated multivariate regression model is free from multicollinearity problem.

Table 7.22: Test of Multicollinearity between Stock Price and Macro Variables

Variables	Collinearity Statistics		
	Tolerance Value	VIF	Condition Index
D(CPI)	0.367	2.726	1.234
D(DIR)	0.933	1.072	1.369
D(EXR)	0.592	1.690	1.506
D(EXRPT)	0.645	1.551	1.587
D(FXRES)	0.859	1.164	1.766
D(IMPMT)	0.924	1.083	1.804
D(INVMP)	0.914	1.094	1.915
D(IPD)	0.647	1.546	1.960
D(M2)	0.626	1.598	2.229
D(NID)	0.416	2.405	2.551
D(PCAPGDP)	0.361	2.771	2.724
D(REMIT)	0.786	1.272	3.423
D(TDC)	0.426	2.349	4.517

Source: Author's own calculation estimates

After examining the presence of serial correlation and multicollinearity, the test of statistical significance of the joint regression coefficients have been done through the use of Wald Test. This test assumes under null hypothesis that all the regression coefficients are jointly not different from zero. Here the test estimates of Wald test has been presented in Table: 7.23 and it calculates F-statistic as well as Chi-square statistic along with their associated *p*-values. In this case, the *p*-value for both of these statistics is equal 0.0000 which implies that null hypothesis can not be accepted at 5 percent level of significance.

Table 7.23: Wald Test for Regression Model between Stock Price and Macro Variables

Test Statistic	Value	df	Probability
F-statistic	3.668850	(13, 261)	0.0000
Chi-square	47.69505	13	0.0000

Source: Author's own calculation estimates

Then, the estimates of White's General Heteroskedasticity (WGH) Test have been presented in Table: 7.24 which assume under null hypothesis that residuals in the regression model are homoskedastic. Here the *p*-value of the F-statistics and Obs*R-squared statistics are 0.1575 and 0.1592 respectively which implies that null hypothesis homoskedasticity can not be rejected at 5 percent significant level. In brief, the residuals of the concerned multivariate regression model are homoskedastic.

Table 7.24: White's Heteroskedasticity Test for Regression Model between Stock Price and Macro Variables

F-statistic	1.390135	Prob. F(14,261)	0.1575
Obs*R-squared	19.15227	Prob. Chi-Square(14)	0.1592
Scaled explained SS	40.93162	Prob. Chi-Square(14)	0.0002

Source: Author's own calculation estimates

At the end, the presence of specification error in the regression model has been examined through Ramsey's RESET test where null hypothesis has been assumed that error terms in the regression model will produce a zero mean and identical variances. In that case, the regression model will be considered to be free from any specification error. On the other hand, alternative hypothesis assumes that the presence of specification error will produce non-zero mean and different variances for the error terms. The estimates of the Ramsey's RESET test have been presented in Table: 7.25. It is clearly observed that the value of F-statistic is 1.761225 with a *p*-value of 0.1075 which accepts the null hypothesis of having no specification error in the multivariate regression model. So, the result of the Ramsey's RESET test indicates the fact that this multivariate time series regression model is free from any specification error.

Table 7.25: Ramsey RESET Test for Regression Model between DSI and Macro Variables

	Value	df	Probability
F-statistic	1.761225	(6, 255)	0.1075
Likelihood ratio	11.20696	6	0.0822

Source: Author's own calculation estimates

However, the test of multivariate time series regression estimates between stock price and selected macro variables (Model: 2 of Section: A) has been conducted and different types of tests have been utilized for ensuring the statistical reliability of the regression estimates. The model has been checked for my misspecification errors as well. Finally, this regression model provides important findings of the short run relationship between stock price and selected macro variables. Deposit interest rate, foreign exchange rate, per capita GDP, aggregate investment, national income deflator and foreign remittance all have significant short run negative association with stock price. Import payment and broad money supply also have negative association with stock price and their relationship is not found to be statistically significant. Consumer price index as a measure of inflation, export receipt, foreign exchange reserve, industrial production index and total domestic credit provides positive relationship with stock price and their relationship have been found statistically insignificant. So it can be said that, this model provides significant empirical short run evidence between stock price in DSE and selected macro variables in the economy.

7.7 Regression between Stock Price and Joint Micro-Macro Variables:

Multivariate time series regression analysis has also been used to test the absolute short run relationship between DSE all share price index (DSI) and a joint micro-macro variables. In this situation it is not important to test the order of integration to know the level of stationarity in each of the independent variable because they have already been identified earlier (Table: 7.5; Table: 7.12 and Table: 7.19). Now based on the stationarity test result the multivariate regression model has been designed in the following specification:

$$
\begin{aligned}
&D\log(DSI) = \alpha + \beta_1 D\log(WMKTCAP) + \beta_2(WMKTDY(-1)) + \beta_3(WMKTDY(-2)) + \\
&\beta_4(WMKTDY(-3)) + \beta_5(WMKTEPS(-1)) + \beta_6(WMKTEPS(-2)) + \beta_7(WMKTEPS(-3)) + \\
&\beta_8(WMKTPE(-1)) + \beta_9(WMKTPE(-2)) + \beta_{10}(WMKTPE(-3)) + \beta_{11}D\log(MTV(-2)) + \\
&\beta_{12}D\log(CPI(-2)) + \beta_{13}D\log(DIR(-2)) + \beta_{14}D\log(EXR(-1)) + \beta_{15}D\log(EXRPT(-3)) + \\
&\beta_{16}D\log(FXRES(-4)) + \beta_{17}D\log(PCAPGDP(-2)) + \beta_{18}D\log(IMPMT(-2)) + \\
&\beta_{19}D\log(INVMP(-3)) + \beta_{20}D\log(IPD(-5)) + \beta_{21}D\log(M2(-3)) + \beta_{22}D\log(NID(-6)) \\
&+ \beta_{23}D\log(REMIT(-4)) + \beta_{24}D\log(TDC(-2)) + \beta_{25}D\log(DSI(-1)) + u
\end{aligned}
$$

The software generated specification of the above regression model looks like the following:

DLOG(DSI) = C(1) + C(2)*DLOG(WMKTCAP) + C(3)*WMKTDY(-1) + C(4)*WMKTDY(-2) + C(5)*WMKTDY(-3) + C(6)*WMKTEPS(-1) + C(7)*WMKTEPS(-2) + C(8)*WMKTEPS(-3) + C(9)*WMKTPE(-1) + C(10)*WMKTPE(-2) + C(11)*WMKTPE(-3) + C(12)*DLOG(MTV(-2)) + C(13)*DLOG(CPI(-2)) + C(14)*DLOG(DIR(-2)) + C(15)*DLOG(EXR(-1)) + C(16)*DLOG(EXRPT(-3)) + C(17)*DLOG(FXRES(-4)) + C(18)*DLOG(PCAPGDP(-2)) + C(19)*DLOG(IMPMT(-2)) + C(20)*DLOG(INVMP(-3)) + C(21)*DLOG(IPD(-5)) + C(22)*DLOG(M2(-3)) + C(23)*DLOG(NID(-6)) + C(24)*DLOG(REMIT(-4)) + C(25)*DLOG(TDC(-2)) + C(26)*DLOG(DSI(-1))

Table 7.26: Regression Coefficients Estimates between Stock Price and Joint Micro-Macro Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020522	0.013147	1.560955	0.1198
DLOG(WMKTCAP)	0.135154	0.035098	3.850751	0.0001*
WMKTDY(-1)	0.000895	0.000407	2.196876	0.0289**
WMKTDY(-2)	0.000498	0.000297	1.677528	0.0947***
WMKTDY(-3)	-0.000139	0.000144	-0.966228	0.3349
WMKTEPS(-1)	0.000142	0.000219	0.647886	0.5177
WMKTEPS(-2)	-0.000118	0.000253	-0.467572	0.6405
WMKTEPS(-3)	0.000148	0.000188	0.784202	0.4337
WMKTPE(-1)	-5.64E-05	0.000308	-0.183045	0.8549
WMKTPE(-2)	-0.000551	0.000291	-1.893254	0.0595***
WMKTPE(-3)	-0.000144	0.000314	-0.458312	0.6471
DLOG(MTV(-2))	0.007145	0.010819	0.660386	0.5096
DLOG(CPI(-2))	0.515000	0.471617	1.091989	0.2759
DLOG(DIR(-2))	-0.178612	0.123183	-1.449970	0.1483
DLOG(EXR(-1))	-1.490509	0.502640	-2.965363	0.0033*
DLOG(EXRPT(-3))	0.006373	0.039969	0.159450	0.8734
DLOG(FXRES(-4))	0.064199	0.062966	1.019589	0.3089
DLOG(PCAPGDP(-2))	-0.688602	0.350325	-1.965606	0.0505**
DLOG(IMPMT(-2))	-0.001943	0.028518	-0.068129	0.9457
DLOG(INVMP(-3))	-0.071278	0.020714	-3.441097	0.0007*
DLOG(IPD(-5))	0.032773	0.110054	0.297786	0.7661
DLOG(M2(-3))	-0.020260	0.155114	-0.130615	0.8962
DLOG(NID(-6))	-0.696513	0.305690	-2.278491	0.0235**
DLOG(REMIT(-4))	-0.088087	0.038176	-2.307357	0.0219**
DLOG(TDC(-2))	0.071781	0.088692	0.809333	0.4191
DLOG(DSI(-1))	0.030547	0.065057	0.469542	0.6391

Note: *, ** and *** indicates statistical significance at 1%, 5% and 10% respectively.
Source: Author's own calculation estimates

Discussion of the Regression Model

Table: 7.26 presents the test output of the multivariate regression between DSE all share price index (DSI) and the joint micro-macro variables. This test result reveals that weighted market capitalization i.e. DLOG(WMKTCAP) has positive regression coefficient (i.e. 0.135154) and it is also statistically significant at 1 percent level. Although weighted market dividend yield (WMKTDY) at lag 1 and lag 2 provide positive regression coefficients (i.e. 0.000895 and 0.000498 respectively) but lag 3 of

WMKTDY provides negative coefficient (i.e. -0.000139). But only the first two lag of WMKTDY are found to be statistically significant at 5 percent and 10 percent significance level respectively. The model includes the first three lag of weighted market earnings per share (WMKTEPS) and found that the lag 1 and lag 3 data have very small positive coefficients (i.e. 0.000142 and 0.000148 respectively) but the lag 2 data provides negative coefficient (i.e. -0.000118). But none of these regression coefficients have been found to be statistically significant. This model also includes the weighted market price to earnings multiples (WMKTPE) from lag 1 to lag 3 and they all have negative regression coefficients (i.e. -5.64E-05, -0.000551 and -0.000144 respectively). But only lag 2 of WMKTPE has been found to be statistically significant at 10 percent level. However, market trading volume at lag 2 (DLOG(MTV(-2)) has positive but insignificant regression coefficient (i.e. 0.007145) in the model.

Macro variables data have also been incorporated in this regression model and found that consumer price index at lag 2 [i.e. DLOG(CPI(-2))] has been positively associated with stock price but the regression coefficient (i.e. 0.51500) is not statistically significant. Deposit interest rate lat lag 2 [i.e. DLOG(DIR(-2))] has negative regression coefficient (i.e. -0.178612) and it is not found to be statistically significant. Similarly foreign exchange rate at lag 1 [i.e. DLOG(EXR(-1))] also provides negative regression coefficient (i.e. -1.490509) which is also statistically significant at 1 percent level. Export receipt at lag 3 [i.e. DLOG(EXRPT(-3))] generates positive but insignificant regression coefficient (i.e. 0.006373) in this model. Foreign exchange reserve at lag 4 [i.e. DLOG(FXRES(-4))] produces positive but insignificant regression coefficient (i.e. 0.064199). The relationship between per capita GDP at lag 2 [i.e. DLOG(PCAPGDP(-2))] and stock price has been found to be inverse and significant (i.e. -0.688602). Whereas import payment at lag 2 [i.e. DLOG(IMPMT(-2))] and broad money supply at lag 3 [i.e. DLOG(M2(-3))] provides negative but insignificant regression coefficients (i.e. -0.001943 and -0.020260 respectively) . Aggregate investment at lag 3 [i.e. DLOG(INVMP(-3))] generates negative regression coefficient (i.e. -0.071278) and it is found to be significant at 1 percent level. Whereas both national income deflator at lag 6 [i.e. DLOG(NID(-6))] and foreign remittance at lag 4 [i.e. DLOG(REMIT(-4))] provides negative regression coefficients (i.e. -0.696513 and -0.088087 respectively) and they found to be statistically significant at 5 percent level. Finally total domestic credit at lag 2 [i.e. DLOG(TDC(-2))] generates positive but insignificant regression coefficient (i.e. 0.071781) in this model. Model: 3 of Section: A provides few significant findings in this research. From the micro variables, only two variables i.e. weighted market capitalization, weighted market dividend yield are found to have significant short rn relationship with stock price. on the other hand, from the macro variables, foreign exchange rate, per capita GDP, aggregate investment, national income deflator and foreign remittances are found to have strong association with stock price in Dhaka Stock Exchange (DSE)

After estimating the regression coefficients based on the above mentioned specification, *Breusch-Godfrey Serial Correlation LM Test* has been applied and presented in Table: 7.27. It is found that *p*-value of F-statistics and Obs*R-squared are 0.1837 and 0.1537 respectively which implies that null hypothesis of no serial correlation in the residuals can not be rejected at 5 percent significance level which is presented below.

Table 7.27: Breusch-Godfrey Serial Correlation LM Test for Regression Model between DSI and Joint Micro-Macro Variables

F-statistic	1.175992	Prob. F(2,248)	0.1837
Obs*R-squared	3.745676	Prob. Chi-Square(2)	0.1537

Source: Author's own calculation estimates

The test of multicollinearity has been presented in Table: 7.28. In order to check for the existence of multicollinearity, Tolerance Value, Variance Inflation Factor or Condition Index can be estimated and, regression model is said to be free from multicollinearity issue if the following three conditions has been satisfied:

- ✓ The Tolerance Value must be greater than 0.20 i.e. Tolerance Value > 0.20
- ✓ Variance Inflation Factor must be less than 4 i.e. VIF < 4
- ✓ The Condition Index value must be less than 30 i.e. Condition Index < 30.

Table 7.28: Test of Multicollinearity in the Regression Model between DSI and Joint Micro-Macro Variables

Model	Collinearity Statistics		
	Tolerance Value	VIF	Condition Index
DLOG(WMKTCAP)	0.899	1.112	1.390
WMKTDY	0.961	1.040	1.534
WMKTEPS	0.958	1.044	1.559
WMKTPE	0.973	1.028	1.708
DLOG(MTV)	0.850	1.176	1.778
DLOG(CPI)	0.363	2.758	1.921
DLOG(DIR)	0.923	1.084	2.045
DLOG(EXR)	0.584	1.713	2.078
DLOG(EXRPT)	0.642	1.557	2.207
DLOG(FXRES)	0.846	1.182	2.286
DLOG(PCAPGDP)	0.355	2.817	2.344
DLOG(IMPMT)	0.894	1.118	2.516
DLOG(INVMP)	0.898	1.113	2.672
DLOG(IPD)	0.634	1.578	2.896
DLOG(M2)	0.607	1.646	3.097
DLOG(NID)	0.411	2.432	3.924
DLOG(REMIT)	0.749	1.335	5.246
DLOG(TDC)	0.421	2.377	5.917

Source: Author's own calculation estimates

Table: 7.28 Presents the test of multicollinearity in the regression model between DSI and the joint micro-macro variables. It is clearly evident that all the tolerance value associated with difference independent variables are greater than 0.20. Variance Inflation Factors are also less than 4 and condition indices are less than 30. So it can be concluded that the multivariate regression model between DSI and joint micro-macro variables is free from multicollinearity issue.

After examining the presence of serial correlation and multicollinearity, a test of statistical significance of all the joint regression coefficients have been done through the application of Wald test. This test assumes under null hypothesis that all the regression coefficients are jointly not different from zero. Here Table: 7.29 shows the test estimates of Wald test and it calculates F-statistic as well as Chi-square statistic along with their associated *p*-value. In this case the *p*-value for both of these statistics are 0.0000 which implies that the null hypothesis of having joint regression coefficient not different from zero can not be accepted at 5 percent significant level.

Table 7.29: Wald Test for Regression Model between DSI and Joint Micro-Macro Variables

Test Statistic	Value	df	Probability
F-statistic	3.452658	(25, 250)	0.0000
Chi-square	86.31646	25	0.0000

Source: Author's own calculation estimates

The assumptions of homoskedasticity in the residual in the model has been examined by the application of White's General Heteroskedasticity (WGH) Test which assumes that residuals in the model are homoskedastic under null hypothesis. In Table: 7.30, the *p*-value of the F-statistics and Obs*R-squared statistics are 0.0728 and 0.0803 respectively which implies that null hypothesis of homoskedastic residuals can not be rejected at 5 percent significant level.

Table 7.30: White's Heteroskedasticity Test for Regression Model between DSI and Joint Micro-Macro Variables

F-statistic	1.473855	Prob. F(25,250)	0.0728
Obs*R-squared	35.45311	Prob. Chi-Square(25)	0.0803
Scaled explained SS	64.38846	Prob. Chi-Square(25)	0.0000

Source: Author's own calculation estimates

Finally, specification error in the regression model has been examined by Ramsey's RESET test where null hypothesis has been assumed to have no specification error. Table: 7.31 shows the test result of the Ramsey's RESET test associated with the multivariate regression model between DSI and the joint micro-macro variables. Here F-statistic has been found to be 0.486444 with *p*-value of 0.8182 which is more than 0.05. This test result reveals that null hypothesis of no specification error in the regression model can not be rejected at 5 percent significance level which lead to the conclusion that this concerned regression model doesn't involve with any specification error.

Table 7.31: Ramsey RESET Test for Regression Model between DSI and Joint Micro-Macro Variables

	Value	df	Probability
F-statistic	0.486444	(6, 244)	0.8182
Likelihood ratio	3.281853	6	0.7727

Source: Author's own calculation estimates

Therefore, multivariate time series regression analysis between DSE-all share price index (DSI) and 5 weighted market micro variables & 13 selected macro variables provides very important statistical findings. Weighted market capitalization (WMKTCAP), weighted market dividend yield (WMKTDY) and weighted market price to earnings multiples (WMKTPE) have significant absolute relationship with DSI. This finding also supports the result of regression estimates between DSI and weighted market micro variables (Model: 1). On the other hand, from the macro economic variables, deposit interest rate (DIR), exchange rate (EXR), per capita GDP (PCAPGDP), aggregate investment at current market price (INVMP), national income deflator (NID), and foreign remittances (REMIT) have been found to have significant statistical absolute relationship with DSI. At the same time, consumer price index as a measure of inflation (CPI), export receipt (EXRPT), foreign exchange reserve (FXRES), import payment (IMPMT), industrial production index (IPD), broad money supply (M2), and total domestic credit (TDC) have been found to have no statistical relationship with DSI. This finding also supports the result of the regression estimates between DSI and macro variables (Model: 2). In certain variables a little bit inconsistency have been observed between Regression Model: 1 and Regression Model: 3. In Model: 1 weighted market capitalization, weighted market dividend yield and weighted market price to earnings multiples have been found to be significantly associated with stock price. But in Model: 3 weighted market capitalization, weighted market dividend yield at lag 1 and weighted market price to earnings multiples at lag 2 have been found to be statistically significant. But in terms of sign and statistical significance Regression Model: 2 and Model: 3 provide consistence findings in this research.

7.8 Summery of Regression Results:

Table: 7.32 reveal the summery estimates of the test of goodness-of-fit for the entire three multivariate time series regression models. It has been found that the 1st model can explain approximately 12.17 percent changes in stock prices by the combined change in all the weighted market micro-variables. Here the Adjusted R-squared value in not far away from R-squared value (i.e. 10.24 percent). Standard error of the regression model is also found to be very small (i.e. 0.079531) which implies statistical reliability of the regression estimates. This model also involves with no serial correlation problem; no multicollinearity among the independent variables; joint regression coefficients are found to be statistically significant; satisfies the assumptions of homoskedasticity in the residuals and finally have no specification error in Regression Model-1.

Table 7.32: Summery of All Regression Estimates

Multivariate Regression Estimates	When Regressors are Micro-Variables (Model -1)	When Regressors are Macro-Variables (Model -2)	When Regressors are Combined Variables (Model -3)
R-squared	0.121728	0.140674	0.256303
Adjusted R-squared	0.102426	0.094580	0.181933
S.E. of regression	0.079531	0.077764	0.073918
Breusch-Godfrey Serial Correlation LM Test:	No Serial Correlation in the residual	No Serial Correlation in the residual	No Serial Correlation in the residual
Test of Multicollinearity	No Multicollinearity Exists in the Model	No Multicollinearity Exists in the Model	No Multicollinearity Exists in the Model
Coefficient Significance WALD Test	All the regression coefficients are jointly significant @ 5 percent	All the regression coefficients are jointly significant @ 5 percent	All the regression coefficients are jointly significant @ 5 percent
White's General Heteroskedasticity (WGH)Test:	Residuals are homoskedastic.	Residuals are heteroskedastic.	Residuals are homoskedastic.
Ramsey's (RESET) Test	No specification error in the model	No specification error in the model	No specification error in the model

Source: Author's own calculation estimates

Regression Model-2 involves with the multivariate time series regression model between DSI and all the macro variables. This model provides R-squared and Adjusted R-squared value equal to approximately 14.06 percent and 9.45 percent respectively. Regression estimates are also found to be statistically reliable which is represented by small values of the standard error estimates. So it can be said that when macro variables are the regressors then is can better explain the changes in the dependent variable DSI. This model also has no serial correlation in the residuals; no multicollinearity among the impendent variables; regression coefficients are jointly found to be statistically significant; residuals are homoskedastic and finally this model doesn't associated with specification error.

Finally model -3 involves with a regression model where both the weighted market micro variables and all the macro variables are taken as regressors to estimate their joint influence on the change in dependent variable DSI. It is found that R-squared and Adjusted R-squared value equal to approximately 25.63 percent and 18.19 percent respectively. At this stage it can be said that when two models (i.e. model-1 and model-2) are combined, they can explain the changes in DSI far better than the previous two models. This model also has no serial correlation in the residuals; has no multicollinearity among the independent variables and regression coefficients are jointly statistically significant. This model also satisfies the conditions of homoskedasticity in the residuals and doesn't have any specification error. Another convincing issue found in all the three regression model that the standard error values associated with the R-squared and Adjusted R-squared value are all very small which ultimately reveals the statistical reliability of these regression estimates. Finally, it can be concluded that model-3 seems to have better specification of the regression model than the other two models to explain the changes in the dependent variable DSE-all share price index (DSI).

CHAPTER 8

JOHANSEN’S COINTEGRATION TEST AND VECTOR ERROR CORRECTION MODEL

8.1 An Overview of Johansens's Cointegration Test and Vector Error Correction Model:

The analysis of multivariate time series regression is often done by making the non-stationary variables into stationary simply by first differencing that throws away lots of potential valuable information about long run equilibrium relationship upon which economic theories have a great concern. The theory of cointegration developed by Granger (1981) and elaborated in Engle and Granger (1987) addresses this issue of integrating short run dynamics with long run equilibrium. They pointed out that a linear combination of two or more non-stationary time series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be *cointegrated*. This stationary linear combination is called the *cointegrating relationship* and may be interpreted as a long-run equilibrium relationship among the variables. As we are using a group object to establish equilibrium relationship, so a VAR based cointegration methodology developed by Soren Johansen (1990, 1995) is most appropriate. There are two advantages of using Johansen's Cointegration methodology:

1. It relaxes the assumption that the cointegrating vector is unique,
2. It takes into account the short-run dynamics of the system when estimating the cointegrating vectors.

Johansen's methodology (1991, 1995) takes its starting point in the vector autoregression (VAR) of order *p* given by

$$\boxed{y_t = A_1 y_{t-1} + A_2 y_{t-2} + \ldots\ldots\ldots\ldots + A_p y_{t-p} + Bx_t + \varepsilon_t}$$

where y_t is a k-vector of non-stationary l(1) variables, x_t is a d vector of deterministic variables, and ε_t is a vector of innovations. We can rewrite the VAR as:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta Y_{t-1} + BX_t + \varepsilon$$

Where

$$\Pi = \sum_{i=1}^{p} A_t - 1 \quad \text{and} \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

If the coefficient matrix Π has reduced rank $r < k$, then there exist k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). Here, r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. The elements of α are known as adjustment parameter in the Vector Error Correction Model. In practice, we can obtain only estimates of the r and the characteristic roots. The test for the number of characteristic roots that are insignificantly different from unity can be conducted using the following two test statistic:

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

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

Where

$\hat{\lambda}_i$ = the estimated value of the characteristic roots (also called eigenvalues) obtained from the estimated r matrix.

T = the number of usable observations.

Johansen proposes to test of the significance of two different likelihood ratios: the trace statistics and maximum eigenvalue statistics. The trace statistics tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigenvalue statistics, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r +1 cointegrating vectors. Johansen and Juselius (1990) provide the critical values of the λ_{trace} and $\lambda_{\max}$ statistics obtained using simulation studies.

Vector Error Correction Model (VECM)

A Vector Error Correction Model (VECM) is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. If two time series are *x* and y are nonstationary I(1) processes that are cointegrated, then we can work with rational distribution lag model as:

$$\boxed{\Delta y_t = \lambda_0 + \gamma_0 \Delta x_t + \rho \Delta y_{t-1} + \gamma_1 \Delta x_{t-1} + u_t}$$

In this model, we can include an additional I(0) variables which defines as ($s_t = y_t - \beta x_t$) the error in the equilibrium relationship at time t. Now we can introduce the lag of s_t in the equation:

$$\boxed{\Delta y_t = \lambda_0 + \gamma_0 \Delta x_t + \rho \Delta y_{t-1} + \gamma_1 \Delta x_{t-1} + \delta s_t + u_t}$$

$$\boxed{\Delta y_t = \lambda_0 + \gamma_0 \Delta x_t + \rho \Delta y_{t-1} + \gamma_1 \Delta x_{t-1} + \delta (y_{t-1} - \beta x_{t-1}) + u_t}$$

This is so- called error correction model, which takes into account the fact that there is an equilibrium relationship between the non-stationary level variables *x* and *y*. The error correction term s_t expresses the impact of disequilibrium on the relationship. To consider this, we can work with an even simpler form of the model in differences:

$$\boxed{\Delta y_t = \lambda_0 + \gamma_0 \Delta x_t + \delta \left(y_{t-1} - \beta x_{t-1} \right) + u_t}$$

With $\delta \langle 0$, it represents the principle of negative feedback. If last period $y_{t-1} \rangle \beta x_{t-1}$, *y* is above its equilibrium level, so that the error correction term pushes *y* down. If $y_{t-1} \langle \beta x_{t-1}$, the error correction term serve to increase *y* this period. So the coefficient δ is a measure of speed of adjustment of the *i*-th endogenous variables towards the equilibrium condition.

8.2 Cointegration between Stock Price and Weighted Market Micro Variables:

Soren Johansen's (1900, 1995) methodology of testing cointegration has been used to estimate long run equilibrium relationship between DSE-all share price index (DSI) and weighted market micro variables. In this test, the selected micro variables are weighted market capitalization (WMKTCAP), weighted market dividend yield (WMKTDY), weighted market earnings per share (WMKTEPS), weighted market price to earnings multiples (WMKTPE), and market trading volume (MTV). However, the following steps have been followed to conduct Johansens's Cointegration test:

(i) The Cointegration test starts with identifying the order of integration for each specific endogenous variable by applying Augmented Dickey-Fuller (ADF) Test and Phillips-Parron (P-P) Test. If any variable doesn't have the same order of integration, it will not be incorporated in this test.

(ii) Then it is important to identify the optimal lag length. This can be found by Akaike info criterion (AIC), Schwarz criterion (SC) or Hannan-Quinn criterion (HQ) etc.

(iii) Then a VAR model has to be developed to determine the rank of π. The rank of π is the value of 'r' which implies the number of cointegrated vectors. When $r = 0$, it means there is not cointegrating vectors. If there are 'g' variables in the system equations, there can be a maximum of g-1 cointegrating vectors.

(iv) Two different test statistic (i.e. trace statistics and max-eigen value statistics) need to be examined to identify the number of cointegrating vector in the system. Here the following hypothesis has been used to analyze trace statistic and max-eigen value statistics.

<u>*Hypothesis about Trace Statistics:*</u>

H_o : There is no cointegrating variables i.e. r = 0 or r ≤ 1

H_a : There exists cointegrating variables i.e. r ≥1 or r = 2

<u>*Hypothesis about Max-Eigen Value Statistics:*</u>

H_o : There is no cointegrating variables i.e. r = 0 or r = 1

H_a : There exists cointegrating variables i.e. r = 1 or r = 2

(v) If trace statistics and max-eigen value statistics is greater than critical value at 5 percent, the test reject H_o and vice versa. Rejecting H_o implies that there exists long run equilibrium relationship among the endogenous variables.

(vi) If the endogenous variables are found to have cointegrating relationship, then normalized cointegrating equation need to be discuss to identify their long run equilibrium relationship in detail.

According to the methodology explained above to conduct Johansens's Cointegration test, DSI, WMKTCAP, WMKTDY, WMKTEPS, WMKTPE, and MTV have been incorporated as endogenous variables. At this stage, test of stationarity has been conducted and already presented in Table: 7.5 to identify whether all the variables stationary or not. This table clearly displays the fact that except WMKTDY, WMKTEPS, and WMKTPE, all remaining endogenous variables are non-stationary i.e. I(1) process. Without considering whether all the variables are stationary or not, this research incorporate all the endogenous variables for the selection of appropriate lag length. However, different methods for selection of optimal lag length have been used like, LR: sequential modified LR test statistic; Final prediction error (FPE); Akaike information criterion (AIC); Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). In this case optimal lag length has been identified based on Akaike information criterion (AIC). It has been found that lag length of 3 has been selected by AIC method which is also supported by FPE method. So optimal lag length of 3 (Table: 8.1) has been finally chosen for the application of Johansen's Cointegration test.

Table 8.1: VAR Lag Order Selection Criteria in Cointegration Test between Stock Price and Weighted Market Micro Variables

Endogenous variables: DSI WMKTCAP WMKTDY WMKTEPS WMKTPE MTV						
Exogenous variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10453.55	NA	1.35e+26	77.19229	77.27204	77.22431
1	-9324.225	2200.317	4.22e+22	69.12344	69.68170*	69.34758*
2	-9274.423	94.82650	3.81e+22	69.02157	70.05835	69.43785
3	-9210.135	119.5620	**3.10e+22***	**68.81280***	70.32809	69.42121
4	-9175.459	62.95340	3.13e+22	68.82258	70.81637	69.62311
5	-9150.900	43.49906	3.42e+22	68.90701	71.37932	69.89967
6	-9107.307	75.28352	3.25e+22	68.85097	71.80179	70.03576
7	-9079.734	46.39630	3.47e+22	68.91316	72.34249	70.29007
8	-9045.588	55.94278	3.55e+22	68.92685	72.83468	70.49589
9	-9024.583	33.48527	4.01e+22	69.03751	73.42385	70.79867
10	-9002.359	34.44214	4.49e+22	69.13918	74.00404	71.09247
11	-8945.765	85.20501	3.92e+22	68.98719	74.33056	71.13261
12	-8900.284	66.45899*	3.72e+22	68.91722	74.73910	71.25477
* 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						

Note: Author's own calculation estimates

Then Johansen's Cointegration test has been applied at lag length 2[1] and allowing linear deterministic trend and intercept in the data series. Now it is essential to identify the rank of π i.e. number of cointegrating vector and that could be done through analyzing trace statistics and max-eigen value statistics.

Table 8.2: Unrestricted Cointegration Rank Test (Trace) between Stock Price and Weighted Market Micro Variables

Hypothesized No. of CE(s)	Trace Statistic	Critical Value(0.05)	Prob.**
None *	295.7099	95.75366	0.0000
At most 1 *	194.2501	69.81889	0.0000
At most 2 *	116.0500	47.85613	0.0000
At most 3 *	65.34718	29.79707	0.0000
At most 4 *	31.30159	15.49471	0.0001
At most 5 *	5.421595	3.841466	0.0199

Note: Author's own calculation estimates

[1] According to the instruction to the Eviews end-users given by Eviews Forum, appropriate lag length should be one less than optimal lag length provided by specific Information Criterion.

Table: 8.2 shows the trace statistics through unrestricted cointegration rank test. Null hypothesis has been assumed as no cointegrating variables i.e. r = 0 or r ≤ 1 against alternative of having cointegrating variables i.e. r ≥1 or r = 2. According to MacKinnon-Haug-Michelis (1999) *p*-values of the trace statistics, it has been found that there are six cointegrating vectors in the system which is significant at 5 percent level.

Table 8.3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue) between Stock Price and Weighted Market Micro Variables

Hypothesized No. of CE(s)	Max-Eigen Statistic	Critical Value (0.05)	Prob.**
None *	101.4598	40.07757	0.0000
At most 1 *	78.20004	33.87687	0.0000
At most 2 *	50.70285	27.58434	0.0000
At most 3 *	34.04559	21.13162	0.0005
At most 4 *	25.87999	14.26460	0.0005
At most 5 *	5.421595	3.841466	0.0199

Note: Author's own calculation estimates

Table: 8.3 presents the max-eigen value statistics through unrestricted cointegration rank test. Here null hypothesis has been set as having no cointegrating variables, i.e. r = 0 or r = 1 against alternative of having cointegrating variables, i.e. r = 1 or r = 2. According to max-eigen value test statistics, null hypothesis of no cointegrating vectors can not be accepted up to five which reveal that there are six cointegrating vectors among the DSI and selected weighted market micro variables at 5 percent significance level. If Rank (π)= n; means full rank, then all the variables are either stationary i.e. I(0), which violates the usual norms of having cointegration. It may be due to mixing variables with different order of integration in the system or due to specification errors. So technically, Johansen's Cointegration test is not suitable for identifying long run equilibrium relationship among the variables. In such a conflicting situation, research convention provides the guideline to use Vector Autoregression (VAR)[1] test between stock price and weighted market micro variables.

[1] The Theory of Vector Autoregression Test has been discussed in Appendix (g).

8.3 Vector Autoregression Test (VAR) between Stock Price and Weighted Market Micro Variables:

The Vector Autoregressive (VAR) Model describes about how two or more variables are operating in a system where the dependent variables are found as lagged ones on the right hand side of the equation. It generates a set of linear dynamic equations where each variable is specified as a function of an equal number of lags of itself and all the variables in the system. In addition, VAR is a technique that facilitates to capture both the dynamic and interdependent relationship of the said variables. However, the following steps have been followed in the process of conducting VAR test between stock price and weighted market micro variables.

i. At the very outset, order of integration of all the endogenous variables has been determined. If they provide a mix of stationary I(0) and non-stationary I(1) process, then the first differenced value of the I(1) variables have been taken to make it stationary.
ii. Then, appropriate lag length of the VAR model have to be determined. In this case, different information criterion can be used to estimate the appropriate lag length of the VAR test.
iii. Then the VAR model has been developed with the appropriate lag length estimated earlier.
iv. Then the VAR model has been used for different diagnostic checking like, serial correlation, normality, AR root graph etc.

Based on the above mentioned guideline, this research has used different unit root test to determine the order of integration of the endogenous variables. When DSI, WMKTCAP and MTV are found I(1) process, their first differenced value have been taken for use in the VAR model. Then appropriate lag length has been determined by applying different information criterion and the test result has been presented in Table: 8.4. According to AIC method, the appropriate lag length has been found to be 12 which are also supported by LR and FPE method. So, the lag length of 12 has been finally selected for use in the VAR model.

Table 8.4: Lag Order Selection Criteria in VAR Test between Stock Price and Weighted Market Micro Variables

Endogenous variables: D(DSI) D(WMKTCAP) WMKTDY WMKTEPS WMKTPE D(MTV)						
Exogenous variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9505.860	NA	1.60e+23	70.45822	70.53819	70.49033
1	-9354.067	295.7154	6.80e+22	69.60049	70.16025*	69.82527
2	-9262.513	174.2910	4.51e+22	69.18899	70.22853	69.60642*
3	-9216.624	85.31906	4.19e+22	69.11574	70.63507	69.72583
4	-9187.310	53.19940	4.41e+22	69.16526	71.16439	69.96802
5	-9154.083	58.82538	4.52e+22	69.18580	71.66471	70.18122
6	-9124.188	51.59624	4.75e+22	69.23102	72.18972	70.41911
7	-9078.852	76.23129	4.46e+22	69.16187	72.60036	70.54262
8	-9050.536	46.35434	4.75e+22	69.21879	73.13707	70.79220
9	-9021.746	45.85129	5.07e+22	69.27219	73.67026	71.03826
10	-8973.422	74.81274	4.68e+22	69.18090	74.05876	71.13964
11	-8921.477	78.11015	4.23e+22	69.06279	74.42044	71.21419
12	-8880.866	**59.26097***	**4.17e+22***	**69.02864***	74.86608	71.37270
* 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						

Note: Author's own calculation estimates

In the next stage, a single VAR model has been developed where stock price has been considered as dependent variable and lagged stock price & weighted market micro variables have been considered as independent variables. Table: 8.5 presents the list of coefficients associated with each of the independent variables in the VAR test from lag 1 to 12. In addition, standard errors, t-statistics and *p*-values have also been presented associated with each VAR coefficients. In this case, each VAR coefficient of a particular variable at a specific lag presents the power of that variable to explain any changes in dependent variable i.e. stock price. Standard errors explain the statistical reliability of the each coefficients estimates of the VAR model whereas t-statistics and *p*-values measures the statistical significance of the VAR estimates. After examining this table, it is quite visible that although some of the standard errors are positive and some are negative but they all possess a small numerical value, representing reliability of the VAR estimates.

Table 8.5: Estimates of Vector Autoregression (VAR) Test between Stock Price and Weighted Market Micro Variables

Lags	Estimates	D(DSI)	D(WMKTCAP)	WMKTDY	WMKTEPS	WMKTPE	D(MTV)
1	Coefficient	0.26866	0.000667	0.243943	-0.726376	-0.265607	0.23132
	Std. errors	0.08899	0.00052	0.75240	0.34933	0.52836	0.08359
	t-statistics	3.01899	1.29377	0.32422	-2.07934	-0.50270	2.76741
	p-value	0.0026	0.1960	0.7458	0.0378	0.6153	0.0057
2	Coefficient	-0.11142	0.001661	1.752094	-0.290283	-0.047710	-0.02464
	Std. errors	0.08795	0.00051	0.74867	0.41514	0.56635	0.10310
	t-statistics	-1.26688	3.23359	2.34028	-0.69924	-0.08424	-0.23906
	p-value	0.2054	0.0013	0.0194	0.4845	0.9329	0.8111
3	Coefficient	0.11894	-0.000675	0.944047	0.650886	-0.145820	0.56391
	Std. errors	0.08042	0.00053	0.74261	0.41647	0.56255	0.10626
	t-statistics	1.47910	-1.27783	1.27125	1.56286	-0.25921	5.30691
	p-value	0.1394	0.2016	0.2039	0.1184	0.7955	0.0000
4	Coefficient	-0.11250	0.000381	-0.355031	0.786591	-0.293811	0.18307
	Std. errors	0.08073	0.00054	0.75827	0.40887	0.55896	0.12447
	t-statistics	-1.39363	0.70185	-0.46821	1.92380	-0.52564	1.47083
	p-value	0.1637	0.4829	0.6397	0.0546	0.5992	0.1416
5	Coefficient	0.05597	-0.000143	-0.572536	-0.342447	-0.482849	0.21367
	Std. errors	0.08294	0.00052	0.76233	0.41265	0.55143	0.12544
	t-statistics	0.67489	-0.27530	-0.75103	-0.82988	-0.87563	1.70340
	p-value	0.4999	0.7831	0.4528	0.4068	0.3814	0.0888
6	Coefficient	-0.04737	0.001311	0.955019	-0.447177	0.819023	-0.02732
	Std. errors	0.08227	0.00054	0.75758	0.41127	0.55712	0.12880
	t-statistics	-0.57591	2.41001	1.26062	-1.08731	1.47010	-0.21218
	p-value	0.5648	0.0161	0.2077	0.2771	0.1418	0.8320
7	Coefficient	-0.27494	0.001275	-0.122388	0.459650	-0.344881	0.11674
	Std. errors	0.08061	0.00057	0.76660	0.41124	0.55881	0.13149
	t-statistics	-3.41064	2.23385	-0.15965	1.11772	-0.61718	0.88787
	p-value	0.0007	0.0257	0.8732	0.2639	0.5372	0.3748
8	Coefficient	-0.12883	0.001241	0.808933	-0.191129	0.098691	0.32568
	Std. errors	0.08241	0.00057	0.76651	0.41302	0.55469	0.12730
	t-statistics	-1.56338	2.16625	1.05534	-0.46276	0.17792	2.55847
	p-value	0.1182	0.0305	0.2915	0.6436	0.8588	0.0106
9	Coefficient	0.22069	-0.002313	0.336923	0.342054	-0.083785	0.31750
	Std. errors	0.08268	0.00058	0.76396	0.41690	0.55342	0.13261
	t-statistics	2.66922	-4.01473	0.44102	0.82047	-0.15140	2.39431
	p-value	0.0077	0.0001	0.6593	0.4121	0.8797	0.0168
10	Coefficient	0.22351	-0.002449	-0.065571	0.301182	0.422385	0.29798
	Std. errors	0.08467	0.00062	0.77333	0.40674	0.52681	0.12748
	t-statistics	2.63967	-3.96682	-0.08479	0.74047	0.80179	2.33748
	p-value	0.0084	0.0001	0.9324	0.4592	0.4228	0.0196
11	Coefficient	-0.31931	0.002428	-0.965078	-0.307229	-0.523551	0.06001
	Std. errors	0.08728	0.00088	0.76529	0.39772	0.52678	0.13082
	t-statistics	-3.65873	2.75985	-1.26107	-0.77247	-0.99387	0.45875
	p-value	0.0003	0.0059	0.2075	0.4400	0.3205	0.6465
12	Coefficient	0.00437	-0.001318	0.327974	-0.317155	-0.065075	-0.070558
	Std. errors	0.08751	0.00088	0.71421	0.38280	0.49154	0.13057
	t-statistics	0.05002	-1.50313	0.45921	-0.82850	-0.13239	-0.54039
	p-value	0.9601	0.1331	0.6462	0.4076	0.8947	0.5890

Note: Author’s own calculation estimates

But when t-statistics and *p*-values have been examined, they provide that all of the endogenous variables at their specific lag are not statistically significant. Here, t-statistics is concerned with the null hypothesis that each VAR coefficient is not statistically significant. Coefficients having *p*-values less than 0.05 has been revealed as statistically significant coefficients. At this stage, different variables have been found to be statistically significant at different lags. For instance, stock price at lag 1, 7, 9, 10 and 11 have been found to have statistically significant coefficients at 5 percent level. Weighted market capitalization (WMKTCAP) is found to get statistically significant coefficients at lag 2, 6, 7, 8, 9, 10 and 11. Weighted market dividend yield (WMKTDY) has been found to be significant only at lag 2. Weighted market earnings per share (WMKTEPS) have been found to be significant at 5 percent level only at lag 1 and 4. Weighted market price to earnings multiples (WMKTPE) are not found to be significant at any lag. Finally, market trading volume (MTV) is found to be significant at lag 1, 3, 5, 8, 9 and 10. So, in order to derive a good VAR model, this research conducts a test known as '*VAR Lag Exclusion Wald Test*' to identify any particular lag which is not significant in the VAR model. Table: 8.6 show the test estimates of the VAR lag exclusion test. Here, null hypothesis has been assumed to have non-significance of different lags. Table: 8.6 reports that lagged stock price at 4, 5 and 12 are not significant at 5 percent level. Lagged weighted market capitalization at 2 and 9 are not significant. Weighted market dividend yield is significant only at lag 1. Lagged weighted market earnings per share are significant at lag 1, 2 and 12. Lagged weighted market price to earnings multiples is significant at lag 1. Finally lagged market trading volume is significant at lag 1, 2, 3, 6, 7, 10 and 11. But the joint lag exclusion test provide that at lag 4 and 5, *p*-values are more than 0.05; representing the fact that null hypothesis of non-significance of the lag level can not be rejected at 5 percent level. Therefore, this two lag has been found to be statistically insignificant and can be excluded from the VAR model specification.

Table 8.6: Estimates of VAR Lag Exclusion Wald Test

Chi-square Test Statistics for Lag Exclusion							
	D(DSI)	D(WMKTCAP)	WMKTDY	WMKTEPS	WMKTPE	D(MTV)	Joint
Lag 1	38.76214	16.01461	50.21298	20.67034	40.97192	87.20687	284.64
p-value	7.97e-07	0.013676	4.26e-09	0.002102	2.93e-07	1.11e-16	0.0000
Lag 2	17.22510	3.043503	6.563600	13.87898	2.805059	40.89737	82.940
p-value	0.008491	0.803367	0.363095	0.031018	0.832886	3.03e-07	1.44e-05
Lag 3	33.29049	48.66700	1.298317	5.558640	11.78410	14.23870	102.85
p-value	9.22e-06	8.69e-09	0.971750	0.474398	0.066962	0.027081	2.36e-08
Lag 4	8.683866	24.63261	1.540833	2.176684	3.291838	6.338881	45.404
p-value	0.192153	0.000399	0.956736	0.902753	0.771427	0.386318	0.1353
Lag 5	5.774883	14.32578	3.389028	6.378401	8.687159	12.29451	49.005
p-value	0.448875	0.026201	0.758671	0.382162	0.191951	0.055712	0.0727
Lag 6	12.62635	38.58252	3.937547	0.927435	4.799240	20.44428	75.990
p-value	0.049369	8.64e-07	0.685128	0.988214	0.569808	0.002307	0.0001
Lag 7	14.70730	13.65794	6.226399	4.455203	2.894480	32.04654	66.581
p-value	0.022660	0.033699	0.398313	0.615322	0.821969	1.60e-05	0.0014
Lag 8	13.92877	35.58582	2.775474	3.884371	7.148876	7.261692	57.919
p-value	0.030442	3.32e-06	0.836453	0.692321	0.307299	0.297323	0.0117
Lag 9	23.23158	10.78246	9.702330	8.811732	3.099228	8.010041	54.295
p-value	0.000723	0.095337	0.137760	0.184446	0.796294	0.237369	0.0257
Lag 10	21.13769	28.20165	9.309086	5.060615	1.734937	12.86160	80.796
p-value	0.001733	8.61e-05	0.156927	0.536063	0.942392	0.045287	2.74e-05
Lag 11	19.96082	14.75575	4.623005	6.205075	6.093907	18.09598	69.910
p-value	0.002814	0.022244	0.592991	0.400614	0.412753	0.005997	0.0006
Lag 12	5.386979	20.63213	7.721527	13.61217	2.039192	12.06576	63.353
p-value	0.495221	0.002136	0.259223	0.034282	0.916059	0.060518	0.0032
df	6	6	6	6	6	6	36

Note: Author's own calculation estimates

Finally, after excluding lag 4 and lag 5, the final VAR model has been developed and their coefficients have been estimates which are presented in the following:

D(DSI) = 0.2849*D(DSI(-1)) - 0.11135*D(DSI(-2)) + 0.07512*D(DSI(-3)) - 0.023660*D(DSI(-6)) - 0.26500*D(DSI(-7)) - 0.14563*D(DSI(-8)) + 0.23460*D(DSI(-9)) + 0.21006*D(DSI(-10)) - 0.30678*D(DSI(-11)) + 0.013236*D(DSI(-12)) + 0.000832*D(WMKTCAP(-1)) + 0.00173*D(WMKTCAP(-2)) - 0.000479*D(WMKTCAP(-3)) + 0.00136*D(WMKTCAP(-6)) + 0.00107*D(WMKTCAP(-7)) + 0.00136*D(WMKTCAP(-8)) - 0.00245*D(WMKTCAP(-9)) - 0.00230*D(WMKTCAP(-10)) + 0.00255*D(WMKTCAP(-11)) - 0.00128*D(WMKTCAP(-12)) + 0.1932*WMKTDY(-1) + 1.8215*WMKTDY(-2) + 0.23105*WMKTDY(-3) + 0.61533*WMKTDY(-6) - 0.37052*WMKTDY(-7) + 0.5590*WMKTDY(-8) + 0.62652*WMKTDY(-9) - 0.19014*WMKTDY(-10) - 0.9351*WMKTDY(-11) + 0.28252*WMKTDY(-12) - 0.7759*WMKTEPS(-1) - 0.14601*WMKTEPS(-2) + 0.73805*WMKTEPS(-3) - 0.2022*WMKTEPS(-6) + 0.28110*WMKTEPS(-7) - 0.16578*WMKTEPS(-8) + 0.27965*WMKTEPS(-9) + 0.4037*WMKTEPS(-10) - 0.32756*WMKTEPS(-11) - 0.2380*WMKTEPS(-12) - 0.2958*WMKTPE(-1) - 0.14611*WMKTPE(-2) - 0.29612*WMKTPE(-3) + 0.51760*WMKTPE(-6) - 0.37909*WMKTPE(-7) + 0.09765*WMKTPE(-8) - 0.12980*WMKTPE(-9) + 0.32582*WMKTPE(-10) - 0.5053*WMKTPE(-11) - 0.01813*WMKTPE(-12) + 0.21304*D(MTV(-1)) - 0.1034*D(MTV(-2)) + 0.4726*D(MTV(-3)) - 0.16862*D(MTV(-6)) + 0.01629*D(MTV(-7)) + 0.25384*D(MTV(-8)) + 0.22856*D(MTV(-9)) + 0.26967*D(MTV(-10)) - 0.007179*D(MTV(-11)) - 0.070990*D(MTV(-12)) - 3.07605

After then, the VAR model has been examined for the presence of serial correlation in the residuals in different lag orders. In this case, 12 different lag orders has been considered in VAR Residual Serial Correlation LM Tests and presented in Table: 8.7. This table reveals that except lag 4, 8, 9, and 13, all lag orders provide the result that the VAR model residuals is free from serial correlation.

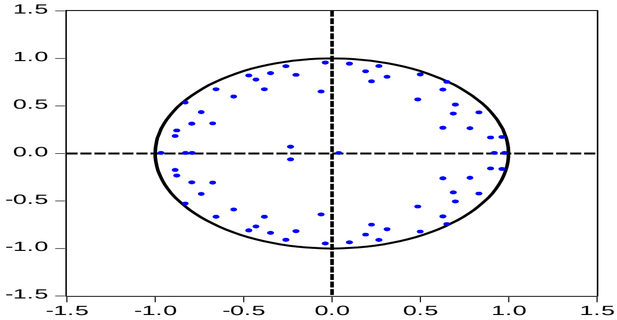
Table 8.7: VAR Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h		
Lags	LM-Stat	Prob
1	33.45333	0.5903
2	47.03864	0.1030
3	32.17462	0.6512
4	**57.56283**	**0.0127**
5	43.60144	0.1796
6	34.93487	0.5191
7	45.38024	0.1359
8	**63.73485**	**0.0030**
9	**75.21452**	**0.0001**
10	38.18746	0.3703
11	46.33647	0.1161
12	43.58011	0.1802
13	**52.69328**	**0.0358**

Note: Author’s own calculation estimates

Finally, the VAR model has been examined for their stability by applying inverse roots of AR characteristics polynomial and the result is presented in Figure: 8.1. In this case, if al the roots of the characteristic AR polynomial have absolute value less than one and lie inside the unit circle implies that the VAR model will be considered stationary and stable. Based on the observation, it can be concluded that, as all the points have been laid within the unit circle, so the VAR model has been considered to be stationary and stable model.

Figure 8.1: Inverse Roots of AR Characteristics Polynomial of the VAR Model



8.4 Cointegration between Stock Price and Macro Variables:

Soren Johansen's (1900, 1995) methodology of testing cointegration has been used to estimate long run equilibrium relationship between DSE all share price index (DSI) and the selected macro variables. In this case, deposit interest rate (DIR), export receipt (EXRPT), import payment (IMPMT), per capita gross domestic product (PCAPGDP), aggregate investment at current market price (INVMP), industrial production index (IPD), broad money supply (M2), national income deflator (NID), and foreign remittances (REMIT) has been selected as macro variables. However, the following steps have been followed in this respect:

(vii) The Cointegration test starts with identifying the order of integration for each specific endogenous variable by applying Augmented Dickey-Fuller (ADF) Test and Phillips-Parron (P-P) Test. If any variable doesn't have the same order of integration, it will not be incorporated in this test.

(viii) Then it is important to identify the optimal lag length. This can be found by Akaike info criterion (AIC), Schwarz criterion (SC) or Hannan-Quinn criterion (HQ) etc.

(ix) Then a VAR model has to be developed to determine the rank of π. The rank of π is the value of 'r' which implies the number of cointegrated vectors. When $r = 0$, it means there is not cointegrating vectors. If there are 'g' variables in the system equations, there can be a maximum of g-1 cointegrating vectors.

(x) Two different test statistic (i.e. trace statistics and max-eigen value statistics) need to be examined to identify the number of cointegrating vector in the system. Here the following hypothesis has been used to analyze trace statistic and max-eigen value statistics.

<u>*Hypothesis about Trace Statistics:*</u>

H_o : There is no cointegrating variables i.e. r = 0 or r ≤ 1

H_a : There exists cointegrating variables i.e. r ≥1 or r = 2

<u>*Hypothesis about Max-Eigen Value Statistics:*</u>

H_o : There is no cointegrating variables i.e. r = 0 or r = 1

H_a : There exists cointegrating variables i.e. r = 1 or r = 2

(xi) If trace statistics and max-eigen value statistics is greater than critical value at 5 percent, the test reject H_o and vice versa. Rejecting H_o implies that there exists long run equilibrium relationship among the variables.

(xii) If the endogenous variables are found to have cointegrating relationship, then normalized cointegrating equation need to be discuss to identify their long run equilibrium relationship in detail.

According to the above instructions, initially it is important to select the variables to be incorporated in the cointegration test. Here DSI, DIR, EXRPT, IMPMT, PCAPGDP, INVMP, IPD, M2, NID, and REMIT have been selected for this study and found that they are all integrated of order one i.e. I (1) processes (Table: 7.19).

Five different lag length selection methods have been used but this research has chosen those lag length which is supported by majority of the lag length selection methods. Table: 8.8 presents different selection of lag length estimated by different methods. It is found that lag length of 12 has been chosen by LR, FPE and AIC methods. So this lag length has been considered as optimal lag length for conducting Johansen's Cointegration test between stock price (DSI) and the selected macro variables.

Table 8.8: VAR Lag Order Selection Criteria between Stock Price and Macro Variables

Endogenous variables: DSI DIR EXRPT IMPMT PCAPGDP INVMP IPD M2 NID REMIT						
Exogenous variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-17697.93	NA	2.70e+44	130.6859	130.8188	130.7392
1	-14778.19	5602.468	2.48e+35	109.8759	111.3380*	110.4630
2	-14558.75	404.8582	1.03e+35	108.9945	111.7858	110.1152*
3	-14402.10	277.4577	6.82e+34	108.5764	112.6969	110.2308
4	-14253.80	251.7344	4.84e+34	108.2199	113.6696	110.4080
5	-14138.52	187.1738	4.42e+34	108.1071	114.8860	110.8289
6	-14011.37	197.0517	3.74e+34	107.9068	116.0149	111.1623
7	-13796.16	317.6575	1.67e+34	107.0565	116.4938	110.8457
8	-13668.64	178.8073	1.45e+34	106.8534	117.6199	111.1763
9	-13544.23	165.2734	1.32e+34	106.6733	118.7689	111.5298
10	-13396.19	185.7288	1.03e+34	106.3188	119.7436	111.7090
11	-13203.71	227.2792	5.95e+33	105.6363	120.3903	111.5602
12	-13011.68	**212.5787***	**3.56e+33***	**104.9571***	121.0403	111.4147
* 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						

Note: Author's own calculation estimates

Then Johansen's Cointegration test has been applied at lag length 11[2], allowing linear deterministic trend and intercept in the data series. Now it is essential to identify the rank of π i.e. number of cointegrating vector and that could be done through analyzing and examining trace statistics and max-eigen value statistics.

Table: 8.9 shows the trace statistics through unrestricted cointegration rank test. Null hypothesis has been assumed as no cointegrating variables i.e. $r = 0$ or $r \leq 1$ against alternative of having cointegrating variables i.e. $r \geq 1$ or $r = 2$. According to MacKinnon-Haug-Michelis (1999) *p*-values of the trace statistics, it has been found that there are eight cointegrating vectors in the system which is statistically significant at 5 percent level.

[2] According to the instruction to the Eviews end-users given by Eviews Forum, appropriate lag length should be one less than optimal lag length provided by specific Information Criterion.

Table 8.9: Unrestricted Cointegration Rank Test (Trace) between Stock Price and Macro Variables

Hypothesized No. of CE(s)	Trace Statistic	Critical Value(0.05)	Prob.**
None *	0.475585	597.9966	0.0000
At most 1 *	0.352369	423.0736	0.0000
At most 2 *	0.281331	305.3419	0.0000
At most 3 *	0.235007	215.8157	0.0000
At most 4 *	0.154953	143.2180	0.0000
At most 5 *	0.111297	97.59153	0.0001
At most 6 *	0.102203	65.61572	0.0005
At most 7 *	0.076893	36.39883	0.0075
At most 8	0.048773	14.71613	0.0653
At most 9	0.004291	1.165403	0.2803

Note: Author's own calculation estimates

Table 8.10: Unrestricted Cointegration Rank Test (Maximum Eigenvalue) between Stock Price and Macro Variables

Hypothesized No. of CE(s)	Max-Eigen Statistic	Critical Value (0.05)	Prob.**
None *	174.9230	64.50472	0.0000
At most 1 *	117.7317	58.43354	0.0000
At most 2 *	89.52619	52.36261	0.0000
At most 3 *	72.59775	46.23142	0.0000
At most 4 *	45.62644	40.07757	0.0107
At most 5	31.97581	33.87687	0.0829
At most 6 *	29.21688	27.58434	0.0306
At most 7 *	21.68270	21.13162	0.0418
At most 8	13.55073	14.26460	0.0646
At most 9	1.165403	3.841466	0.2803

Note: Author's own calculation estimates

On the other hand, Table: 8.10 presents max-eigen value statistics through unrestricted cointegration rank test. Here null hypothesis has been set as having no cointegrating variables i.e. r = 0 or r = 1 against alternative of having cointegrating variables i.e. r = 1 or r = 2. According to max-eigen value test statistics, null hypothesis of no cointegrating vectors can not be accepted up to four which reveal that there are at least five cointegrating vectors among the DSI and selected macro variables which is statistically significant at 5 percent significance level. It is important to note that the numbers of cointegrating vectors are not same in trace test and max-eigen value test. When there is any discrepancy or conflict between trace test and max-eigen value test in estimating number of cointegrating vectors, research guidelines suggest to follow max-eigen value test. That's why, Johansen's Cointegration test in this research finally decides to accept five cointegrating vector in this model.

Table 8.11: Cointegrating Equation(s) among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation(s)	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
1	1.00	157.61	-2.087	1.548	-0.5472	0.2539	9.521	0.023	53.92	-1.187
		(19.18)	(1.01)	(0.664)	(0.071)	(0.026)	(2.19)	(0.006)	(8.01)	(0.132)
2	1.00	0.00	1.830	-0.564	-0.297	0.336	0.204	0.019	26.43	-0.776
			(1.20)	(0.824)	(0.07)	(0.036)	(2.35)	(0.008)	(8.84)	(0.167)
3	1.00	0.00	0.00	1.05	-0.322	0.368	2.06	0.016	27.77	-0.798
				(0.596)	(0.077)	(0.043)	(2.35)	(0.008)	(10.18)	(0.192)
4	1.00	0.00	0.00	0.00	-0.601	0.441	5.11	0.033	54.70	-0.389
					(0.119)	(0.067)	(3.51)	(0.015)	(15.82)	(0.262)
5	1.00	0.00	0.00	0.00	0.00	0.3608	3.213	-0.0086	-1.424	-1.073
						(0.052)	(2.96)	(0.007)	(6.73)	(0.191)

Note: Author's own calculation estimates

Table: 8.11 presents the five cointegrating equations with their normalized cointegrating coefficients. The first equation entails that the coefficient of DIR has positive coefficient with DSI meaning that when DIR increases by 1 percent DSI increases by approximately 157.61 percent. But the standard error of this coefficient has been found to be high which implies less reliable estimates for the DIR. However, the coefficient of DIR in the 1st cointegrating equation doesn't support the hypothecated relationship between DSI and DIR in this research. However, positive relationship has been found to exist between stock price and deposit interest rates in the long run. The normalized coefficients of EXRPT have been found to be -2.087 and 1.830 with DSI in equation 1 and 2 respectively. This situation explains that at the presence of DIR, EXRPT has negative association with DSI. But when DIR is absent the same negative relation has turned to be positive. However, the coefficient of EXRPT in the 1st cointegrating equation provides that negative relationship exist between EXRPT and stock price in the long run. IMPMT provides positive cointegrating coefficient in equation 1 and 3 (i.e. 1.548 and 1.05 respectively) but in equation 2, cointegrating efficient has been found to be negative (i.e. -0.564). If the 1st cointegrating equation has been considered, the cointegrating efficient of IMPMT doesn't support the hypothecated relationship but explain a long run positive relationship with stock price. PCAPGDP has been found to have negative cointegrating coefficients in all the five cointegrating equations and this evidence also supports the hypothecated relationship between DSI and PCAPGDP in this research. In different estimates of PCAPGDP, standard errors are also found to be very small indicating statistical reliability of the cointegration estimates. However, all the five equation depicts the fact that, PCAPGDP has long run negative relationship with stock price. IMVMP and IPD also provide positive cointegrating coefficients in all the five cointegrating equations and again this evidence supports the hypothecated relationship between DSI and INVMP in this research. It also explains long run positive relationship among the three variables. Whereas M2 and NID provide positive cointegrating coefficients from equation 1 to equation 4 but in equations 5, both of these two macro variables provide negative coefficients. As the hypothecated relationship between DSI & M2 and DSI & NID is positive, so the evidence of M2 and NID from equation 1 to 4 supports the hypothecated relationship in this research. This result also documents the fact that they have long run positive relationship with themselves. Finally REMIT provides negative coefficients in all the cointegrating equations which imply that when foreign remittances increase, stock price in DSE decreases in the long run and vice versa. But this negative association between DSI and REMIT doesn't support the hypothecated relationship of this research.

8.5 Estimates of Vector Error Correction Model between Stock Price and Macro Variables:

According to the test of cointegration between DSI and the selected macro variables (i.e. deposit interest rate, export receipt, import payment, per capita gross domestic products, aggregate investment at current market price, industrial production index, road money supply and foreign remittances), it is found that there are five cointegrating equations among the selected variables (Table: 8.11). This result implies that there are five possible ways between DSI and selected macro variables to converge towards equilibrium in the long run. It also explains that there must have five different error correction term associated with each cointegrating equations.

Table: 8.12 and Table: 8.13 present the first cointegrating equation and its associated error correction estimates between DSI and the selected macro variables. Based on the first cointegrating equation with its normalized cointegrating coefficients, error correction term produces a value equal to -0.196362. This error correction estimates which is associated with the first cointegrating equation explain that DSE all share price index (DSI) will decline approximately by 19.63 percent per month to achieve long run equilibrium condition in the future. This error correction term also have very low standard error which is a representative of the statistical reliability of the estimates. This result also reveals that, when all the selected macro variables are considered in the cointegration model, stock price requires a period of approximately 5.1 months to attain equilibrium condition.

Table 8.12: First Cointegrating Equation among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
1	1.00	157.61	-2.087	1.548	-0.5472	0.2539	9.521	0.023	53.92	-1.187
		(19.18)	(1.01)	(0.664)	(0.071)	(0.026)	(2.19)	(0.006)	(8.01)	(0.132)

Note: Author's own calculation estimates

Table 8.13: Adjustment coefficients with the First Cointegrating Equation

Cointegrating Equation 1	***-0.196362 (0.03787)***
D(DIR)	-0.000143 (0.00013)
D(EXRPT)	-0.012927 (0.02732)
D(IMPMT)	-0.039605 (0.03070)
D(PCAPGDP)	0.719197 (0.11969)
D(INVMP)	-0.528014 (0.18465)
D(IPD)	-0.001168 (0.00610)
D(M2)	-2.590264 (0.42249)
D(NID)	-0.000368 (0.00052)
D(REMIT)	-0.128484 (0.06838)

Note: standard error in parentheses

In the same way, Table: 8.14 and Table: 8.15 present the second cointegrating equation with its associated error correction estimates. This equation has been generated when DIR is dropped from the cointegration model. According to the result presented in the second cointegrating equation, error correction term is equal to -0.190758 which explain that when the effect of DIR has been eliminated from the cointegrating model, DSE all share price index (DSI) will decline approximately 19.07 percent per month for correcting short run disequilibrium condition. In this error correction term, stock price requires approximately 5.24 months to converge towards equilibrium condition.

Table 8.14: Second Cointegrating Equation among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
2	1.00	0.00	1.830	-0.564	-0.297	0.336	0.204	0.019	26.43	-0.776
			(1.20)	(0.824)	(0.07)	(0.036)	(2.35)	(0.008)	(8.84)	(0.167)

Note: Author's own calculation estimates

Table 8.15: Adjustment coefficients with the Second Cointegrating Equation

Cointegrating Equation 2	-0.190758 (0.04072)
D(DIR)	-7.94E-05 (0.00014)
D(EXRPT)	-0.001970 (0.02930)
D(IMPMT)	-0.025865 (0.03289)
D(PCAPGDP)	0.920265 (0.12125)
D(INVMP)	-0.647725 (0.19694)
D(IPD)	0.011133 (0.00601)
D(M2)	-2.421305 (0.45301)
D(NID)	0.000280 (0.00054)
D(REMIT)	-0.043893 (0.07126)

Note: standard error in parentheses

Table: 8.16 and Table: 8.17 present the third cointegrating equation with its associated error correction estimates. In this equation, it is clearly visible that the effect of DIR and EXRPT has been eliminated. After excluding their influence from the cointegrating model, error correction term is estimated which is equal to -0.188873. This error correction estimate reveals that, the rate of short run dynamics adjustment of stock price per month is approximately 18.89 percent.

Table 8.16: Third Cointegrating Equation among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
3	1.00	0.00	0.00	1.05	-0.322	0.368	2.06	0.016	27.77	-0.798
				(0.596)	(0.077)	(0.043)	(2.35)	(0.008)	(10.18)	(0.192)

Note: Author's own calculation estimates

Table 8.17: Adjustment coefficients with the Third Cointegrating Equation

Cointegrating Equation 3	-0.188873 (0.05062)
D(DIR)	-0.000219 (0.00017)
D(EXRPT)	-0.076087 (0.03505)
D(IMPMT)	0.061255 (0.03919)
D(PCAPGDP)	0.702260 (0.14790)
D(INVMP)	-0.946866 (0.24155)
D(IPD)	0.011087 (0.00747)
D(M2)	-2.569219 (0.56280)
D(NID)	-0.000315 (0.00067)
D(REMIT)	-0.184606 (0.08657)

Note: standard error in parentheses

Table: 7.18 and Table: 7.19 show the forth cointegrating equation with its error correction estimates between stock price and macro variables. According to this estimate, error correction term is equal to -0.173205. This result explains that when DIR, EXRPT and IMPMT have no influence in the cointegration model, stock price will decline approximately by 17.32 percent per month to converge towards long run equilibrium. So in this estimates stock price requires at least 5.77 months to reach long run equilibrium condition.

Table 8.18: Fourth Cointegrating Equation among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
4	1.00	0.00	0.00	0.00	-0.601	0.441	5.11	0.033	54.70	-0.389
					(0.119)	(0.067)	(3.51)	(0.015)	(15.82)	(0.262)

Note: Author's own calculation estimates

Table 8.19: Adjustment coefficients with the Fourth Cointegrating Equation

Cointegrating Equation 4	-0.173205 (0.04852)
D(DIR)	-0.000248 (0.00017)
D(EXRPT)	-0.081197 (0.03482)
D(IMPMT)	0.058558 (0.03924)
D(PCAPGDP)	0.724891 (0.14681)
D(INVMP)	-0.956820 (0.24219)
D(IPD)	0.008941 (0.00720)
D(M2)	-2.645008 (0.56002)
D(NID)	-0.000146 (0.00065)
D(REMIT)	-0.197139 (0.08603)

Note: standard error in parentheses

Finally Table: 8.20 and 8.21 show the fifth cointegrating equation with its error correction estimates between stock price and macro variables. According to this estimate, error correction term is equal to -0.167235. This result explains that when DIR, EXRPT, IMPMT and PCAPGDP have no influence in the cointegration model, stock price will decline approximately by 16.72 percent per month to converge towards long run equilibrium. So in this estimates DSI requires at least six months to get equilibrium condition.

Table 8.20: Fifth Cointegrating Equation among Stock Price and Macro Variables

Normalized cointegrating coefficients (standard errors in the parentheses)										
Equation	DSI	DIR	EXRPT	IMPMT	PCAPGDP	INVMP	IPD	M2	NID	REMIT
5	1.00	0.00	0.00	0.00	0.00	0.3608	3.213	-0.0086	-1.424	-1.073
						(0.052)	(2.96)	(0.007)	(6.73)	(0.191)

Note: Author's own calculation estimates

Table 8.21: Adjustment coefficients with the Fifth Cointegrating Equation

Cointegrating Equation 5	-0.167235 (0.05054)
D(DIR)	-0.000248 (0.00017)
D(EXRPT)	-0.116628 (0.03490)
D(IMPMT)	0.040511 (0.04058)
D(PCAPGDP)	0.775869 (0.15233)
D(INVMP)	-0.832873 (0.24999)
D(IPD)	0.006896 (0.00748)
D(M2)	-2.569769 (0.58329)
D(NID)	-0.000441 (0.00068)
D(REMIT)	-0.193984 (0.08966)

Note: standard error in parentheses

At the end, it can be concluded that, although Johansen's cointegration test provides five cointegrating vector which subsequently generate five cointegrating equations, but research guideline would suggest to consider only the first cointegrating equation. That's why, this research also considers the first cointegrating equation that successfully represents and explain long run equilibrium relationship between stock price and the selected macroeconomic variables. In this equation, it is also found that stock price declines approximately 19.64 percent per month for adjusting short run disequilibrium and converge towards long run equilibrium condition in the future.

CHAPTER 9

TODA-YAMAMOTO (T-Y) GRANGER CAUSALITY ANALYSIS

9.1 An Overview of Basic Granger Causality Theorem:

The traditional approach to examine the causal relationships between two variables is *Standard Granger-Causality Test* proposed by Clive Granger (1969). This test states that, if past values of the variable Y significantly contribute to forecast the values of another variable X, then Y is said to Granger Cause X and vice versa. The test involves estimating the following simple *vector autoregressions (*VAR):

$$\boxed{X_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{j=1}^{m} \beta X_{t-j} + \mu_{1t}} \text{..................(1)}$$

$$\boxed{Y_t = \sum_{i=1}^{m} \lambda_i Y_{t-i} + \sum_{j=1}^{m} \delta_j X_{t-j} + \mu_{2t}} \text{..................(2)}$$

Where Y_t and X_t are the variables to be tested, μ_{1t} and μ_{2t} are mutually uncorrelated white noise errors, and *t* denotes the time period and *'i'* and *'j'* are the number of lags. Granger-Causality means the lagged Y influence X significantly in equation (1) and the lagged X influence Y significantly in equation (2). In other words they can be jointly tested if the estimated lagged coefficient $\Sigma\alpha_i$ and $\Sigma\lambda_i$ are different from zero with *F*-statistics. When the jointly test reject the two null hypothesis that $\Sigma\alpha_i$ and $\Sigma\lambda_i$ both are not different from zero, causal relationships between X and Y are confirmed.

9.2 Drawbacks of Basic Granger Causality Test:

Granger Causality test is easy to carry out and be able to apply in many kinds of empirical studies. But later on, the *Standard Granger Causality Test* has been found to have two major drawbacks when more than two variables are considered:

1. Problems of Specification-Bias: *A* two-variable Granger-Causality test without considering the effect of other variables is subject to possible *specification bias*. As pointed out by Gujarati (1995), a causality test is sensitive to model specification and the number of lags. It would reveal different results if it was relevant and was not included in the model. Therefore, the empirical evidence of a two-variable Granger-Causality is fragile because of this problem.

2. Problems of Spurious Regression: Time series are often non-stationary. This situation could exemplify the problem of *spurious regression*. Gujarati (1995) has also identified that when the variables are integrated, the *F*-test procedure is not valid, because the test statistics do not have standard distribution. Although researchers can still test the significance of individual coefficients with *t*- statistic, one may not be able to use *F*-statistic to jointly test the Granger-Causality. Enders (2004) has proved that in some specific cases, using *F*-statistic to jointly test first differential VAR is permissible. First differential VAR also has its limitations, which can not be employed universally.

To sum up, because of the probable shortcomings of *specification bias* and *spurious regression*, this study does not carry out traditional Granger-Causality procedure to test the relationship between more than two variables but the improved Granger Causality procedure instead.

9.3 Introduction of Toda-Yamamoto (T-Y) Granger Causality Analysis:

A times series x_t Granger-causes another time series y_t if series y_t can be predicted with better accuracy by using past values of x_t rather than by not doing so, other information is being identical. In other words, variables x_t fails to Granger-cause y_t if,

$$\Pr(y_{t+m}|\Omega_t) = \Pr(y_{t+m}|\Psi_t)$$

Where $\Pr(y_{t+m}|\Omega_t)$ denotes conditional probability of y_t, where Ω_t is the set of all information available at time t, and $\Pr(y_{t+m}|\Psi_t)$ denotes conditional probability of y_t obtained by excluding all information on x_t from y_t. This set of information is depicted as Ψ_t. The selection of the VAR system requires an analysis of unit roots and cointegration which may cause inadequate results (Blough, 1992). This can lead to select an incorrect model for verifying the relations of causality, possibly causing a problem of over-rejection of non-causal null hypothesis (Giles and Mirza, 1999). In this way Toda and Yamamoto (1995), Dolado and Luketerpohl (1996) propose an applicable methodology independent of the integration or cointegration properties of the model. In this method, a Modified Wald Test is used to contrast the parameters of the VAR. An extended VAR model is used, whose order is determined by the number of optimal lag lengths in the system (k) and the maximum number of times one must differentiate the variables ($d_{\max}$). When a VAR ($k + d_{\max}$) is predicted (where $d_{\max}$ is the maximum order of integration to occur in the system), this test displays asymptotic chi-square distribution, it is also shown that if variables are integrated of order *d*, the usual selection procedure is valid whenever $k \geq d$. Toda and Yamamoto test has been used to capture long run causality pattern of the stock indices and the following specification has been used to estimate:

$$\boxed{X_t = \alpha_1 + \sum_{i=1}^{k+d_{\max}} \alpha_{11}(i) X_{t-(k+d_{\max})} + \sum_{j=}^{k+d_{\max}} \alpha_{12}(j) Y_{t-(k+d_{\max})} + \varepsilon_{xt}}$$

$$\boxed{Y_t = \alpha_2 + \sum_{i=1}^{k+d_{\max}} \alpha_{21}(i) X_{t-(k+d_{\max})} + \sum_{j=1}^{k+d_{\max}} \alpha_{22}(j) Y_{t-(k+d_{\max})} + \varepsilon_{yt}}$$

Where ε_{xt} and ε_{yt} are stationary random processes intended to capture other pertinent information not contained in lagged values of X_t and Y_t. The lag length (k) is decided by either Akaike information criterion (AIC) or Schwarz information criterion (SC) or Hannan-Quinn information criterion (HQ) etc. In this research, the series Y_t fails to Granger cause X_t if $\alpha_{12}(j) = 0$ where $(j = 1,2,3,\ldots.. + k + d_{\max})$; and the series X_t fails to cause Y_t if $\alpha_{21}(i) = 0$ where $(i = 1,2,3,\ldots..+ k + d_{\max})$.

9.4 Toda-Yamamoto Granger Causality Test between Stock Price and Micro Variables:

According to the basic steps of Toda-Yamamoto Granger Causality Test, it is important to estimate two things: (i) maximum order of integration $(d_{\max})$ of dependent variable i.e. DSI and all the weighted market micro variables; (ii) optimal lag length (k) of the VAR model. In this case maximum order of integration can be identified by applying different types of stationarity test like Augmented Dickey Fuller (ADF) Test, GLS transformed Dickey-Fuller (DFGLS) test, Phillips-Perron (PP) test, Kwiatkowski, *et. al.* (KPSS) test, Elliot, Richardson and Stock (ERS) Point Optimal test, and Ng and Perron (NP) unit root tests etc. In this research, the order of integration for the sample data series have been estimated through Augmented Dickey Fuller (ADF) Test and Phillips-Parron (P-P) Test allowing for a drift and trend in each series. Table: 9.1 provide the estimates of the order of integration between DSE- all share price index (DSI) and the weighted market micro variables. It has been found that WMKTDY, WMKTEPS, WMKTPE involves with integrated of order zero, i.e. stationary variables. On the other hand, DSI, WMKTCAP and MTV have been found to be non-stationary variables i.e. integrated of order one. As selection of the order of integration must be done based on maximum level, so this research incorporates the maximum order of integration, $d_{\max} = 1$.

Table: 9.1 Estimates of the Order of Integration between Stock Price and Weighted Market Micro Variables

Variables	Augmented Dickey Fuller (ADF) Test				Phillips-Parron (P-P)Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.02	1.0	-13.0	0.00	2.95	1.0	-13.7	0.0	I(1)	I(1)
WMKTCAP	7.34	1.0	-1.5	0.80	9.92	1.0	-16.7	0.0	I(1)	I(1)
WMKTDY	-14.8	0.0	----	----	-14.9	0.0	----	----	I(0)	I(0)
WMKTEPS	-6.42	0.0	----	----	-12.2	0.0	----	----	I(0)	I(0)
WMKTPE	-9.30	0.0	----	----	-13.6	0.0	----	----	I(0)	I(0)
MTV	7.22	1.0	-17.3	0.00	0.09	0.9	-27.5	0.0	I(1)	I(1)

Source: Author's own calculation estimates

The second step involves with the identification of the optimal lag length of the VAR model between stock price and weighted market micro variables. The estimates of the optimal lag length (k) in the VAR model can be identified through applying different types of information criteria like Akaike information criterion (AIC), Schwarz information criterion (SC) or Hannan-Quinn information criterion (HQ) etc. In this research, the optimal lag length provided by Akaike information criterion (AIC) has been particularly used. Table: 9.2 provide different estimates of the optimal lag length based on different information criteria. Here Akaike information criterion (AIC) provides the optimal lag length of 4 which is also supported by Final Prediction Error (FPE) method.

Table 9.2: VAR Lag Order Selection Criteria between Stock Price and Weighted Market Micro Variables

Endogenous variables: DSI WMKTCAP WMKTDY WMKTEPS WMKTPE MTV						
Exogenous variables: C						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-10735.17	NA	3.40e+26	78.11764	78.19655	78.14931
1	-9599.045	2214.421	1.14e+23	70.11669	70.66907*	70.33837*
2	-9553.290	87.18375	1.06e+23	70.04574	71.07159	70.45745
3	-9479.877	136.6817	8.09e+22	69.77365	71.27296	70.37537
4	-9442.140	68.61194	***8.00e+22****	***69.76102****	71.73380	70.55275
5	-9412.596	52.42782	8.41e+22	69.80797	72.25422	70.78972
6	-9375.739	63.79613	8.39e+22	69.80174	72.72146	70.97350
7	-9350.359	42.82236	9.12e+22	69.87898	73.27216	71.24076
8	-9319.249	51.13436*	9.52e+22	69.91454	73.78119	71.46634
* 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						

Source: Author's own calculation estimates

At this stage, the VAR model at lag 4 have to be examined to identify the presence of serial correlation in the residuals. Here ***VAR Residual Serial Correlation LM tests*** has been applied where null hypothesis is assumed to have no serial correlation at different lag order. Table: 9.3 shows the LM-statistics with their *p*- values at lag orders from 1 to

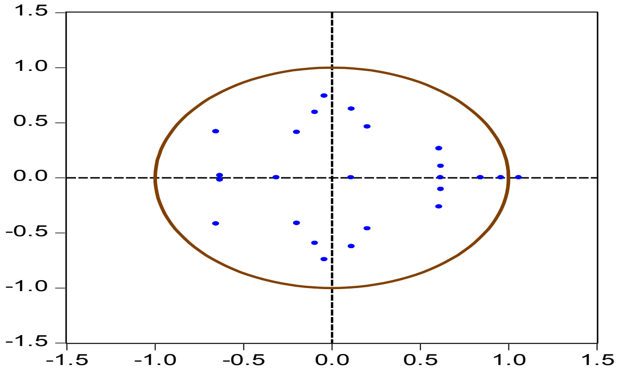
12. It has been found that at lag order 4, the *p*- value of the LM stat is more than 0.05 which implies that null hypothesis of having no serial correlation can not be rejected at 5 percent significance level. This result explains that the VAR model at lag 4 is free from serial correlation. In the mean time, the estimated VAR model at lag 4 is also found to be dynamically stable which is represented in Figure: 9.1.

Table 9.3: Estimates of Serial Correlation in the VAR Model between Stock Price and Weighted Market Micro Variables

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	**LM-Stat**	**Prob.**
1	52.81424	0.0349
2	60.39733	0.0066
3	55.95585	0.0181
4	***39.44114***	***0.3187***
5	65.23145	0.0020
6	53.92720	0.0278
7	36.95484	0.4246
8	46.35164	0.1158
9	50.62794	0.0537
10	41.00222	0.2604
11	55.84503	0.0185
12	71.65474	0.0004

Source: Author's own calculation estimates

Figure 9.1 Inverse Roots of AR Characteristic Polynomial between Stock Price and Weighted Market Micro Variables



Now the VAR model with lag order 4 and six exogenous variables (constant and 5 endogenous variables at lag 5) has been used to get VAR Granger Causality/Block Exogeneity Wald Tests result. After then, we have organized the test result to get Toda-Yamamoto Granger Causality test estimates which has been presented in Table: 9.4.

Table: 9.4: T-Y Granger Causality Test Between Stock Price and Weighted Market Micro Variables

Direction of Causality			df.	Chi-sq.	Prob.
DSI	~	WMKTCAP	4	6.843505	0.1444
WMKTCAP	→	DSI		9.751353	0.0448**
DSI	~	WMKTDY	4	4.062283	0.3976
WMKTDY	→	DSI		9.865248	0.0428**
DSI	~	WMKTEPS	4	7.760748	0.1007
WMKTEPS	→	DSI		9.588652	0.0480**
DSI	~	WMKTPE	4	0.897999	0.9248
WMKTPE	~	DSI		0.957878	0.9161
DSI	~	MTV	4	1.649488	0.7999
MTV	→	DSI		37.52853	0.0000*

Note: → shows direction of causal relationship and ~ signifies lack of any causal relationship
* sig. @ 1 percent level
** sig. @ 5percent level
*** sig. @ 10 percent level

Source: Author's own calculation estimates

Table: 9.4 shows the test estimates (i.e. chi-sq. with *p*-values) of Toda-Yamamoto (T-Y) Granger Causality test at 4 degrees of freedom. Here null hypothesis has been assumed to have no causal relation between two variables. It has been found that WMKTCAP, WMKTDY, and WMKTEPS granger causes DSI at 5 percent level and MTV granger causes DSI at 1 percent level. It is also found that DSI doesn't granger causes any of the weighted market micro variables which are represented by the *p*-values greater than 5 percent level.

On the other hand, when segmented micro variables are considered, it has been found that maximum order of integration, $d_{\max} = 1$ and optimal lag length of the VAR model provided by Akaike information criterion (AIC) is $k = 3$. The estimates of the two tests have been presented in Table: 9.5 and 9.6 respectively.

Table 9.5: Estimates of the Order of Integration between Stock Price and Segmented Micro Variable

Variables	Augmented Dickey Fuller (ADF) Test				Phillips-Parron (PP) Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.02	1.00	-13.02	0.00	2.95	1.00	-13.74	0.00	I(1)	I(1)
FINCAP	4.30	1.00	-3.03	0.124	4.89	1.00	-14.30	0.00	I(2)	I(1)
FINDY	4.84	0.00	-----	-----	-11.41	0.00	----	------	I(0)	I(0)
FINEPS	-3.33	0.00	------	-----	-11.95	0.00	-----	------	I(0)	I(0)
FINPE	-6.28	0.00	-----	-----	-8.52	0.00	-------	------	I(0)	I(0)
MFCCAP	7.60	1.00	-1.02	0.938	8.27	1.00	-16.94	0.00	I(2)	I(1)
MFCDY	-15.70	0.00	-----	-----	-15.70	0.00	-----	------	I(0)	I(0)
MFCEPS	-13.18	0.00	-----	-----	-13.95	0.00	-----	------	I(0)	I(0)
MFCPE	-10.92	0.00	----	-----	-10.92	0.00	-----	------	I(0)	I(0)

Source: Author's own calculation estimates

Table 9.6: VAR Lag Order Selection Criteria between Stock Price and Segmented Micro Variables

Endogenous variables: DSI FINCAP FINDY FINEPS FINPE MFCCAP MFCDY MFCEPS						
Exogenous variables: C						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-17277.33	NA	3.00e+42	126.1849	126.3167	126.2378
1	-15933.29	2580.159	3.41e+38	117.1043	118.5548*	117.6865*
2	-15824.05	201.7268	3.20e+38	117.0369	119.8061	118.1484
3	-15693.15	***232.1866****	***2.57e+38****	***116.8113****	120.8992	118.4521
4	-15609.20	142.7843	2.93e+38	116.9284	122.3349	119.0985
5	-15514.37	154.3580	3.11e+38	116.9662	123.6913	119.6655
6	-15410.17	161.9928	3.11e+38	116.9356	124.9794	120.1642
7	-15320.17	133.3612	3.50e+38	117.0085	126.3710	120.7664
8	-15192.63	179.6774	3.04e+38	116.8075	127.4886	121.0946
* 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						

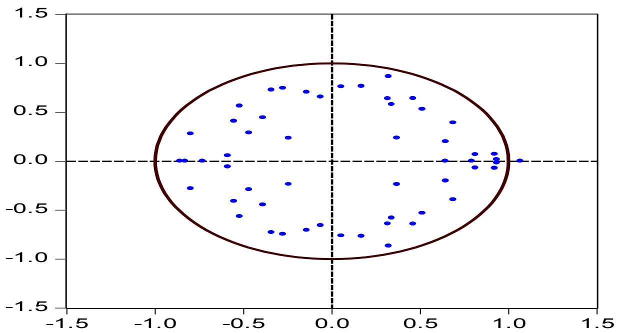
But when the VAR model has been examined at lag 3 for the presence of serial correlation, it is found that serial correlation in the VAR exists at lag 3 which has been presented in Table: 9.7. At lag order 3, LM-Stat involves with a *p*-value less than 0.05 which implies that the null hypothesis of no serial correlation can not be accepted at 5 percent significance level. But this serial correlation has been removed at lag 6 which is evident by LM-Stat with *p*-value greater than 0.05. That means, a VAR model need to be developed at lag 6 to remove the presence of serial correlation. In the same time, at lag order 6, the VAR model is also found to be dynamically stable which is presented in Figure: 9.2.

Table 9.7: Estimates of Serial Correlation in the VAR Model between Stock Price and Weighted Market Micro Variables

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	**LM-Stat**	**Prob**
1	116.1456	0.0064
2	104.0515	0.0432
3	111.7833	0.0133
4	117.8418	0.0047
5	127.3465	0.0008
6	***86.91484***	***0.3064***
7	141.0588	0.0000
8	115.7474	0.0068
9	79.94431	0.5123
10	103.3032	0.0480
11	147.9873	0.0000
12	123.7387	0.0016

Source: Author’s own calculation estimates

Figure 9.2 Inverse Roots of AR Characteristic Polynomial between Stock Price and Segmented Micro Variables



Finally, a VAR model has been developed at lag order 6 with 7 exogenous variables (i.e. constant and the entire endogenous variables at lag 7). This will lead to get VAR Granger Causality/Block Exogeneity Wald Tests result. After then, this test result has been organized to get Toda-Yamamoto Granger Causality test estimates which have been presented in Table: 9.8.

Table 9.8: T-Y Granger Causality between Stock Price and Segmented Micro Variables

Direction of Causality			df.	Chi-sq.	Prob.
DSI	→	FINCAP	6	16.49661	0.0113**
FINCAP	~	DSI		10.27990	0.1133
DSI	~	FINDY	6	3.639979	0.7253
FINDY	→	DSI		12.10898	0.0596***
DSI	~	FINEPS	6	9.519630	0.1464
FINEPS	~	DSI		5.581009	0.4717
DSI	~	FINPE	6	1.649451	0.9490
FINPE	~	DSI		4.749525	0.5763
DSI	~	MFCCAP	6	4.937954	0.5518
MFCCAP	→	DSI		15.95618	0.0140**
DSI	→	MFCDY	6	16.13584	0.0130**
MFCDY	~	DSI		9.417427	0.1514
DSI	→	MFCEPS	6	17.19842	0.0086*
MFCEPS	~	DSI		4.756422	0.5754
DSI	~	MFCPE	6	1.729349	0.9428
MFCPE	~	DSI		2.939153	0.8164

Note: → shows direction of causal relationship and ~ signifies lack of any causal relationship
* sig. @ 1 percent level
** sig. @ 5percent level
*** sig. @ 10 percent level

Source: Author's own calculation estimates

Table: 9.8 provides the test estimates of Tada-Yamamoto Granger causality between stock price and segmented micro variables. This test estimates involves with a null hypothesis that there is not causal relation between stock price and any of the segmented micro variables. In this case, null hypothesis of no causal relation can not be accepted in several cases for having *p*-values less than 0.05. The evidence of unidirectional causality has been found from DSI to FINCAP, from DSI to MFCDY and from DSI to MFCEPS at 5 percent level. On the other hand, FINDY and MFCCAP granger causes DSI at 10 percent and 5 percent significance level respectively. In this situation, few inconsistencies have been identified in T-Y granger causality test estimates between stock price & weighted average micro variables, and stock price & segmented micro variables. The reasons for this inconsistency may be due to the following factors:

(i) Selection of lag length has been found to be very sensitive for conducting any types of econometric test. Here the chosen lag length for estimating T-Y Granger causality is not same for these two tests. For example: a VAR model at lag 4 has been developed for estimating the T-Y granger causal relation between stock price and weighted average micro variables; but in case of stock price and segmented micro variables, a VAR model has been developed at lag order 6. Different selection of lag length for conducting T-Y Granger causality tests is believed to be a major reason for getting lack of inconsistency in the test estimates.

(ii) Sometimes significant causal relation between two variables contributes to remove non-causal relation in another two variables in the test estimates. For example: although there is no causal relation from FINCAP to DSI, but a significant causal relation from MFCCAP to DSI contributes to have significant causal relation from DSI to WMKTCAP.

(iii) In the same way, sometimes significant non-causal relation between two variables contributes to remove causal relation in another two variables. For instance: although significant causal relationship has been found from DSI to MFCEPS; but due to non-causal relation from DSI to FINEPS, significant causal relation has not been identified from DSI to WMKTEPS.

9.5 Toda-Yamamoto Granger Causality Test between Stock Price and Macro Variables:

Toda-Yamamoto Granger Causality Test has been applied to investigate the dynamic long run causal relationship between DSE all share price index (DSI) and a set of 13 macro variables during the sample period. According to T-Y Granger Causality Test Procedure, all the variables have been examined for their maximum order of integration $(d_{\max})$ and optimal lag length of the VAR model (k). In this case, ADF and P-P unit root test have been used to identify the maximum order of integration. It has been found that maximum order of integration for each and every variable is one. i.e. $(d_{\max})=1$ which is presented in Table: 9.9. On the other hand, different *Information Criterion* (IC) have been applied to identify the optimal lag length of the VAR model. Here, according Akaike information criterion (AIC), lag length has been found to be 12. This optimal lag length is also supported sequential modified LR test statistic (LR) and Final Prediction Error (FPR) method which is presented in Table: 9.10.

Table 9.9: Estimates of the Order of Integration between Stock Price and Segmented Micro Variables

Variables	Augmented Dickey Fuller Test				Phillips-Parron Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.02	1.00	-13.02	0.00	2.95	1.00	-13.74	0.00	I(1)	I(1)
CPI	1.60	1.00	-3.87	0.01	-1.03	0.93	-28.03	0.00	I(1)	I(1)
DIR	-1.55	0.80	-19.65	0.00	-1.81	0.69	-19.42	0.00	I(1)	I(1)
EXR	-2.04	0.57	-16.5	0.00	-2.04	0.57	-16.58	0.00	I(1)	I(1)
EXRPT	0.11	0.99	-5.53	0.00	-5.36	0.00	-59.67	0.00	I(1)	I(1)
FXRES	-0.16	0.99	-3.37	0.00	1.15	0.99	-18.13	0.00	I(1)	I(1)
PCAPGDP	3.649	1.00	-3.07	0.00	1.37	1.00	-20.20	0.00	I(1)	I(1)
IMPMT	0.02	0.99	-6.89	0.00	-3.10	0.10	-59.93	0.00	I(1)	I(1)
INVMP	-0.40	0.98	-14.82	0.00	-0.35	0.98	-19.26	0.00	I(1)	I(1)
IPD	-0.24	0.99	-12.28	0.00	-4.38	0.00	-44.60	0.00	I(1)	I(1)
M2	4.10	1.00	-1.31	1.00	22.23	1.00	-18.58	0.00	I(1)	I(1)
NID	-0.62	0.97	-3.16	0.01	-0.65	0.97	-20.95	0.00	I(1)	I(1)
REMIT	-0.24	0.99	-18.95	0.00	-1.21	0.90	-39.65	0.00	I(1)	I(1)
TDC	1.27	1.00	-2.43	0.03	2.41	1.00	-21.36	0.00	I(1)	I(1)

Source: Author's own calculation estimates

Table 9.10: VAR Lag Order Selection Criteria between Stock Price and Macro Variables

Endogenous variables: DSI CPI DIR EXR EXRPT FXRES IMPMT INVMP IPD LIR M2 NID PCAPGDP REMIT TDC						
Exogenous variables: C						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-23971.49	NA	2.47e+58	177.0221	177.2215	177.1021
1	-19853.04	7750.588	8.21e+45	148.2881	151.4782*	149.5690*
2	-19548.29	539.7727	4.62e+45	147.6996	153.8803	150.1812
3	-19278.38	448.2003	3.43e+45	147.3681	156.5396	151.0505
4	-19028.93	386.6007	3.07e+45	147.1877	159.3498	152.0709
5	-18782.86	354.1241	2.94e+45	147.0322	162.1850	153.1162
6	-18313.15	623.9661	5.76e+44	145.2262	163.3697	152.5110
7	-17715.39	727.8992	4.74e+43	142.4752	163.6094	150.9608
8	-17437.59	307.5322	4.58e+43	142.0855	166.2104	151.7719
9	-17184.51	252.1422	6.03e+43	141.8783	168.9939	152.7655
10	-16806.82	334.4879	3.74e+43	140.7514	170.8577	152.8394
11	-16421.85	298.3127	2.73e+43	139.5709	172.6678	152.8597
12	-15919.51	***333.6607****	***1.12e+43****	***137.5240****	173.6117	152.0136
* 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						

Source: Author's own calculation estimates

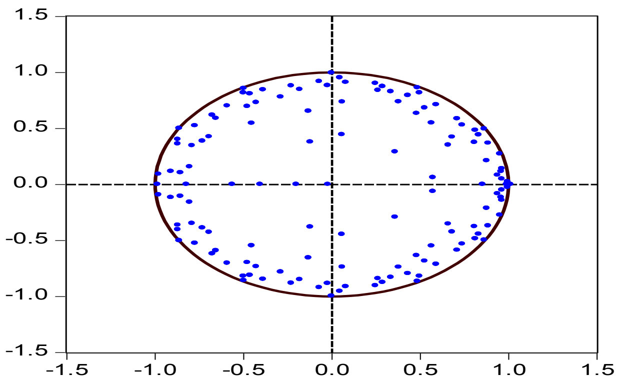
After identifying the optimal lag length of 12, the VAR model at lag 12 has been examined for the presence of serial correlation in the residuals. In this case, ***VAR Residual Serial Correlation LM Test*** has been applied which assumes under null hypothesis that there is no serial correlation at lag h. From this test, VAR model at lag 12 has been found to be serially correlated in the residuals due to having *p*-value of the LM-statistic less than 0.05. This test result has been presented in Table: 9.11. This table also reveals that serial correlation in the residuals is non-existent at lag 13 which is apparent by the fact that *p*-value of LM statistics at lag 13 is greater than 0.05. It implies that null hypothesis of no serial correlation at lag 13 can not be rejected at 5 percent significance level. In addition, the VAR model at lag 13 is also found to be dynamically stable which is presented in Figure: 9.3.

Table 9.11: Estimates of Serial Correlation in the VAR Model between Stock Price and Macro Variables

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	**LM-Stat**	**Prob**
1	386.4772	0.0000
2	269.3332	0.0229
3	293.3061	0.0015
4	221.1716	0.5596
5	239.9557	0.2354
6	251.0504	0.1122
7	233.0220	0.3427
8	195.0513	0.9262
9	240.3527	0.2299
10	231.0866	0.3761
11	158.9402	0.9997
12	284.4529	0.0044
13	***236.7071***	***0.2830***

Source: Author's own calculation estimates

Figure 9.3: Inverse Roots of AR Characteristic Polynomial between Stock Price and Macro Variables



Finally, a VAR model has been developed at lag order 13 with 14 exogenous variables (i.e. constant and the entire endogenous variables at lag 14). This will lead to get VAR Granger Causality/Block Exogeneity Wald Tests result. After then, this test result has been organized to get Toda-Yamamoto (T-Y) Granger Causality test estimates which have been presented in Table: 9.12. This table presents chi-sq. statistics at 13 degrees of freedom along with their *p*-values. This test assumes under null hypothesis that there is no causal relation between stock price and any of the selected macro variables. If the *p*-value of the chi-sq. statistics is less than 0.05, we can reject the null hypothesis of no causal relation between stock price and macro variables.

Table 9.12: T-Y Granger Causality Test between Stock Price and Selected Macro Variables

Direction of Causality			df.	Chi-sq.	Prob.
DSI	~	CPI	13	15.50778	0.2767
CPI	→	DSI		23.06561	0.0409**
DSI	~	DIR	13	7.814200	0.8555
DIR	→	DSI		23.36402	0.0375**
DSI	~	EXR	13	11.08964	0.6033
EXR	→	DSI		27.90877	0.0093*
DSI	~	EXRPT	13	16.68061	0.2143
EXRPT	→	DSI		20.66328	0.0799***
DSI	~	FXRES	13	11.17901	0.5958
FXRES	~	DSI		17.60020	0.1733
DSI	~	IMPMT	13	19.30264	0.1140
IMPMT	~	DSI		15.96772	0.2509
DSI	~	INVMP	13	5.573776	0.9603
INVMP	~	DSI		16.90237	0.2038
DSI	→	IPD	13	24.91632	0.0237**
IPD	~	DSI		13.68410	0.3965
DSI	~	M2	13	11.60566	0.5602
M2	~	DSI		19.09456	0.1202
DSI	~	NID	13	7.453363	0.8773
NID	→	DSI		25.42497	0.0203**
DSI	~	PCAPGDP	13	17.37431	0.1828
PCAPGDP	→	DSI		25.90888	0.0175**
DSI	~	REMIT	13	14.60695	0.3325
REMIT	→	DSI		35.66499	0.0007*
DSI	~	TDC	13	12.27766	0.5050
TDC	→	DSI		22.09886	0.0538***

Note: → shows direction of causal relationship and ~ signifies lack of any causal relationship
* sig. @ 1 percent level
** sig. @ 5percent level
*** sig. @ 10 percent level

Source: Author's own calculation estimates

According to Toda-Yamamoto Granger causality test estimates, significant unidirectional causality has been found from CPI, DIR, EXR, EXRPT, NID, PCAPGDP, REMIT and TDC to DSI. In addition, uni-directional causality has been found from DSI to IPD at 5 percent significance level. On the other hand, the test estimates didn't found any uni-directional causality from DSI to CPI; DSI to DIR; DSI to EXR; DSI to EXRPT; IPD to DSI; DSI to NID; DSI to PCAPGDP; DSI to REMIT; and DSI to TDC. Finally, for few macro variables like FXRES, IMPMT, INVMP and M2 have neither uni-directional nor bi-directional causality with stock prices at 5 percent significance level.

In brief, the T-Y Granger causal relationship between DSI and all the macro variables can be summarized in the following way:

i. CPI granger causes DSI at 5 percent significance level.
ii. DIR granger causes DSI at 5 percent significance level
iii. EXR granger causes DSI at 1 percent significance level.
iv. EXRPT granger causes DSI at 10 percent significance level.
v. DSI granger causes IPD at 5 percent significance level.
vi. NID granger causes DSI at 5 percent significance level.
vii. PCAPGDP granger causes DSI at 5 percent significance level.
viii. REMIT granger causes DSI at 1 percent significance level.
ix. TDC granger causes DSI at 10 percent significance level.

9.6 Toda-Yamamoto Granger Causality Test between Stock Price and the Joint Micro-Macro Variables:

At the final stage, long run causal relationship has been examined between stock price and a set of joint micro-macro variables through the application of Toda-Yamamoto Granger Causality test. In this case, identical procedures and steps have been followed to examine these causal relationships. At first, maximum order of integration of all the variables (i.e. DSI and the joint-micro-macro variables) have been examined and found that their order of integration at maximum level is $(d_{\max}) = 1$. This test result has been presented in Table: 9.1 and 9.9 respectively. Then the optimal lag length of the VAR model (k) is found to be 11 from Akaike information criterion (AIC) which is also supported by sequential modified LR test statistic (LR), Final Prediction Error (FPR) method and Hannan-Quinn information criterion.

Table 9.13: VAR Lag Order Selection Criteria between Stock Price and Macro Variables

Endogenous variables: DSI WMKTCAP WMKTDY WMKTEPS WMKTPE MTV CPI DIR EXR EXRPT FXRES IMPMT INVMP IPD M2 NID PCAPGDP REMIT TDC						
Exogenous variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-32153.28	NA	1.23e+78	236.5682	236.8333	236.6747
1	-27533.63	8525.972	4.16e+64	205.5414	211.1092*	207.7766
2	-27049.25	822.7334	2.33e+64	204.9209	215.7914	209.2850
3	-26595.80	703.5105	1.75e+64	204.5279	220.7010	211.0209
4	-26119.11	669.4730	1.24e+64	203.9640	225.4397	212.5858
5	-25707.91	517.0188	1.66e+64	203.8817	230.6601	214.6323
6	-25035.35	746.7403	4.03e+63	201.8776	233.9586	214.7570
7	-24272.98	734.3437	6.85e+62	199.2131	236.5967	214.2213
8	-23736.90	437.5371	9.42e+62	198.2125	240.8988	215.3495
9	-22958.73	520.6825	4.04e+62	195.4319	243.4208	214.6978
10	-21956.59	523.1760	8.66e+61	191.0044	244.2960	212.3991
11	-20613.36	***503.7128****	***7.61e+60****	***184.0688****	242.6631	***207.5924****
* 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						

Source: Author's own calculation estimates

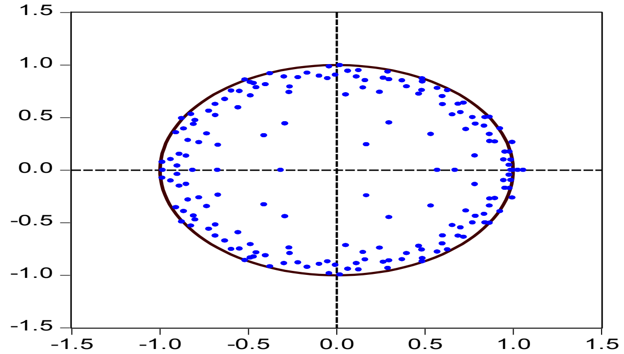
Then when a VAR model at lag 11 has been tested for the presence of serial correlation, it is found that the model doesn't involve with serial correlation in the residuals. The test of serial correlation has been conducted by VAR Serial Correlation LM test and presented in Table: 9.14. At lag 11 the LM-statistics is 395.2248 with a *p*-value 0.5580 for which null hypothesis of no serial correlation can not be rejected at 5 percent significance level. So it can be concluded that the VAR model at lag 11 is free from the presence of serial correlation in the residuals which is also found to be dynamically stable found in Figure: 9.4.

Table 9.14: Estimates of Serial Correlation in the VAR Model between Stock Price and Joint Micro-Macro Variables

VAR Residual Serial Correlation LM Tests		
Null Hypothesis: no serial correlation at lag order h		
Lags	**LM-Stat**	**Prob**
1	463.1559	0.0158
2	447.6892	0.0498
3	474.0207	0.0063
4	444.1855	0.0628
5	422.4391	0.2111
6	528.1142	0.0000
7	437.2663	0.0964
8	408.6897	0.3712
9	377.9995	0.7790
10	410.1386	0.3523
11	***395.2248***	***0.5580***
12	411.8369	0.3307

Source: Author's own calculation estimates

Figure 9.4: Inverse Roots of AR Characteristic Polynomial between Stock Price and Joint Micro-Macro Variables



These situations actually lead to the construction of a VAR model at lag 11. Finally, a VAR model has been developed at lag order 11 with 19 exogenous variables (i.e. constant and the entire endogenous variables at lag 12). This will lead to get VAR Granger Causality/Block Exogeneity Wald Tests result. After then, this test result has been organized to get Toda-Yamamoto Granger Causality test estimates which have been presented in Table: 9.11. This table presents chi-sq. statistics at 11 degrees of freedom along with their *p*-values. This test assumes under null hypothesis that there is no causal relation between stock price and any of the joint micro-macro variables. in this case, if the *p*-value of the chi-sq. statistics is less than 0.05, the null hypothesis of no causal relation between DSI and the joint micro-macro variables can be rejected. Rejection of null hypothesis implies that causal relationship exist between stock price and any of the joint micro-macro variables.

Table: 9.15 shows the long run Granger Causal estimates between stock price and the joint micro-macro variables. It has been found that WMKTDY, WMKTPE, and MTV granger causes DSI at 5 percent significance with stock price. In addition, bi-directional causality has been found between stock price and WMKTCAP. On the other hand, CPI, FXRES, IMPMT, INVMP, M2, and REMIT granger causes stock price. But bi-directional causality have been found between stock price and EXRPT; stock price and IPD; and stock price and PCAPGDP. However, neither unidirectional nor bi-directional causality have been found between stock price & WMKTEPS; stock price & DIR; stock price & EXR; and stock price & TDC.

Table 9.15: T-Y Granger Causality Test between Stock Price and Joint Micro-Macro Variables

Direction of Causality			df.	Chi-sq.	Prob.
DSI	→	WMKTCAP	11	27.23216	0.0042*
WMKTCAP	→	DSI		34.47414	0.0003*
DSI	~	WMKTDY	11	4.654968	0.9467
WMKTDY	→	DSI		21.98121	0.0245**
DSI	~	WMKTEPS	11	5.971060	0.8753
WMKTEPS	~	DSI		16.64077	0.1190
DSI	~	WMKTPE	11	8.741115	0.6458
WMKTPE	→	DSI		21.66331	0.0271**
DSI	~	MTV	11	12.48396	0.3284
MTV	→	DSI		21.18106	0.0315**
DSI	~	CPI	11	15.29547	0.1694
CPI	→	DSI		36.77260	0.0001*
DSI	~	DIR	11	11.30065	0.4184
DIR	~	DSI		14.20355	0.2219
DSI	~	EXR	11	9.361435	0.5886
EXR	~	DSI		16.99113	0.1081
DSI	→	EXRPT	11	18.84712	0.0639***
EXRPT	→	DSI		29.27275	0.0021*
DSI	~	FXRES	11	9.535385	0.5726
FXRES	→	DSI		22.79386	0.0189**
DSI	~	IMPMT	11	4.592694	0.9493
IMPMT	→	DSI		31.00998	0.0011*
DSI	~	INVMP	11	3.490995	0.9825
INVMP	→	DSI		24.36500	0.0113**
DSI	→	IPD	11	34.31822	0.0003*
IPD	→	DSI		17.73926	0.0878***
DSI	~	M2	11	12.97319	0.2951
M2	→	DSI		32.26822	0.0007*
DSI	→	NID	11	21.61830	0.0275**
NID	→	DSI		21.92863	0.0249**
DSI	→	PCAPGDP	11	18.15084	0.0781***
PCAPGDP	→	DSI		18.77833	0.0652***
DSI	~	REMIT	11	10.90245	0.4515
REMIT	→	DSI		30.45493	0.0013*
DSI	~	TDC	11	12.08828	0.3570
TDC	~	DSI		11.02884	0.4409

Note: → shows direction of causal relationship and ~ signifies lack of any causal relationship
* sig. @ 1 percent level
** sig. @ 5percent level
*** sig. @ 10 percent level

Source: Author’s own calculation estimates

In brief, the summery of the Toda-Yamamoto Granger Causality test between DSI and the set joint micro-macro variables can be presented in the following way:

i. Bi-directional causality exists from WMKTCAP to DSI at 1 percent significance level.
ii. Uni-directional causality exists from WMKTDY, WMKTPE and MTV to DSI at 5 percent significance level.
iii. Uni-directional causality exists from CPI to DSI at 1 percent significance level.
iv. Bi-directional causality exists between DSI and EXRPT at 10 percent and 1 percent significance level respectively.
v. Uni-directional causality exists from FXRES to DSI at 5 percent significance level.
vi. Uni-directional causality exists from IMPMT to DSI at 1 percent significance level.
vii. Uni-directional causality exists from INVMP to DSI at 5 percent significance level.
viii. Uni-directional causality exists from M2 to DSI at 1 percent significance level.
ix. Bi-directional causality exists between NID and DSI at 5 percent significance level.
x. Bi-directional causality exists between PCAPGDP and DSI at 10 percent significance level.
xi. Uni-directional causality exists from REMIT to DSI at 1 percent significance level.

Part III

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 10

SUMMERY AND CONCLUSIONS

10.1 Findings and Discussion:

According to the methodology explained in chapter 6, this research has been conducted under three different sections:

Section: A, involves with the application of the ***Multivariate Time Series Regression Analysis*** between dependent variables i.e. DSE all share price index (DSI) and different sets of independent variables (i.e. micro and macro variables). Under this section three different multivariate regression models have been developed: Model 1 is concerned with structuring regression model between DSI and weighted market micro variables. Model 1 also deals with regression model between DSI and segmented micro variables. Model 2 is concerned with structuring a regression model between DSI and selected macro variables. Finally, Model 3 is concerned with designing a regression model between DSI and the joint micro-macro variables.

Section: B involves with ***Johansen's Cointegration Analysis*** and ***Vector Error Correction Model*** which has been conducted under two different models: Model: 1 is concerned with identifying long-run equilibrium relationship and short-run disequilibrium adjustment between DSI and micro variables. But due to a technical inconsistency, this research has incorporated Vector Autoregressive (VAR) Test with the same endogenous variables. Model: 2 is concerned with Johansens's Cointegrating Test and Vector Error Correction Model between DSI and macro variables.

Section: C involves with the application of ***Toda-Yamamoto (T-Y) Granger Causality Analysis*** which also uses three different models in its examination process: Model: 1 deals with identifying T-Y causal relation between DSI and micro variables; Model: 2 deals with identifying T-Y causal relation between DSI and macro variables and finally, Model: 3 deals with identifying T-Y causal relation between DSI and the joint micro-macro variables. However, brief discussions of all these test results have been given below:

Stock Price (DSI) and Weighted Market Capitalization (WMKTCAP)

Market capitalization is considered to be an important performance indicator in explaining the behavior of stock prices. This research also provides sufficient evidence on this issue. At the beginning, it has been assumed that market capitalization has positive association with stock price. In this case, multivariate time series regression analysis (Section: A) under Model: 1 and Model: 3 provide positive coefficients (i.e. 0.144859 & 0.135154 respectively) for market capitalization which is also found to be statistically significant at 1 percent level. As market capitalization represents the total market value of all the companies' outstanding shares, so an increase in market capitalization might encourage and attract existing and prospective investors to augment their investment which results an overall increase in the demand for stocks in the market. This increase in demand contributes to increase the overall price of stocks in the stock market. So it can be concluded that this research evidence between stock price and weighted market capitalization has been complied with the null hypothesis of this research and significant positive relationship has been found to exist between DSI and WMKTCAP in the short-run.

On the other hand, the estimates of Johansen's cointegration test between stock price and weighted market micro variables revealed a different form of result. When the test results has been observed, it is found that the number of cointegrating vectors (i.e. 6 cointegrating vectors) is equal to number of endogenous variables (i.e. 6 variables) which denotes to a technical inconsistency in the Cointegration test. This inconsistency in the cointegration test estimates may be due to mixing different endogenous variables with different order of integration or due to any model misspecification error. According to the general instructions to extend the research is to conduct a VAR test with variables having the same order of integration. This research also follows the same guidelines and executes the VAR test between stock price and weighted market micro variables. Here weighted market capitalization at lag 2, 6, 7, 8, 9, 10 and 11 have been found to be significant at 5 percent level. But out of 7 different significant lagged variables, only lag 9 and lag 10 involves with negative coefficients and the rest of the significant coefficients are positive. Based on this empirical result, it can be concluded that weighted market capitalization have long run positive association with stock price.

The evidence of T-Y Granger causality has been presented in Model: 1 and Model: 3 of Section: C. Here Model: 1 is concerned with T-Y Granger causality test between stock price (DSI) and weighted market micro variables whereas Model: 3 is concerned with estimating T-Y Granger causality between stock price and the joint micro-macro variables. In Model: 1, this research found a uni-directional causal evidence from WMKTCAP to DSI which is significant at 5 percent level. But in Model: 3, bi-directional causality has been found between DSI and WMKTCAP. In one way, increasing market capitalization reflects the investor's confidence in stock market which in turn reflects in rising demand for the stock which ultimately leads to an increase in stock prices in the stock market. In another way, a rise in stock price provides a positive message to the existing market participants which induce the investors to have larger investment in stocks than before.

Stock Price (DSI) and Weighted Market Dividend Yield (WMKTDY)

The relationship between stock price and dividend policy becomes a controversial issue when Merton H. Miller and Franco Modigliany (M-M)[1] explained their arguments in *Dividend Irrelevance Theory* and Myron J. Gordon and John Lintner[2] explained their arguments in *Dividend Relevance Theory.* The distribution of dividend reduces the liquidity of the company and thereby produces an equivalent downward pressure in stock prices in one hand, at the same time, current dividend reduces opportunity cost factor (i.e. through reduction of future uncertainty as stockholders consider current dividend is better than future dividend or capital gain) and thereby contributing to increase stock price. In addition, the influence of dividend payment on stock price may also differ in different industry or within a specific industry. Beside

[1] Merton H. Miller and Franco Modigliani, "Dividend Policy, Growth and Valuation of Shares" *Journal of Business* 34 (October 1961), pp. 411-433.

[2] Myron J. Gordon, "Optimal Investment and Financing Policy", Journal of Finance 18 (May 1963), pp. 264-272 and John Lintner, "Dividends, Earnings, Leverage, Stock Prices, and the Supply of Capital to Corporation," *Review of Economics and Statistics* 44 (August 1962), pp. 243-269.

that controversial relation, this research assumes negative hypothetical relationship between stock price and market dividend yield.

In this research, Model: 1 in Section: A, multivariate regression analysis provides positive regression coefficient (i.e. 0.001056) for weighted market dividend yield (WMKTDY) at lag 2 which is statistically significant at 1 percent level. In Model: 3, lag 1 and lag 2 of WMKTDY also involves with a positive regression coefficient (i.e. 0.000895 & 0.000498 respectively and these coefficients are also found to be statistically significant at 5 and 10 percent level respectively. But WMKTDY at lag 3 provides a negative regression coefficient (i.e. -0.000139) and the coefficient is not statistically significant. Therefore, the test result of multivariate time series regression analysis in Model: 1 and Model: 3 are not consistent with the null hypothesis of negative relationship between stock price and weighted market dividend yield. Based on this result, it can be concluded that weighted market dividend yield has significant positive association with stock price in the short-run.

In Section: B, this research initiates to execute Johansen's Cointegration test but due to a technical reason[3], this research develops a VAR model to examine long run relationship between DSI and WMKTDY. This VAR model incorporates the lagged values of WMKTDY from 1 to 12 and found that only the 2nd lag data is significant which provides a positive coefficient in the VAR test. Therefore, VAR test provides the evidence that WMKTDY have significant positive association with stock price in the long run. This significant positive evidence between stock price and weighted market dividend yield fails to comply with the basic concepts of *"Dividend Irrelevance Theory"* and follows the path of Gordon and Lintner's *"Dividend Relevance Theory"*. In literature, dividend yield has been defined as the relative percentage of stock price that the company pays out as dividend. If the stock price goes down then the yield increases and if the stock price goes up the yield decreases. This research also assumed to have negative association between stock price and

[3] Johansen's Cointegration test is not an appropriate test when the number of cointegrating variables is found to be equal to the number of endogenous variables in the test. In this situation, it is commonly instructed to use VAR test to examine long-run relationship between the variables.

dividend yield. This empirical result in Section: A & Section: B reveals the fact that any increase in lagged dividend yield (either by decreasing stock price or by increasing dividend payment) contributes to the increase in stock prices in the future both in short-run and long-run time frame.

Theoretically, dividends should play an important role in an investment strategy, whether they are a signal to investors' of a company's strength or a telling sign that the company can not reinvest its cash at a higher rate than the investors' required rate of return. In this situation, given the uncertainty of future monetary policy, investors who are more concerned with capital risk than earning risk may prefer high-dividend stocks to low-dividend stocks. Even some investors have reached the conclusion that retained earnings bear only a tenuous relationship to subsequent capital gains and that the high dividend-yielding stocks offer, on risk-adjusted basis, greater returns than low dividend-yielding stocks[4]. Ahmed M. F.(1991)[5] have pointed out that dividend yield is become an important factor behind stock price formation as it is universally accepted that one can look upon a share of stock as profit sharing security. The purchase of stocks with low dividend yield may create problems for most institutional shareholders. Banks have cash flow requirements for giving return to their clients. Unit Trusts and mutual Funds have their overriding requirement to obtain portfolio returns higher than returns on the broad market index although trust funds pension funds and registered charities are yet to invest a significant amount in Dhaka Stock Exchange (DSE). Consequently, the purchase of low yielding market issues squeezes these institutions' ability to meet other commitments (Barnea et al., 1981). As these institutions have predictable outflows of funds, they are likely to ensure some form of inflow predictability through corporate dividend income and thereby creating a *'clientele effect'* that explains dividend payout behavior. As lagged dividend yield has been used as predictor variable in this research, therefore, the result of this research in Section: A and Section: B also supports prior empirical evidence that higher dividend

[4] Chaum, A. and Bryan P. "What Affect Long Term Stock Prices", Online Paper, URL Address: www.docstoc.com/docs/27253487/What-Effects-Stock-Prices

[5] Ahmed M. F. (1991). "Dividend Policy : A Study of Enterprises Registered with The Dhaka Stock Exchange (DSE) ", *Dhaka University Journal of Business Studies*, Vol. 12, No. 2, pp. 107-121.

yield will likely to cause investors to pursue such shares, thus resulting into an increase in the demand as well as price of these stocks, eventually ensures more than average market return for investors. This result of this research is consistent with Safari, M. (2009), Ahmed M. F. (2000), Annuar & Shamsher (1993).

Finally in Section: C, when causal relationship has been examined through the application of T-Y Granger causality test, this research found a very consistent result. In Model: 1, uni-directional causality has been found from WMKTDY to DSI which is statistically significant at 5 percent level. In model: 3, this research also found the identical uni-directional causality from WMKTDY to DSI. According to this causality test result, it can be said that any increase or decrease in WMKTDY significantly causes DSI in the long-run.

Stock Price (DSI) and Weighted Market Earnings per Share (WMKTEPS)

An earning per share (EPS) is considered to be a well known fundamental performance indicator of different firms and organizations. In this research, a positive relationship has been hypothecated between DSI and weighted market EPS based on the argument that rising EPS convey positive message in the stock market which is ultimately reflected in increasing demand for any particular stock as well a rising stock prices in the stock exchange. As this research depends on three different types of econometric tools, therefore the research output is found to be not perfectly identical to each other. In Model: 1 of Section: A, Multivariate Time Series Regression Analysis between stock price and weighted market micro variables provides a negative coefficient (i.e. -0.000241) for WMKTEPS which is not statistically significant. In Model: 3, the first three lags of WMKTEPS provide a mixed result. In lag 1 and lag 3, WMKTEPS involves with positive coefficients (i.e. 0.000142 & 0.000148) but in lag 2, the coefficient is found to be negative (i.e. -0.000118) whereas each of these coefficients are not statistically significant. So in the short run, weighted market EPS is not found to be a significant variable to predict the value of stock price in DSE.

In Section: B, the VAR model between stock price and weighted market micro variables incorporates lagged weighted market EPS from 1 to 12 which also provides mixed results. Weighted market EPS at lag 1 and 4 have been found to be significant but the coefficient at lag 1 has a negative coefficient (i.e. -0.726376) whereas lag 4 has a positive coefficient (i.e. 0.786591). In this VAR model maximum lagged values of WMKTEPS have been found insignificant which provide sufficient evidence that WMKTEPS is not influencial variables for explaining the behavior and volatility of stock prices in DSE.

The causal evidence between weighted market EPS and stock price in Section: C provides a relatively conflicting result. In Model: 1, WMKTEPS has been found to granger cause DSI at 5 percent level whereas in Model: 3, no causal evidence has been found between them. This conflicting result may be contributed either by different selection of appropriate lag length or additional inclusion of macro variables in Model: 3. Therefore, it could be concluded that WMKTEPS is not so influential variable to predict the volatility and trend of stock prices in Dhaka Stock Exchange (DSE).

<u>Stock Price (DSI) and Weighted Market Price to Earnings Multiples (WMKTPE)</u>

Price to earnings multiples (P/E) is an index obtained through dividing the closing price of stocks by the earnings per share to show the ratio between these two figures, as such it is contemplated as a criterion for investment decisions. It is considered to be one of several ‘valuation ratios’ that scale a firm’s stock price by some measure of the firm’s assets or potential to generate income for shareholders. Having been used with stock yields in the developed economies since 1920, investors particularly institutional investors have come to consider market price to earnings multiples more important than yield in recent times. In this research, it has been hypothesized that market price to earnings multiples have positive association with stock price. In Section: A, Multivariate Regression Model: 1 provides negative coefficient (i.e. -

0.000586) for WMKTPE which is also statistically significant at 5 percent level. In Model: 3, each of the first three lag data for WMKTPE provides negative coefficients (i.e. -5.64E-05, -0.000551 & -0.000144 respectively) but the coefficient of the 2nd lag data has been found to be statistically significant at 10 percent level. Therefore, the evidence found in Section: A explains the fact the WMKTPE has negative association with stock price in the short run.

In Section: B, the VAR Model provides a mixed result. Here lagged values of WMKTPE have been used and found no statistically significant coefficient for WMKTPE. Except for lag 6, 8, and 10, other remaining lagged WMKTPE provide negative coefficients. The VAR test evidence, therefore, implies that negative relationship exists between WMKTPE and DSI in the long run but it is not statistically significant.

This negative evidence between stock price and price to earnings multiples (P/E ratios) could be due to several consecutive reasons. Firstly, the reduced transaction costs are expected to lead an in increase in P/E ratios in two possible ways: (i) as transaction cost fall, the net return to investors will increase even if the gross return remains same. This increases the demand for stocks and boost stock price and P/E ratios; (ii) lower transaction costs make it easier for individual investors to diversify among many different stocks, which reduce the risk of stock-investment. In addition, market overreaction, insider-trading, market rumors and noise-trading also contribute to high P/E ratios. Some analysts view the current high price to earnings multiples of the stock market as a sign that the stock market may be headed for a downturn. This view receives some support from historical evidence that very high price-earnings ratios have usually been followed by poor stock market performance. When price-earnings ratios have been high, stock prices have usually grown slowly in the following period. Moreover, at times such as the present when high price-earnings ratios have reduced the earnings yield on stocks relative to interest rates, stock prices also tended to grow slowly in the short run. On the other hand, high price to earnings multiples which results from immediate disequilibrium market price (i.e. due to market overreactions, noise trading or market rumors) tends to converge towards true price to earnings multiples shortly, reflecting an inverse relationship between stock price and market price to earnings multiples. The empirical evidence of this research in Section: A and Section: B, simply contradicts with the null hypothesis of positive relationship between DSI and WMKTPE. This negative association of weighted market price to earnings multiples with DSI could be obvious when the price paid per stocks by investors' increases at slower pace than the earnings per share (EPS).

In Section: C, T-Y Granger causality test among stock price and weighted market micro variables (Model: 1) provides no causal evidence from any direction between DSI and WMKTPE. But in Model: 3, uni-directional causality has been found from WMKTPE to DSI which is significant at 5 percent level.

Stock Price (DSI) and Market Trading Volume (MTV)

Market Trading Volume implies the number of stocks traded in the entire capital market during a particular period of time. In this research, it has been hypothesized to have positive relation between market trading volume and stock price at Dhaka Stock Exchange (DSE). In Multivariate Regression Model: 1 of Section: A, positive coefficient (i.e. 0.007209) has been found for market trading volume but it is not statistically significant. In the same way, Model: 3 of Section: A, provides similar positive but insignificant regression coefficient (i.e. 0.007145) for MTV. So, the results of Section: A clearly revealed to have positive but insignificant relationship between stock price and market trading volume in the short run.

In Section: B, The VAR model incorporates 12 lagged values of the market trading volume and test result indicate the MTV at lag 1, 3, 5, 8, 9 and 10 are found to be significant at 10 percent level. All of these six lagged coefficients are found to be positive which is consistent with the null hypothesis of positive relationship between stock price and market trading volume. The result in Section: A and Section: B, seems that increasing trading volume has been worked like signal of market liquidity which actually reduces uncertainty about stock investment and increase demand for stock in the market place. As a result stock price increases with correspondent increase in trading volume. Therefore, it can be concluded that market trading volume has long run positive relationship with stock price.

In Section: C, the estimates of T-Y Granger causality test provides a consistent result. In Model: 1, uni-directional causality has been estimated from MTV to DSI which is significant at 1 percent level. Moreover, in Model: 3, similar uni-directional causality has been estimated from MTV to DSI which is significant at 5 percent level. Therefore, the results of Section: C describes that change in MTV can cause the stock price to change in DSE.

Stock Price (DSI) and Consumer Price Index (CPI):

Consumer price index (CPI) as a measure of inflation is an important macroeconomic variables which is believed to be strongly associated with stock price. According to research findings of Fama and Schwert (1977), Chen, Roll and Ross (1986), Nelson (1976) and Jaffe and Mandelker (1976), Mukherjee and Naka (1995), DeFina (1991), Wongbangpo and Sharman (2002), Flannery and Protopapadakis (2002), this research also hypothesize a negative association between inflation and stock price (DSI). But the finding of this research is contrary to the hypothecated relationship between consumer price index and stock price. This research documents a positive but insignificant relationship between consumer price index (CPI) and stock price (DSI). The multivariate regression result in Model: 2 provide a positive regression coefficient (i.e. 0.626292) for CPI which is not found to be statistically significant. In Model: 3, regression coefficient of CPI also found to be positive (i.e. 0.515000) and statistically insignificant. A possible explanation for this positive relationship might be the higher discount rates for rising inflation in the economy. The effect of a higher discount rate would necessarily be neutralized by an increase in cash flows resulting from inflation, primarily because cash flows do generally grow at the same time as inflation. Firth (1979) posited that holding stocks might be an effective hedge against inflation and hence, the “Fisher Effect” would explain this positive correlation between stock price and inflation. Marshall (1992) stated that if inflation is caused by money shock, it would lower the rate of interest and investors would shift their cash holdings to stocks and bonds in order to maximize potential capital gains. The increase in demand would in turn raise stock prices. Increases in expected inflation may also signal a potential increase in real productive activity and hence higher stock returns (Fama and Gibbons, 1982). This positive relationship between inflation and stock price is also supported by Ali, M. B. (2011) for Bangladesh, Maysami et al. (2004) for Singapore and Adam and Tweneboah (2008) for Ghana.

On the other hand, the test of Toda-Yamamoto (T-Y) Granger causality under Section: C, causal relationship between stock price and a list of macro variables (Model: 2) reveals that uni-directional causal relation existed from Consumer Price Index (CPI) to stock price. When the joint micro-macro variables are used in Model: 3 of the same section, identical causal evidence has been found. This long run causal evidence simply explains that a continuous rise in the price level of goods and services have also causes the price of stocks in the stock market. However, similar causal relation is also found by Sangeeta Chakravarty (2006) for India, Ibrahim and Yousoff (2001) for Malaysia, Siaw Frimpong (2011) for Ghana etc. Based on this research evidence, it can be concluded that consumer price index (CPI) has positive association with the stock price in the short run and it also causes stock price in DSE in the long run.

<u>Stock Price (DSI) and Deposit Interest Rate (DIR)</u>

Deposit interest rate (DIR) has been defined as the rate of return which is provided to different savings unit of the economy for their contribution of deposit amount in their bank account. In this research, monthly weighted average deposit interest rates for the amount of deposit for 3 to less than 6 months has been used as a representative of deposit interest rate and also hypothesized to have negative relationship with stock price in Dhaka Stock Exchange (DSE). The empirical result of this research also support our null hypothesis of negative relationship between deposit interest rate and stock price which is demonstrated in Multivariate Regression Model: 2 and Model: 3. In Regression Model: 2, regression coefficient for DIR has been found to be negative (i.e. -0.267402) which is statistically significant at 10 percent level. On the other hand, in Model: 3, the regression coefficient is still negative (i.e. -0.178612) but not statistically significant at 5 percent level. The economic interpretation of this negative relationship could also be viewed in terms of expectations of existing and prospective investors from alternative investment opportunities. It is commonly agreed that investors always search for better alternative investment opportunity where they can earn a better rate of return. In this case, investment in stocks and investment through bank deposit account are two well-recognized alternative investment options and along with other sources, investors always examine and evaluate these two investment opportunities for making their investment decision. In such a near mutually exclusive investment projects, investors are biased towards that investment option which provides better return than other alternatives. If return from stocks seems better than any other alternative options, investors began to increase their investment in stocks by shifting their investment from some other sources. In the same way, if return from bank deposit seems better than return from investment in stocks then investors will channel their investment from stock market to bank deposit. There is always an inverse relationship among alternative investment projects in terms of their associated return. That’s why deposit interest rate and stock prices exhibit short run negative relationship with each other in this research. This result is also supported by other empirical evidences like Alam M.H. and Uddin G.S. (2009) for Bangladesh.

On the other hand, monetary authority (i.e. Bangladesh Bank) have engaged in monitoring the level of interest rate and if required interfere or impose some restrictions on the rate of interest rate for ensuring better functioning of the money market. This government interference has short run and long run influence on the rate of return from stock market. When multivariate time series regression model demonstrate a short run negative relationship between deposit interest rate (DIR) and stock price (DSI), Johansen’s cointegration test provides a positive relationship between them. Here Johansen's Cointegrating test provides normalized cointegrating coefficient for deposit interest rate of 157.61 which is positive. In the short run, when stock price is rising, market participants are discouraged to invest in different deposit accounts. They decide to shift their investment from bank account to different stocks which results a rise in stock prices in the stock market. If this situation continues then it significantly depressing banking industry in terms of lower deposit collection. In this situation, monetary authority takes steps to increase the rate of interest in bank accounts against the corresponding increase in stock prices. This monetary decision leads to a long run linear relationship between deposit interest rates and stock price. In addition, the investors' ***'mental accounting'*** also lead them to invest more in stock market even at the time when deposit interest rate is rising. Because they tends to divide their investment between safe investment portfolio and speculative investment portfolio in order to prevent the negative returns that speculative investment may have from affecting the entire portfolio. So investors have no problem to invest in speculative stock market because their speculative investment decision is backed by safe return from increasing deposit interest rate. This also leads to a long run positive relationship between stock price and deposit interest rate. In Model: 2 of Section: C, T-Y granger causality test provides uni-directional causality from DIR to DSI. But Model: 3 of the same section provide that no uni-directional or bi-directional causality exist between DIR and DSI. The differences in the causal evidence in Model: 2 and Model: 3 could be due to inclusion of weighted market micro variables in the Model: 3 which also lead to select different lag in the causality test. Therefore, this research evidence indicates that the facts that deposit interest rate have negative association with the stock prices in the short run but they do have positive relationship in the long run. However, when only macro variables are considered, this research provides uni-directional causality from DIR to DSI.

Stock Price (DSI) and Foreign Exchange Rate (EXR)

Change in foreign exchange rate seems to impact stock prices positively. The empirical evidence between foreign exchange rate and stock prices is inconclusive. While, Mukherjee and Naka (1995) document a positive relationship between foreign exchange rate and stock prices, the result of this research revealed in Multivariate Regression Analysis in Model: 2 and Model: 3 is contrary to that evidence but supports our null hypothesis that change in foreign exchange rates have negative influence over the behavior of DSE- all share price index (DSI) at Dhaka Stock Exchange (DSE). In Regression Model: 2, regression coefficient for foreign exchange rates has been found to be negative (i.e. -1.396525) which is statistically significant at 1 percent level. In Regression Model: 3 the coefficient of foreign exchange rate is also found to be negative (i.e. -1.490509) and statistically significant 1 percent level. This inverse relationship between foreign exchange rate and stock price can be interpreted by the *Theory of Portfolio Balance Model*. This model explains that when import dominating country depreciates their domestic currency, it will exert a positive pressure towards the demand for export and negative pressure towards the demand for import. This is because a depreciation of the local currency makes exporting goods more attractive to foreign consumers that leads to an increase in foreign demand. This increase in the demand for export results an increase in cash flows to the exporter firms. As a result shares of the exporter firms will rise in the stock market. On the other hand, the depreciation of the local currency against one of its major trading foreign currency (i.e. USD in case of Bangladesh) makes the imported products more expensive in terms of the local currency. If the price increase has been passed through to customers, earnings will not suffer from the currency adjustment. But price increase will tend to reduce demand for these imported products which lead to lower earnings as well as lower demand for the stocks of importer firms. As a result, the price of stock of the importer firms will fall. As the relative share of import is greater than export in Bangladesh, the net negative effect falls on stock market prices. The lower stock price of the importer firms actually depresses the stock prices. In addition, when import dominating country depreciates their local currency, it motivates local investors to engage in currency commodity trade. In this situation, local investors would like to shift their investment from domestic assets (i.e. stocks) toward assets denominated in foreign currencies The findings of this result is consistent with Ibrahim and Aziz (2003) who explain that while currency depreciation encourage exports, at the same time increases costs of production and intermediate goods.

Similar negative relation between stock price and foreign exchange rate are also found by Abugri (2008) for Brazil and Mexico, Adam and Tweneboah (2008) for Ghana.

The estimates of T-Y Granger causality test in Model: 2 of Section: C also provides supporting evidence that foreign exchange rate granger cause stock price in DSE in the long run. Similar causal relation between foreign exchange rate and stock price has also been found by Christopher G. et al (2006) for New Zealand. But in Model: 3 of Section: C, no causal evidence has been found between foreign exchange rate and stock price. This could be due to additions of weighted market micro variables and selection of different lags in model: 3.

<u>Stock Price (DSI) and Export Receipt (EXRPT)</u>

Export receipt based on F.O.B. mode is considered to be another macroeconomic variable which is expected to have positive influence over the change in stock prices at DSE. The empirical findings in this research provide a positive but insignificant coefficient (i.e. 0.007951 and 0.006373) in both Regression Model: 2 and Model: 3 respectively in Section: A. In this case, the findings in Section: A supports the null hypothesis of positive association between DSI and EXRPT in the short run. This positive relationship between export receipt and stock price in the short run could be due to the fact that, export receipt directly contributes to the profitability and growth of the export oriented firms listed in DSE and thereby provides a positive signal in the stock exchange. On the other hand, the export firms which are not listed also contribute positively to the reserve of foreign exchange of the economy, thereby causing a rise in the money supply and reducing discount rate in the economy. This reduction of discount rate leads to an increase in the value of investment in stock market which in turn reflected in rising stock prices. So in the short run, export receipt generates positive exposure for the rise in stock prices in the stock exchange. On the other hand, Johansen's Cointegration test (i.e. Model: 2 of Section: B) provides a negative normalized cointegration coefficient (i.e. -2.087) for export receipt. This negative normalized coefficient implies inverse relationship between stock price and export receipt in the long run. In reality, both the stock price and export receipt have positive trend within our sample period but stock price seems to have high volatility then export receipt. In addition, the foreign exchange receipt from the export of goods to foreign countries is considered to be insufficient when these foreign exchanges are required to pay against import payment. So the scanty contribution of export receipt towards strengthen our foreign currency reserve generates less significant impact from export receipt to explain the changes in stock price in the long run. However, T-Y Granger causality between macro variables and stock price (Model: 2 of Section: C) provides uni-directional causality from export receipt to stock price but bi-directional causality has been found between export receipt and stock price in Model: 3 of the same section. In this case, selection of two different lags in Model: 2 and Model: 3 of Section: C may lead to provide different results. In one way, increase in export receipt gives pressure for the rise in stock prices and rising stock price also exert pressure to export firms to increase their export amount on the other.

Stock Price (DSI) and Foreign Exchange Reserve (FXRES)

Foreign exchange reserves (FXRES) implies the country’s holdings of internationally acceptable means of payments for the purpose of covering short to medium term deficits on its external balance of payments, and the related purpose of exerting control over the movement of the exchange rate of its currency. In popular usage foreign exchange reserves commonly includes foreign exchange and golds, Special Drawing Rights and International Monetary Fund Reserve positions held by central bank and monetary authorities. This research hypothesized that foreign exchange reserves have positive influence over stock prices in Dhaka Stock Exchange (DSE). The findings of this research partially support the null hypotheses of positive relation between stock price and foreign exchange reserve. Although positive regression coefficients have been found (i.e. 0.075705 & 0.064199) for foreign exchange reserve in both Model: 2 and Model: 3 respectively of Section: A, but still they are found to be statistically insignificant at 5 percent level. The economic interpretation of this positive relationship could be due to that fact that, growth of foreign exchange reserve is mainly stimulated by the growth of foreign remittances which is expected to have diverse impact on the economy. In one hand, the growth of foreign exchange reserves contributes to increase money supply, rising inflation and greater liquidity in the economy, and on the other, it enhances aggregate investment in the economy, and decreases market interest rates that actually cause an increase in the value of investment. As a part of these consequences, the value of investment in the capital market also increases which is represented by a rise in stock prices (DSI) in Dhaka Stock Exchange (DSE). This empirical result is also supported by Rui Tan (2011) and Sarbapriya Ray (2012) who also found positive relationship between foreign exchange reserve and stock prices at Shenzhen Stock Exchange, China and Bombay Stock Exchange (BSE), India respectively. In addition, when we consider only the macro variables and stock price to identify their T-Y causal relation (Model: 2 in Section: C), no uni-directional or a bi-directional causality between foreign exchange reserves and stock prices has been found. But when the joint micro-macro variables have been considered (i.e. Model: 3 in Section: C), uni-directional causality has been found from FXRES to DSI. This evidence indicates that fact that, a change in foreign exchange reserve causes a long run simultaneous change in the prices of stock in Dhaka Stock Exchange (DSE).

Stock Price (DSI) and Per Capita Gross Domestic Product (PCAPGDP)

Per Capita Gross Domestic Product (PCAPGDP) in this research has been hypothesized to have negative influence over share price at Dhaka Stock Exchange (DSE). The result of this research also supports this null hypothesis which is documented in Multivariate Regression Model: 2 and in Model: 3. In Regression Model: 2, negative coefficients (i.e. -0.842423) has been found for PCAPGDP and in Regression Model: 3, the regression coefficient (i.e. -0.6688602) is also negative. Both of these coefficients are statistically significant at 5 and 10 percent level respectively. In addition, Johansen’s Cointegration test also provides a negative normalized regression coefficient (i.e. -0.5472) where standard errors associated with this coefficient is also found to be very small. The underlying reasons for negative association between stock price and per capita GDP in emerging economies have been explained by Krugman (1994) and Young (1995). These authors argued that real economic growth in terms of rising GDP per capita in emerging economies comes from high savings rates and the more efficient utilization of labor, neither of which necessarily translates into higher profits accruing to the shareholders of the existing firms. According to Siegel (2002), investors are concerned about the growth in the earnings per share (EPS). Economic growth requires increased capital expenditures, and this requires both reinvesting more earnings (and paying out fewer dividends in the short term) or higher personal savings that is invested in firms that issue shares. Thus, higher future earnings from the higher investment either are traded off for lower present dividends, or else they accrue to other shareholders, which is of no benefit to current shareholders. In addition, Warren Buffet (1999) and Jeremy Siegel (1999, 2000) have pointed out that in a competitive economy technological change largely benefits consumers through a higher standard of living, rather than benefiting the owners of capital. And if individuals save more and invest their savings, the increased amount of capital per worker will result in higher real wage rate, which is of no benefit to the owners of shares in existing corporations. The point is that economic growth does result in a higher standard of living for consumers, but it does not necessarily translate into higher present value of dividends per share for the owners of the existing capital stock. Thus, whether future economic growth is high or low in a given country has little to do with future equity returns in that country.

In case of estimating T-Y Granger causal evidence between per capita GDP (PCAPGDP) and stock price (DSI), this research has found a reasonable outcome. When selected macro variables have been used to estimate causal relation with stock price (i.e. Model: 2 of Section: C), uni-directional causal relation has been found from PCAPGDP to DSI. But when the joint micro-macro variables have been used (i.e. Model: 3 of Section: C), bi-directional causality has been revealed between

PCAPGDP and DSI. This causal evidence demonstrate the fact that economic growth lead to increased aggregate demand for goods and services which call for additional investment in the stock market that results increased stock market activity, better liquidity and lucrative market capitalization. So, per capita GDP cause stock price to increase. On the other hand, a rising stock price contributes to rising wealth of the stockholders which is also reflected in economic growth and better living standard. In this way, stock price also causes a change in per capita GDP in the economy.

Stock Price (DSI) and Import Payment (IMPMT)

Import payment (IMPMT) based on F.O.B. is considered to be another important macro variable which is expected to have significant bearing on the movement of stock price in Dhaka Stock Exchange (DSE). In this research, IMPMT has been hypothesized to have negative association with stock price. When import payment (IMPMT) data at lag 2 has been used in Multivariate Regression Model: 2 and in Model: 3, it provides negative regression coefficients (i.e. -0.017434 and -0.001943) respectively but these coefficients are found to be statistically insignificant at 5 percent level. This result indicates that import payment has negative association with stock price in the short run and this relationship has also been complied by the null hypothesis of negative association between them. On the other hand, when Johansen's Cointegration test has been applied at lag 11, the normalized cointegrating regression provides a positive coefficient (i.e. 1.548) for import payment. This inverse result of the regression coefficient in Multivariate Time Series Regression Analysis and in Johansen's Cointegration Test may be due to the fact that identical lag data has not been used in these two tests and different lag data could be very sensitive in generating regression coefficients. Whether import oriented companies are listed or unlisted in Dhaka Stock Exchange (DSE) but an increase in import payment reduces the overall reserves of the foreign exchange in the economy. When the demand for imported products increases, the amount of imports as well as profits also increases in both listed and unlisted importing companies. This high profit growth due to increased import activity, import oriented companies which are listed in DSE got positive effect in its stock prices. But, the import payment is actually made by both listed and unlisted import companies which cause a significant decrease in the reserves of foreign exchange in the economy. This reduction of foreign exchange reserve tends to reduce money supply as well as liquidity in the economy which decreases the ability of the investors to invest in stock market. As a result, although listed import companies' stock price increases in the short run, aggregate demand for stock decreases which is reflected by a downward shock of stock prices in the stock market in the short run. On the other hand, importing foreign products in the economy is considered to be an alternative to investment in stocks. So, if profit potential increases in import (trading) business in the individual level then it gradually reduces the interest of the investors to invest their fund in capital markets. In addition, opportunity cost, inherent risk and other regulatory cost also provide an environment where an investor has to make a choice between whether they should go for investment in stock or import business. In brief, it can be said that import payment has negative influence over stock price in the short run. On the other hand, a rising stock price implies greater wealth of the investor which is reflected in higher living standard than before. Therefore investors have got greater affordability to consume imported product at a higher price. This situation leads to an increased demand for imported products by the wealthy consumer. This fact has been translated through a positive long run relationship between stock price and import payment in this research.

When T-Y granger causality has been tested between stock price and macro variables (Model: 2 of Section: C), this research found no significant causal relation between stock price and import payment. But when all the micro-macro variables are used with stock price (Model: 3 of Section: C), it has been found that import payment tends to granger cause stock price at DSE at 5 percent significance level. The evidence of uni-directional causality from IMPMT to DSI could be for the fact that import payment in a developing economy like Bangladesh causes a significant decrease in the reserve of foreign exchange in the long run and also causes a significant profitability of the listed import oriented companies in the short run. That's why significant causal evidence has been documented from IMPMT to DSI.

Stock Price (DSI) and Aggregate Investment at Market Price (INVMP)

Aggregate investment in public and private sector by the contribution of banking industry is expected to have positive influence in stock prices. This influence is expected to be more significant in case of emerging stock markets in recent time like Dhaka Stock Exchange (DSE). In this research, positive relation between stock price and aggregate investment at current market price has been hypothecated. Regression Model: 2 and Model: 3 in Section: A have incorporated 3rd lag data in building model specification. The empirical results in these two Regression Models didn't found to be complying with the null hypothesis. In Regression Model: 2, regression coefficient has been found to be negative (i.e. -0.087735) and statistically significant at 1 percent level. In Regression Model: 3, regression coefficient of INVMP is still negative (i.e. -0.071278) and also statistically significant at 1 percent level. In this section, coefficients associated with aggregate investment have found to be inversely related with stock price. In Model: 2 of Section: B, Johansen's Cointegration test has been applied with an appropriate lag length of 11. In this case, aggregate investment has been found to be positively related with stock price. Here the normalized cointegrating coefficient has been found to be positive (i.e. 0.2539) where standard error is still small (i.e. 0.026) in value. This test result implies that the relationship between aggregate investment and stock price is positive in the long run. Basically, different selection of lag length in two different tests contributes to this inverse relationship. It is very likely that a proposed long term project usually have two alternative source of financing: getting long term loan from different financial institutions or raising equity capital by issuing and selling stocks in the stock market. Although the borrower firm can arrange long term fund facility either by utilizing one of two financing alternatives, they fails to exhibit expected result in the short run. Because aggregate investment in public and private sector causes an immediate shortage of cash flow and liquidity of the borrower organization and fails to report excess productivity, earnings and profitability in the short run. Due to these consequences, aggregate investment in public and private sector fails to generate any upward pressure in the prices of stocks in the short run. This argument is consistent with the findings of this research in Regression Model: 2 and Model: 3 in Section: A. But in the long run, all these expectations (i.e. higher output and productivity, higher aggregate demand, higher earnings and profitability) have been fulfilled by public and private sector projects that certainly generate an upward pressure in prices of stocks in the stock market. If higher expected output implies higher expected earnings, it may lead to higher stock prices in the long run. The information about continued development in goods and service industry provides positive signal about increasing stock price in the capital market. In Johansens's Cointegration test between selected macro variables and stock price, the normalized cointegrating coefficient also revealed the evidence that an increase in aggregate investment has positive influence over the change in stock price in the long run. Finally, T-Y Granger Causality test (Model: 3 in Section: C) revealed the uni-directional causal evidence from aggregate investment and stock price. This causal evidence in Model: 3 of Section: C, also supports the logical arguments that additional investment will bring additional earnings and growth prospects of the firm in the future which is ultimately translated into increased price of stocks in the stock market.

<u>Stock Price (DSI) and Industrial Production Index (IPD)</u>

Industrial Production Index (IPD) is commonly used as a proxy variable for representing the level of real economic activity and this research hypothesized a positive relationship between IPD and stock price (DSI) at Dhaka Stock Exchange (DSE). The evidence of this research indicates that stock prices are positively related to industrial production index (IPD). In Multivariate Regression Model: 2 and Model: 3 in Section: A, the regression coefficients are found to be positive (i.e. 0.052985 and 0.032773 respectively). However, both of the two coefficients are statistically insignificant. As noted earlier that the productive capacity of the economy depends directly on the accumulation of real asset, which in turn contributes to the ability of firms to generate cash. Increase in industrial production increase the corporate earnings enhancing the present value of the firm and hence, it leads to increase the value of investment in stock market which in turn enhances stock prices. Based on this proposition, the findings of this research support the null hypothesis of positive relation between IPD and DSI. Fama (1981) explained this positive relationship by suggesting that market makes rational forecasts of the real sector, while Chen, Roll and Ross (1986) argued that the positive relation reflects the value of insuring against real systematic production risk. Changes in productive activity, through their impact on expected dividends, should in turn influence stock returns (Maysami and Koh, 2000). Fama (1981) also found a positive and significant linkage between stock price and level of economic activity proxied by industrial output. Therefore, this research found a positive relation between IPD and stock price in the short run. On the other hand, in Model: 2 of Section: B, Johansen's Cointegration test between IPD and DSI provides positive normalized cointegrating coefficients (i.e. 9.521) for IPD. This positive normalized coefficient implies that IPD and DSI have long run positive association with each other.

Finally, T-Y Granger causality test in Model: 2 and Model: 3 of Section: C provides causal evidences between IPD and DSI. Estimates of Model: 2 indicates uni-directional causality from stock price to industrial production index (IPD) which is statistically significant at 1 percent level. On the other hand, in Model: 3, bi-directional causality has been found which is also significant at 10 percent level. Thus, stock price do have a feedback effect on the industrial production. It stimulate the state of the economy, the corporate profits and that in turn lead to an increase in stock prices. At the same time, the health of the stock market, in the sense of rising stock prices, translate into the health of the economy. Similar causal relation was also found by Sangeeta Chakravarty (2006), Bhattacharya B. and Mukherjee J. (2002), Naik, P.K. and Padhi P. (2012) in India, Mehrara, M. (2006) in Iran. But the causal evidence of this research between stock price and industrial production index is not consistent with the finding of Ahmed M.F. (2000), Ahmed. M. N. and Imam M. Osman. (2007), and Saifullah, M. (2007) in Bangladesh. This inconsistency may be due to the fact that, this research have incorporated larger monthly data and also used different lag data to estimate the causal evidence between stock price and industrial production index.

<u>Stock Price (DSI) and Broad Money Supply (M2)</u>

It is already stated that broad money supply (M2) is expected to have bilateral effect in both restrictive as well as expansionary monetary policy. In this research, positive relation has been hypothecated between stock price and broad money supply (M2). In Section: A, Regression Model: 2 and Model: 3 provide negative but insignificant regression coefficients (i.e. -0.056458 & -0.020260) respectively for broad money supply. This evidence implies that an increase in broad money supply (M2) has negative association with stock price (DSI) in the short run. In Model: 2 of Section: B, Johansen's Cointegration test provides positive normalized cointegrating coefficient (i.e. 0.023) for M2. This positive normalized coefficient implies M2 has positive association with stock price in the long run. Finally, in Model: 2 of Section: C, the estimates of T-Y Granger Causality test doesn't provide any causal evidence between M2 and stock price. But in Model: 3 of the same section, uni-directional causality has been found from M2 to DSI.

The estimated evidence in multivariate time series regression analysis both in Model: 2 and Model: 3 are very likely as, according to Fisher's Equation[6], monetary growth might result in higher inflation and hence, higher nominal interest rate. The higher interest rate leads to the higher required rate of return, which eventually results a lower valuation of the firm and its stocks in the market place. That's why an excess broad money supply has negative association with stock price in the short run. In the other hand, to stabilize the economy, monetary authority (i.e. Bangladesh Bank) constantly monitors and interferes with the level of interest rate, if required. It frequently engaged in open market operation, discount window policy or reserve rate variation policy to control the amount of credit and money supply in the economy. This operation of the monetary authority has indirect effect on the level of interest

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[6] According to Irving Fisher, nominal interest rate compensates savers in two ways. First, they compensate for a saver's reduced purchasing power. Second, they provide and additional premium to savers for foregoing present consumption. He has developed a model which is most commonly known as Fisher's Effect. This Fisher's Effect explains that nominal interest is the sum of real interest and expected inflation caused by excess money supply. The algebraic expression of the Fisher's Effect can be written as, $i = E(INF) + i_r$.

rates. When monetary authority did something that lowers the level of interest rate, it also leads to a decrease in the firm's cost of capital. In this situation, firms will be able to undertake expansion decisions with ease which eventually produces higher expected earnings, higher productivity and also higher expected share price in the stock market. The evidence of this research also supports this arguments that broad money supply do have significant positive association with stock price in the long run.

However, the empirical evidence of positive relationship between stock price and broad money supply (M2) in the long run is supported by Ratanapakorn & Sharma (2007) for United States, Chen et al. (2005) for Taiwan, Bulmash and Trivoli (1991), Naik & Padhi (2012) for India, Mukherjee and Naka (1995) for Japan, Ahmed & Imam (2007) for Bangladesh. Ibrahim and Yusoff (2001) found positive relationship between stock price and money supply in the short run but negative relationship in the long run for Malaysia. On the other hand, short run negative relationship between money supply and stock price is supported by Fama (1981) and Geske and Roll (1983). Alshogearhri (1998) is his Ph.D. Dissertation, explain that stock price of Saudi Stock Market is positively related with broad money supply (M2) in the long run.

<u>Stock Price (DSI) and National Income Deflator (NID)</u>

National Income Deflator (NID) is the measure of average level of prices of all goods and services included in the Gross Domestic Product (GDP). Therefore, NID is simply the representative of inflation adjusted average price level of all goods and services included in the GDP. This NID has been calculated after adjusting nominal GDP by real GDP. In this research, a positive relationship has been hypothecated between stock price (DSI) and national income deflator (NID). In Regression Model: 2 and Model: 3 in Section: A, negative regression coefficients (i.e. -0.649419 & -0.696513 respectively) have been found for NID which is also statistically significant at 5 percent level. This result indicates that DSI have significant negative association with NID in the short run. On the other hand, Model: 2 of Section: B provides a positive normalized cointegrating coefficient (i.e. 53.92) for NID. This result implies that stock price is positively related with NID in the long run. However, Model: 2 of Section: C provides uni-directional causality from NID to DSI which is significant at 5 percent level. But in Model: 3 of the same section, significant bi-directional Causality have been found between DSI and NID.

In a country like Bangladesh, increased inflation is a usual phenomena caused by a gradual rise in the supply of money in the economy. Although consumer price index covers the price index of a specific basket of goods and services, national income deflator covers the price index of the entire production of goods and services held in the measurement of GDP. In this case, any rise in NID implies that inflation adjusted average price level of goods and services, which is used to calculate GDP, increases. As NID includes price adjusted market value of all the final goods and services in an economy during a particular period of time, corporate additional investment (e.g. which enhances earnings and thereby stock price) is a very small segment that influences NID. NID in its process of calculation, excludes the effect of rising price level or inflation, whereas, stock price determination process doesn't exclude the effect of inflation. So when inflation is rising, stock price also tends to rise but this rising tendency has been adjusted for NID. As a result, NID shows smooth and gradual rising trend whereas the trend of stock price is very volatile. Because of this underlying reason, a short run negative relationship has been found between NID and stock price. But in the long run, when the stock price is adjusted with the economy for any seasonal or cyclical shock, stock price tends to move in the same direction as national income deflator. Johansen's Cointegration test in this research provides a long run positive normalized cointegrating coefficient for NID. A rising price level of the commodities and services held in GDP also results higher cash flows to the economy which actually unlock the opportunity to make additional investment by listed firms. This additional investment leads to additional earnings, higher profitability of the firms which enhances the price of stocks in the market place. As a result, long run positive association with stock price has been revealed in this research. Finally T-Y Granger Causality test in Model: 3 provide the evidence of long run bi-directional causality between NID and DSI. A rise in NID also causes DSI to increase just like any other commodities and services. On the other hand, a rise in DSI also contributes to the adjustment of increased NID in the long run. It is worth noting that, Pilinkus, D. (2009) has found both uni-directional and bi-directional causal evidence between GDP deflator and stock price at different lags in Lithuania. The author found uni-directional causality from GDP deflator to stock price at lag 4, 5, and from lag 7 to 24. But at lag 6 and 8, he found bi-directional causality between them.

Stock Price (DSI) and Foreign Remittances (REMIT)

The role of foreign remittances (REMIT) has been found to have diverse impact in the developing economy especially in the case of Bangladesh. There is no doubt to say that the growth of foreign remittances drives economic growth at its desired level. It can also reduce poverty, strengthen foreign currency reserve, increase capacity import financing, reduce unemployment pressure and enhance consumption, savings and investment both at micro and macro level of the economy. This research hypothesized a positive relation between the growth of foreign remittances and stock prices (DSI) at Dhaka Stock Exchange (DSE). In Regression Model: 2 and Model: 3 of Section: A, regression coefficients have been found to be negative (i.e. -0.096108 & -0.088087 respectively) and statistically significant at 5 percent level. In Model: 2 of Section: B, Johansen's Cointegration test also provides negative normalized cointegrating coefficient for REMIT. Finally, T-Y Granger causality test in Section: C, both Model: 2 and Model: 3 provides the same uni-directional causality from REMIT to DSI which is significant at 5 percent level.

A Study Report titled ***"The Uses of Remittances in Bangladesh: Some Future Directions"***, reports that the beneficiary families use the amount of foreign remittances in different investment alternatives in Bangladesh. The findings of the study reveal the different uses of foreign remittances in Bangladesh by the beneficiary families. Table 10.1 reports the different use of foreign remittances in Bangladesh.

This table also depicts that only 8 percent families who receive foreign remittances from abroad invest in the capital market of Bangladesh. This scanty percentage of the family who invest in stock market may be due to the fact that, they are risk averse and they consider stock market as risky avenues for investment. This table also makes one thing very clear that, majority of the receiver of foreign remittances, use their fund mainly in safe investment like purchase of land/flat or investment in FDR or establishment of houses for accommodation. Another observation is that, the growth rate of foreign remittances runs much faster than the growth rate of investment of foreign remittances in stock market. As a result, a rise in foreign remittances results negative coefficients in both short run and long run estimates. Significant negative relationship between REMIT and DSI in this research is also supported by other empirical evidence like Ali M.B. (2011a) and Ali M.B. (2011b) for Bangladesh.

Table 10.1: Diversified Use of Foreign Remittances in Bangladesh

Classified Investment	Users of Foreign Remittances (%)
Purchase of land/ Flat	42
Purchase of Savings Certificate	13
FDR of different maturity in different financial institutions and purchase of insurance policy	21
Personal lending with interest	1
Starting sole proprietorship business	12
Starting partnership business	2
Sending other family members to abroad	18
Establishing or repairing of houses	39
Purchase of car/motor cycle	5
Investment in capital market	***8***
Use the amount to provide other family members a job in home country	3

Note: Collected from a Study Report Titled ***"The Uses of Remittances in Bangladesh: Some Future Directions"****, published by Bangladesh Bank*

In T-Y Granger causality test, this research found uni-directional causality from foreign remittances to stock price in both Model: 2 and Model: 3 in Section: C. This findings reveal that the increase of foreign remittance indirectly cause the stock prices to decline. Because, although foreign remittances leads to an increased liquidity in the economy but this increased stream of liquidity has been used for investment in real sector like construction of houses and purchase of apartments etc. but not in stock market. As a result, sock market fails to exhibit the true effect of an increase in foreign exchange reserve in the economy. However, uni-directional causality has also been supported by Ali M.B. (2011) for Bangladesh.

Stock Price (DSI) and Total Domestic Credit (TDC)

Total domestic credit (TDC) is a particular macroeconomic variable which describes the sum of total amount of credit to public sector and the gross amount of credit to private sector by the banking system. In this research, it has been hypothesized that total domestic credits have positive influence over stock prices at DSE. The empirical result of Regression Model: 2 and Model: 3 in Section: A also support to this null hypothesis. The coefficients of TDC in regression Model: 2 and Model: 3 provide positive but insignificant regression coefficients (i.e. 0.039575 & 0.071781 respectively) in this research. This result reveals the fact that TDC has positive relationship with DSI in the short run. This positive relationship between TDC and DSI may be due to the increase in money supply and inflation in the economy that force the lending interest rates to decline. As a result, cost of capital associated with getting a loan for investment motive also decline. Therefore, aggregate investment has been induced in the economy which causes the stock price to rise. In this way, it can be said that a growth in TDC have positive contribution to the movement of stock prices at DSE.

On the other hand, In Section: C, when T-Y Granger causality has been estimated between macro variables and stock price (i.e. Model: 2), uni-directional causality has been evident from total domestic credit to stock price. But in Model: 3 of Section: C, when all the micro-macro variables have been used, neither uni-directional nor bi-directional causality has been found. This difference between two estimates may be due to selection of different lags in the model or inclusion of micro variables in the causality model. However, it is worth noting that similar result has also been found by Ali M.B. (2011) for Bangladesh.

10.2 Implications:

This research has been a strategic attempt to identify and measure the impact of some selected micro and macroeconomic variables that might have significant relationship with the Dhaka Stock Exchange (DSE) all share price index (DSI). This attempt incorporates several applications of econometric tools like multivariate time series regression analysis, Soren Johansen's Cointegration test & Vector Error Correction Model, and Toda-Yamamoto (T-Y) Granger Causality test. All the entire test estimates in different analysis are not perfectly identical because some test estimates provides the impact of independent variables on the dependent variable in the short run but other test estimates exhibit their relation in the long run. Causal relationship between stock prices and all the selected micro and macroeconomic variables have also been identified. As a result, this research has a number of significant and practical implications both for government agencies, policy makers, research scholars, particularly in the domain of general and institutional investment in capital market of Bangladesh. From the theoretical point of view, this research has enriched the literature on the impact of micro and macroeconomic variables on stock price as it examined their short-run, long-run and dynamic causal relationship by different econometric tools and techniques. Exploring the relationship between selected micro and macroeconomic variables both in short run and long run has certainly broadened the understanding their inherent associations. Findings of this research can be used by individual as well as institutional investors in the selection, holding and construction of most efficient portfolios. Existing and prospective investors can have some idea about the underlying factors (both from micro and macro area) that could cause the volatility in stock prices in different market and economic conditions. In addition, different regulators like Dhaka Stock Exchange (DSE), Bangladesh Securities and Exchange Commission (BSEC), Bangladesh Bank (BB), Ministry of Finance (MOF), Board of Investment (BOI), National Board of Revenue (NBR), Ministry of Industries (MOI), other regulators and policy makers can use the findings of this research to develop, issue and pursue for efficient policy decisions that ultimately contribute to make the capital market active and economic activity at it's desired level. Finally, academicians and research scholars and money managers can use the findings of this research to find new ways and techniques to advance their study and research in the same relevant field.

10.3 Limitations:

This research has been conducted to identify the micro and macro variables that have long run equilibrium as well as long run causal relationship with Dhaka Stock Exchange (DSE) all share price index (DSI). At the beginning, five micro variables and thirteen macro variables has been initially incorporated to carry on this research. All that independent variables are used in the multivariate time series regression analysis, Soren Johansen's cointegration test and vector error correction model and finally Toda and Yamamoto Granger Causality test. That means this study incorporates all those variables that have consistent and available published data set and that also conforms to the selected sample time frame. There are few important variables such as the size of the industry, market beta, GDP at market price, changes in margin loan ratio, amount of black money in the economy, break down of electricity supply, treasury bill rate, investors risk averseness, capital gain tax rate, book to market ratio, net asset value and the like have not been used due to inconsistency and non-available data set. In addition, some variables' data set have not been found because the appropriate authority doesn't publish that data. If they could be incorporated, this research could expect to provide far better result.

However, this study uses the total sample period to develop a stock pricing model in Dhaka Stock Exchange. But that result has not yet verified and examined by developing several sub-period analysis. Different sub-period may reveal different result which is beyond the research method in this study. This sub-period analysis may also conform to the consistency and reliability of the research findings.

Finally, some important econometric tools like Variance Decomposition and Impulse Response Analysis have not employed in this research. If they are used in this study, it could explore some insight relationship between stock price and all the selected independent variables.

10.4 Conclusion:

This research is intended to identify the factors from both micro and macro level that significantly influences stock prices in Dhaka Stock Exchange (DSE). This research also tries to estimate the degrees of their relationship with DSE –all share price index (DSI) by incorporating monthly data set from July 1986 to September 1010 (283 monthly data). If these estimates could be identified then they could be used to predict the volatility of stock prices, the underlying reasons for this volatility and therefore efficient policy decisions can be taken to brought discipline, harmony, ethical and rational trading practices in Dhaka Stock Exchange (DSE). In addition, the findings of this research are expected to contribute in different sectors of the economy as it is argued that different sectors in the economy are interconnected to each other.

For accomplishing the desired research objectives, three different econometric tools (i.e. multivariate time series regression analysis, Johansen's Cointegration Analysis and Toda-Yamamoto Granger Causality Analysis) have been applied. These research result under three different econometric methods doesn't differ significantly but they are not found to be identical. It can be said that development of different model formulation and the instructions for using these models are the main reason for getting less similar results. However, this research has made it possible to have in-depth ideas about the influences of different factors that could be used to explain the changes in stock prices. This research incorporates relative relationship, absolute relationship, cointegrated relationship as well as causal relationship between DSE –all share price index (DSI) and few selected micro and macroeconomic variables. All the result estimated here will certainly contribute to the existing literature, research findings and gives new ways to advance this study.

10.5 Future Research Avenues:

This study has been attempted to develop a strong guideline and database of stock pricing model in Dhaka Stock Exchange (DSE) which would help researchers to carry out research in the following avenues:

1. This study have used Dhaka Stock Exchange (DSE) all share price index (DSI) to develop a stock pricing model based on selected micro and macro variables. Here, the selected stock price (DSI) includes all category (i.e. A, B, G, N, and Z) company's price index. But Z category shares belong to those companies which do not hold annual general meeting (AGM) or failed to declare dividend on a regular basis and their trading frequency is very irregular. In this case DSEGEN[7] index can be used to develop stock pricing model using the selected independent variables.

2. Few more predictor variables like book to market ratio, weighted net asset value, changes in margin loan ratio, market beta average transaction costs, GDP at market price, interest rate spread, balance of payment (BOP), unemployment rate, production of electricity etc. can be incorporated in this model to make it better feasible and more acceptable.

3. This study is limited to meet up its specified objectives: identifying the relationship between selected micro and macro variables with stock price both in the short-run and long-run as well as estimating the causal relation between them in Dhaka Stock Exchange (DSE). The evidence of this research can also be extended by comparing with the research findings held in some other emerging stock markets.

[7] Dhaka Stock Exchange (DSE) has three main indices: DSE all share price index (DSI), DSE General Index and DSE 20.

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GLOSSARY

Adjusted R-Squared – A measure which panelizes R-squared value for the addition of any regressors which do not contribute to the explanatory power of the model.

Breusch-Godfrey Serial Correlation LM Test -: A statistical test which is used to identify serial correlations in the residuals of the regression model. Here null hypothesis is assumed to have no serial correlations in the residuals.

Cointegration Theory - An econometric theory which pointed out that a linear combination of two or more non-stationary time series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be *cointegrated*. This stationary linear combination is called the *cointegrating relationship* and may be interpreted as a *long-run equilibrium relationship* among the variables.

Condition Index - A statistical estimate which is used to identify multicollinearity among the independent variables in the regression model. The independent variables are said to be not statistically inter-correlated if the value of the condition index is found to be smaller than 30.

Descriptive statistics – The statistical estimates used to identify the basic statistical properties in a data series. This estimate includes mean, median, standard deviation, maximum, minimum, skewness, kurtosis etc.

Efficient Market - The market in which the price of stocks quickly and instantaneously reflects all relevant information that is available about the intrinsic value of that asset.

Emerging market – The stock market is said to be emerging when it belongs to a low- or- middle income country, the investable market capitalization is low to its most recent GDP, less open, less transparent, less liquid and informationally and allocationally inefficient.

Endogenous Variable – Endogenous variables can be defined as those variables generated by the statistical model that is explained by the relationship between functions within the model. However, endogenous variables are correlated with the residuals of the regression functions.

Exogenous Variable – An external independent variable having affect on a model, but not affected by the model. The model builder specified the variable but set no qualitative characteristics or value generation method and these variables are uncorrelated with the residuals.

***The Engle-Granger (1987) Cointegration Test* -** It can identify the cointegrating or long run equilibrium relationship between 2 endogenous variables.

***Granger causality test*-** An econometric test used to identify the unidirectional as well as bi-directional causality between two selected variables.

***Heteroskedasticity test* –** The test which is used to examine whether error terms in the regression equation have a common variance or not. When variances in the error terms are not constant then the situation is called heteroskedasticity.

***Johansen's (1991) Cointegration Test* -** It can identify cointegrating or long run equilibrium relationship between more than 2 endogenous variables.

***Lag Length Selection Criteria* -** An econometric method of appropriate selection lag length for use in the cointegration test or vector autoregressive model or granger causality test etc. Different types of lag length criteria are commonly found for use. These are sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ) etc.

***Macro variables* –** The aggregate economy oriented variables representing the status and development of the overall economy in any country.

***Micro variables* –** The variables which are the performance as well as development indicator related to any particular stock market.

***Multicollinearity Test* -** The test that can identify the situation where independent or explanatory variables in the multiple regression model are highly intercorrelated. When explanatory variables are highly intercorrelated, it becomes difficult to estimate the separate effect of each of the explanatory variables on the explained variables.

Multivariate Regression Analysis - A statistical process of determining absolute Relationship between dependent and a set of Independent variables. It can explain the changes in the dependent variables due to any change in independent variables. It can also provide explanatory power of the independent variables.

Multivariate Time Series Regression Analysis - A least square methods of regression model where multiple variables have been used as independent variables which also involve with time series data.

***Non-stationary time series* -** A time series is said to be non-stationary whose statistical properties like mean, median and autocorrelation is not statistically identical over time. In order to use time series data in the regression model, it is very essential to convert non-stationary time series in to stationary either by de-trending (i.e. taking the log value of the raw data) or taking the first differenced value of the level data. Non-stationary time series is said to have unit root in the data and commonly termed as integrated of order one or I(1) series.

Ramsey's RESET test: A statistical test which is used to identify misspecification errors in the designing of regression models. This test normally assumes under null hypothesis that the concerned model doesn't have any specification error.

***R-Squared* -** A statistic which measures the success of the regression in predicting the values of the dependent variables within the sample size. The statistic will equal to one if the regression fits perfectly, and zero if it fits no better than sample mean of the dependent variable.

***Stationary time series* -** A data series is said to be stationary if its statistical properties like mean, median and autocorrelation is statistical identical over time. In this case, stationary time series data can be directly used in the regression analysis. Stationary time series is said to have no unit root in the data and commonly termed as integrated of order zero or I(0) series.

***Serial Correlation Test* –** The test which is used to identify whether there is any correlation between the error terms exits in the regression model or not.

***t - Statistic* –** A ratio of an estimated coefficient to its standard error. It is used to test the hypothesis that a coefficient is equal to zero.

Standard Error- A measures of the statistical reliability of the regression coefficient estimates – the larger the standard errors, the more statistical noise in the regression estimates.

***Stationary test* -** A statistical test which is used to identify unit root in the data series. Examples of popular unit root test are Augmented Dickey- Fuller (ADF) Test and Phillips-Perron (P-P) Test etc.

***Standard Granger Causality test* -**An econometric test which is used to identify long run causal evidence between two endogenous variables. An important issue is it fails to identify causal relation between more than two endogenous variables.

***Tolerance Value* -** A statistical estimate which is used to identify multicollinearity among the independent variables in the regression model. The independent variables are said to be not statistically inter-correlated if the tolerance value is found to be greater than 0.20.

Toda-Yamamoto (T-Y) Granger Casualty test - An extension of the standard granger causality test which has been used to identify long run causal relationship between more than two endogenous variables. This test actually removes the pitfalls of standard granger causality test.

Variance Inflation Factor (VIF) - A statistical estimate which is used to identify multicollinearity among the independent variables in the regression model. The independent variables are said to be not statistically inter-correlated if the VIF value is found to be smaller than 4.0.

Variance ratio test – The test which is used to determine whether the differences in a series are uncorrelated, or follow a random walk or martingale property.

Vector Error Correction Model (VECM) - An econometric test which has been applied to identify the speed of short-run dynamics (i.e. disequilibrium) adjustment and to determine the required time period within which this disequilibrium will be corrected and converges towards long-run equilibrium relationship among the endogenous variables.

Vector Autoregression (VAR) Test - The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

Wald test – A statistical test which is commonly used to identify statistical significance of the joint regression coefficients in the regression model. It measures whether all the regression coefficients are jointly statistically significant or not. Here null hypothesis assumed that joint regression coefficients are not different from zero.

White's General Heteroskedasticity (WGH) Test - A general Heteroskedasticity test developed by White which assumes under null hypothesis that residuals of the regression model is homoskedastic. A homoskedastic residuals means that residuals have constant variance over time. If they are not found to be constant over time, then residuals are said to be heteroskedastic.

Appendix: (a)

Basic Unit Root Theory

The time series properties of the economic variables can strongly influence the outcome of the estimation. For example, if a series is a non-stationary, persistence of shocks will be infinite. If two variables are trending over time, a regression of one on the other could have a high R^2 even if the two variables have not intuitive relationship. This is called a spurious regression. If the variables in the regression model are not stationary, it shows that the standard assumptions for asymptotic analysis will not be valid. In other words, the usual "t-ratios" will not follow a t-distribution, so we cannot validly undertake hypothesis tests about the regression parameters (Brooks 2002).

Since many of the time series variables seem non-stationary, the first step in any econometric analysis is to check for the stationarity of the variables and determine the order of integration. The order of integration of a series refers to the number of times the series must be differenced in order to make it stationary. A series is integrated in order of d, *I*(d), if it has to be differenced d times to become stationary. If a variable becomes stationary after differencing once it is said it is integrated order 1, *I* (1). If the variables are found to be I(0) then it reveals that data series of the variable is stationary and that can used directly into the regression model. But if they are found to be I(1) which implies non-stationary data and that requires to estimate the first difference value of the same variable to make it stationary.

According to Brooks (2002), a unit root test analyses whether a time series variable is non-stationary using an autoregressive model. There are several unit root tests to examine stationarity of the time series. The most famous test is the augmented Dickey–Fuller test (ADF). Another test is the Phillips–Perron (PP) test. Both these tests use the existence of a unit root as the null hypothesis ($H_0 : y_t \sim \mathrm{I}(1)$). However, another popular test, the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test use the existence of a unit root as the alternative hypothesis ($H_0 : y_t \sim \mathrm{I}(1)$). It is assumed that the series are stationary under the null ($H_0 : y_t \sim \mathrm{I}(0)$). In this thesis, we apply the ADF, PP and KPSS unit root tests to examine the stationarity of the dependent and independent variables.

The standard Dickey Fuller (DF) test is carried out by estimating the following equation:

$$Y = \beta_0 + \beta_1 Y_{t-1} + u_t$$

Where

$$H_o : \beta_1 = 1$$
$$H_a : \beta_1 < 1$$

Under the null hypothesis the AR(1) model has a unit root. But the test is usually implemented considering a modified version of the AR(1) model:

$$\Delta Y = \beta_0 + \delta Y_{t-1} + u_t$$

Where

$$\delta = \beta_1 - 1$$
$$H_o : \beta_1 = 1$$
$$H_a : \beta_1 < 1$$

Usually t-statistics is used to verify the hypothesis and the test known as Dickey-Fuller Test. This test is used only with AR(1) models, when AR(p) model are considered it is necessary to consider Augmented Dickey-Fuller (ADF) Test.

Appendix: (b)

Theory of Augmented Dickey Fuller (ADF) Test

The standard DF test above is only valid if u_t is white noise - AR(1) process. If the series are correlated at higher order lags, the assumption of white noise disturbances u_t is violated. In particular, u_t will be autocorrelated if there was autocorrelation in the dependent variable of the regression (Δy_t). The solution is the ADF test using *p* lags of the dependent variable. The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the *y* series follows an AR(*p*) process and adding *p* lagged difference terms of the dependent variable *y* to the right-hand side of the test regression. The ADF tests involve estimating the following equation:

$$\Delta y_t = \gamma + \delta x_t + \alpha y_{t-1} + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots\ldots + \beta_p \Delta y_{t-p} + \upsilon_t$$

Where, γ is constant, α, β and δ are the parameters, *p* is the lag order of the autoregressive process and v is the error term.

By including lags of the order *p* the ADF formulation allows for higher-order autoregressive processes. This means that the lag length p has to be determined when applying the test. The unit root test is then carried out under the null hypothesis $\beta = 0$ against the alternative hypothesis of $\beta<0$.

Appendix: (c)

Theory of Phillips-Perron (P-P) Test

Phillips and Perron (1988) propose an alternative non-parametric method of controlling for serial correlation in the error terms without adding lagged difference terms. The PP method estimates the non-augmented DF test equation and modifies the t-ratio of the α coefficient so that the serial correlation does not affect the asymptotic distribution of the test statistics. The PP test is based on the following statistics:

$$\hat{t}_{\alpha} = t_{\alpha}\left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{1/2} s}$$

Where $\hat{\alpha}$ is the estimate, and t_{α} is the t-ratio of the $se(\hat{\alpha})$ is the coefficient standard error, and *s* is the α standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance in the following ADF test equation:

$$\Delta y_t = \alpha Y_{t-1} + x_t'\delta + \varepsilon_t$$

The remaining term, f_0 is an estimator of the residual spectrum at frequency zero. Under the null hypothesis that $\alpha = 0$, the PP test statistics have the same aymptotic distribution as the ADF *t*-statistics.

Appendix: (d)

The Theory of Breusch-Godfrey Serial Correlation LM Test

Breusch and Godfrey have developed the test of autocorrelation which is not only suitable for testing serial correlation of any order (i.e. for any higher order autoregressive models), but also suitable for models with or without lagged dependent variables. The test can be illustrated with reference to a *p*-th order autoregressive AR(*p*) scheme. Suppose that we have a model,

$$Y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t \text{ .... } (1)$$

and we assume that the error term u_t follows *p*-th order autoregressive scheme as follows:

$$\varepsilon_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \ldots\ldots + \rho_p u_{t-p} + \varepsilon_t \text{ .... } (2)$$

Then the model could be written as:

$$Y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + \rho_1 u_{t-1} + \rho_2 u_{t-2} + \ldots + \rho_p u_{t-p} + \varepsilon_{t\ldots.} (3)$$

Then the null hypothesis *H*o to be testes is that

$$Ho: \rho_1 = \rho_2 = \ldots\ldots = \rho_p = 0 \text{ i.e. no autocorrelation}$$

For any larger sample Breusch and Godfrey have shown that n-p times R^2 value obtained from the auxiliary regression follows that χ^2 distribution with *p* degrees of freedom. If the test statistics exceed the critical χ^2 value at the chosen level of significance, null hypothesis will be rejected and vice versa.

Appendix: (e)

The Theory of Wald Test

The Wald test computes a test statistic based on the unrestricted regression. The Wald statistic measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are in fact true, then the unrestricted estimates should come close to satisfying the restrictions.

Suppose a general linear regression model is:

$$y = f(\beta) + \varepsilon \quad \ldots\ldots\ldots\ldots(1)$$

Where y and ε are T-vectors and β is a k-vector parameters to be estimated. Any restrictions on the parameters can be written as:

$$H_0 : g(\beta) = 0 \ldots\ldots\ldots\ldots\ldots(2)$$

Where g is a smooth function, g: $R^k \rightarrow R^q$, imposing q restrictions on β. The Wald statistics is then computed as:

$$W = g(\beta)' \left(\frac{\partial g(\beta)}{\partial \beta} \hat{V}(b) \frac{\partial g(\beta)}{\partial \beta'} \right) g(\beta)\Big|_{\beta=b} \ldots\ldots\ldots\ldots..(3)$$

When T is the number of observations and b is the vector of the unrestricted parameter estimates, and where $\hat{V}$ is an estimate of the b covariance. In the standard regression case, $\hat{V}$ is given by:

$$\hat{V}(b) = s^2 \left(\sum_i \frac{\partial f_i(\beta)}{\partial \beta} \frac{\partial f_i(\beta)}{\partial \beta'} \right)' \Big|_{\beta=b} \ldots\ldots\ldots\ldots(4)$$

Where u is the vector of unrestricted residuals, and s^2 is the usual estimator of the unrestricted residual variance, $s^2 = (u'u)/(N-k)$, but the estimator of V may differ.

More formally, under the null hypothesis H_0, the Wald statistics has an asymptotic $\chi^2(q)$ distribution, where q is the number of restrictions under H_0.

For the text book case of linear regression model,

$$y = X\beta + \varepsilon \text{ ....(5)}$$

And linear restrictions:

$$H_0 : R\beta - r = 0 \text{ ....(6)}$$

Where R is a known $q\ X\ k$ matrix, and r is a q- vector, respectively. The Wlad statistics in equation 3 reduces to:

$$W = (Rb - r)'(Rs^2(X'X)'R')^{-1}(Rb - r) \text{ ....(7)}$$

Which is asymptotically distributed as $\chi^2(q)$ under H_0.

If we further assume that the error ε are independent and identically normally distributed, we have an exact, finite sample F-statistics:

$$F = \frac{W}{q} = \frac{(\tilde{u}'\tilde{u} - u'u)/q}{u'u)/(T - k)} \text{ ....(8)}$$

Where $\tilde{u}$ is the vector of residuals from the restricted regression. In this case, the F-statistic compares the residual sum of squares computed with and without the restriction imposed.

Appendix: (f)

The Theory of Variance Inflation Factors (VIFs) and Tolerance

Variance Inflation Factors (VIFs) and Tolerance are two measures that can guide a researcher in identifying the level of multicollinearity between the regressors in the equation. VIFs show how mush of the variance of a coefficient estimate of a regressor has been inflated due to collinearity with other regressors. They can be calculated by simply dividing the variance of a coefficient estimate by the variance of that coefficient has other regressors not been included in the equation.

Suppose the variance of the OLS estimator to a typical regression coefficient (say β_i) can be shown in the following way [Wooldridge (2000), Chapter 3 Appendix for proof].

$$Var(\hat{\beta}_i) = \frac{\sigma^2}{S_{ii}(1-R_i^2)}$$

Where $S_{ii} = \sum_{j=1}^{n}(X_{ij} - \overline{X})^2$ and R_i^2 is the unadjusted R^2 when we regress X_i against all the other explanatory variables in the model, that is, against a constant, $X_2, X_3, \ldots\ldots, X_{i-1}, X_{i+1}, \ldots\ldots, X_k$. Suppose there is no linear relation between X_i and the other explanatory variables in the model. Then R_i^2 will be zero and the variance of $\hat{\beta}_i$ will be σ^2 / S_{ii}. Dividing this into the above expression for $Var(\hat{\beta}_i)$, we obtain variance inflation factor.

$$Var(\hat{\beta}_i) = \frac{1}{1-R_i^2} \qquad \text{Tolerance } (\hat{\beta}_i) = 1/\text{VIF} = 1 - R_i^2$$

It is readily seen that the higher VIF or lower tolerance index, the higher the variance of $\hat{\beta}_i$ and the greater the chance of finding β_i insignificant, which means that severe multicollinearity effects are present. Thus, these measures can be useful in identifying multicollinearity.

Appendix: (g)

The Theory of White's (1980) general Heteroskedasticity Test

The White's (1980) test or sometime called White's General Heteroskedasticity test is a test of the null hypothesis of no heteroskedasticity against heteroskedasticity of unknown, general form. The test statistic is computed by an auxiliary regression, where we regress the squared residuals on all possible cross product of the regressors. For example, we estimate the following regression:

$$Y_t = \beta_1 + \beta_2 X_t + \beta_3 Z_t + \varepsilon_t$$

Where β is the estimated parameters and ε_t is residuals. The test statistic is based on the following auxiliary regression:

$$\varepsilon_t^{\ 2} = \alpha_0 + \alpha_1 X_t + \alpha_2 Z_t + \alpha_3 X_t^{\ 2} + \alpha_4 Z_t^{\ 2} + \alpha_5 X_t Z_t + \upsilon_t$$

Based on the above auxiliary regression, White's test statistics can be computed as the number of observations times the centered R^2 from the test regression. White's test statistics is asymptotically distributed that follows χ^2 with the degrees of freedom equal number of slope coefficients in the test regression.

Suitability:

1. It can be used to test model misspecification.
2. This test is suitable for larger data sets.
3. This test doesn't assume that the data sets are normally distributed.
4. This test is more robust than any other heteroskedasticity test like "The Goldfeld-Quant Test" or The Bruesch-Pegan Test".

Appendix: (h)

The Theory of Ramsey's (1969) RESET Test

Ramsey (1969) has proposed a general test of specification error called RESET which stands for regression specification error test. The classical normal regression model can be specified as:

$$y = X\beta + \varepsilon \text{ ....(i)}$$

Where the disturbance vector ε is presumed to follow the multivariate normal distribution $N(0,\sigma^2 I)$. Specification error is an omnibus term which covers any departure from the assumption of the maintained model. Serial correlation, heteroskedasticity, or normality of all violate the assumption that the disturbances are distributed $N(0,\sigma^2 I)$. Ramsey's RESET is a general test for the following types of specification errors:

- ✓ Omitted Variables; X doesn't include all relevant variables.
- ✓ Incorrect functional form; some or all of the variables in *y* and X should be transformed to logs, powers, reciprocals, or in some other way.
- ✓ Correlation between X and ε, which may be caused, among other things, by measurement errors in X, simultaneity, or the presence of lagged *y* values and serially correlated disturbances.

Under such specification errors, least square (LS) estimators will be biased and inconsistent, and conventional inference procedures will be invalidated. Ramsey (1969) showed that any or all of these specification errors produce a non-zero mean vector for ε. Therefore, the null and alternative hypotheses of the RESET test are:

$$\begin{aligned} H_0 &: \varepsilon \sim (0,\sigma^2 I) \\ H_1 &: \varepsilon \sim (\mu,\sigma^2 I) \end{aligned} \quad \text{where } \mu \neq 0 \text{ ....(ii)}$$

The test is based on an augmented regression:

$$y = X\beta + Z\gamma + \varepsilon \text{ ....(iii)}$$

The test of specification error evaluates the restriction $\gamma = 0$. The crucial question in constructing the test is to determine what variables should enter the Z matrix. In this case Z matrix may, for example, be comprised of variables that are not in the original specification, so that the test of $\gamma = 0$ is simply the omitted variables test described above.

In testing for incorrect functional form, the non-linear part of the regression model may be some function of the regressors included in X. for example, a linear relation,

$$y = \beta_0 + \beta_1 X + \varepsilon \text{ ....(iv)}$$

is specified instead of true relation:

$$y = \beta_0 + \beta_1 X + \beta_2 X^2 + \varepsilon \text{ ....(v)}$$

The augmented model has $Z = X^2$ and we are back to the omitted variable case. A more general example might be specification of n additive relation,

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \text{ ....(vi)}$$

Instead of the (true) multiplicative relation:

$$y = \beta_0 X^{\beta_1}{}_1 X^{\beta_2}{}_2 + \varepsilon \text{ ....(vii)}$$

A Taylor series approximation of the multiplicative relation would yield an expression involving powers and cross-products of the explanatory variables. Ramsey's suggestion is to include powers of the predicted values of the dependent variables (which are, of course, linear combinations of powers and cross-product terms of the explanatory variables) in Z :

$$Z = [\hat{y}^2, \hat{y}^3, \hat{y}^4 \text{ ....}] \text{ ....(viii)}$$

Where $\hat{y}$ is the vector of the fitted values from the regression of y on X. The superscripts indicate the power to which these predictions are raised. The first power is not included since it is perfectly collinear with the X matrix. Output from the test reports the test regression and the *F*- statistics and log likelihood ratio for testing the hypothesis that the coefficients on the powers of the fitted values are all zero.

Appendix: (i)

The Theory of Vector Autoregression (VAR) Test

The Vector Autoregression (VAR) Model is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series. It is a natural extension of the univariate autoregressive model to dynamic multivariate time series. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting. It often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model.

In addition to data description and forecasting, the VAR model is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks or innovations to specified variables on the variables in the model are summarized. These causal impacts are usually summarized with impulse response functions and forecast error variance decompositions.

Let $Y_t = (y_{1t}, y_{2t}, \ldots\ldots\ldots y_{nt})'$ denote an (nx1) vector of time series variables. the basic *p*-lag vector autoregressive (VAR(p)) model has the form:

$$Y_t = c + \prod_1 y_{t-1} + \prod_2 y_{t-2} + \cdots + \prod_p y_{t-p} + \varepsilon_t, t = 1, \ldots\ldots. T \quad \ldots\ldots \quad (1)$$

Where $\prod_i$ are (n x n) coefficient matrices and ε_t is an (n x 1) unobservable zero mean white noise vector process (serially uncorrelated or independent) with time invariant covariance matrix $\sum$. For example, a bivariate VAR(2) model equation by equation has the form:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2 \end{pmatrix} + \begin{pmatrix} \pi_{11}^{1} & \pi_{12}^{1} \\ \pi_{21}^{1} & \pi_{22}^{1} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} \quad \ldots\ldots\ldots(2)$$

$$+ \begin{pmatrix} \pi_{11}^{2} & \pi_{12}^{2} \\ \pi_{21}^{2} & \pi_{22}^{2} \end{pmatrix} \begin{pmatrix} y_{1t-2} \\ y_{2t-2} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} \quad \ldots\ldots\ldots\ldots..(3)$$

Or

$$y_{1t} = c_1 + \pi_{11}^{1} y_{1t-1} + \pi_{12}^{1} y_{2t-1} + \pi_{11}^{2} y_{1t-2} + \pi_{12}^{2} y_{2t-2} + \varepsilon_{1t}$$

$$y_{2t} = c_2 + \pi_{21}^{1} y_{1t-1} + \pi_{22}^{1} y_{2t-1} + \pi_{21}^{2} y_{1t-1} + \pi_{22}^{2} y_{2t-1} + \varepsilon_{2t}$$

Where $\operatorname{cov}(\varepsilon_{1t}, \varepsilon_{2s}) = \sigma_{12}$ for t = s; 0 otherwise. Here each equation has the same regressors – lagged values of y_{1t} and y_{2t}. Hence, the VAR(*p*) model is just a seemingly unrelated regression (SUR) model with lagged variables and deterministic terms as common regressors.

In lag operator notation, the VAR(*p*) is written as

$$\prod(L) Y_t = c + \varepsilon_t$$

Where $\prod(L) = I_n - \prod_1 L - \cdots - \prod_p L^p$. The VAR(*p*) is stable of the roots of

$$\det(I_n - \prod_{1^z} - \cdots - \prod_{p^{z^p}}) = 0$$

lie outside the complex unit circle (have modulus greater than one), or, equivalently, if the eigenvalues of the companion matrix have modulus less than one. Assuming that the process has been initialized in the infinite past, then a stable VAR(*p*) process is stationary and ergodic with time invariant means, variances, and autocovariances.

If Y_t in (1) is covariance stationary, then the unconditional mean is given by

$$\mu = (I_n - \prod_1 - \cdots - \prod_p)^{-1} c$$

The *mean adjusted* form of the VAR(*p*) is then

$$Y_t - \mu = \prod_1 (Y_{t-1} - \mu) + \prod_2 (Y_{t-2} - \mu) + \cdots + \prod_p (Y_{t-p} - \mu) + \varepsilon_t$$

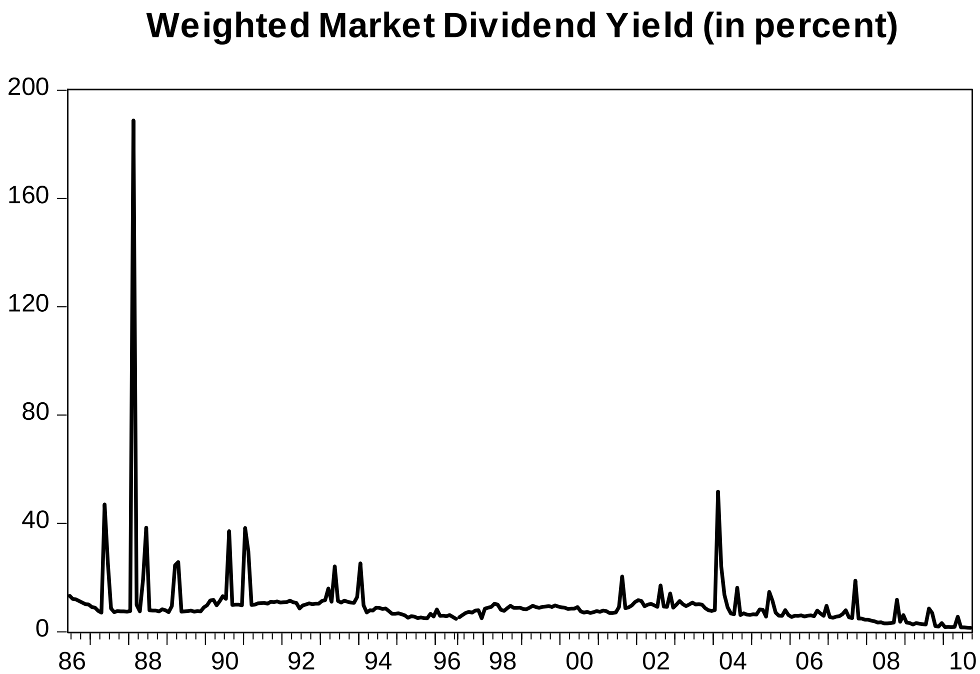
The basic VAR(*p*) model may be to restrictive to represent sufficiently he main characteristics of the data. In particular, other deterministic terms such as a linear time trend or seasonal dummy variables may be required to represent the data properly. Additionally, stochastic exogenous variables may be required as well. The general form of the VAR(*p*) model with deterministic terms and exogenous variables is given by

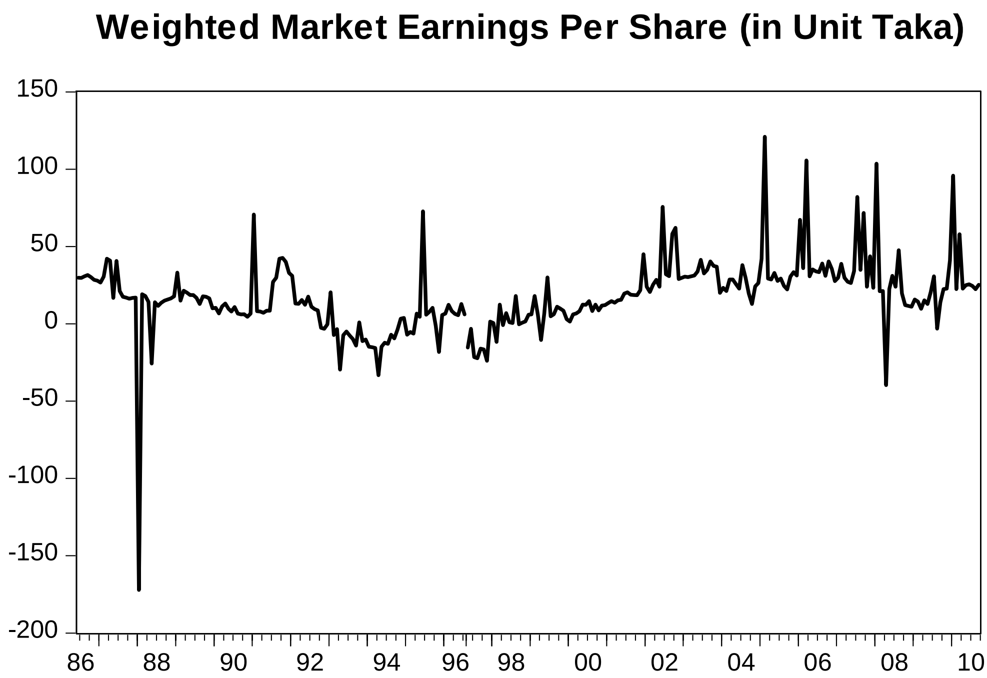
$$Y_t = \prod_1 Y_{t-1} + \prod_2 Y_{t-2} + \ldots \prod_p Y_{t-p} + \Phi D_t + GX_t + \varepsilon_t \text{ ....(4)}$$

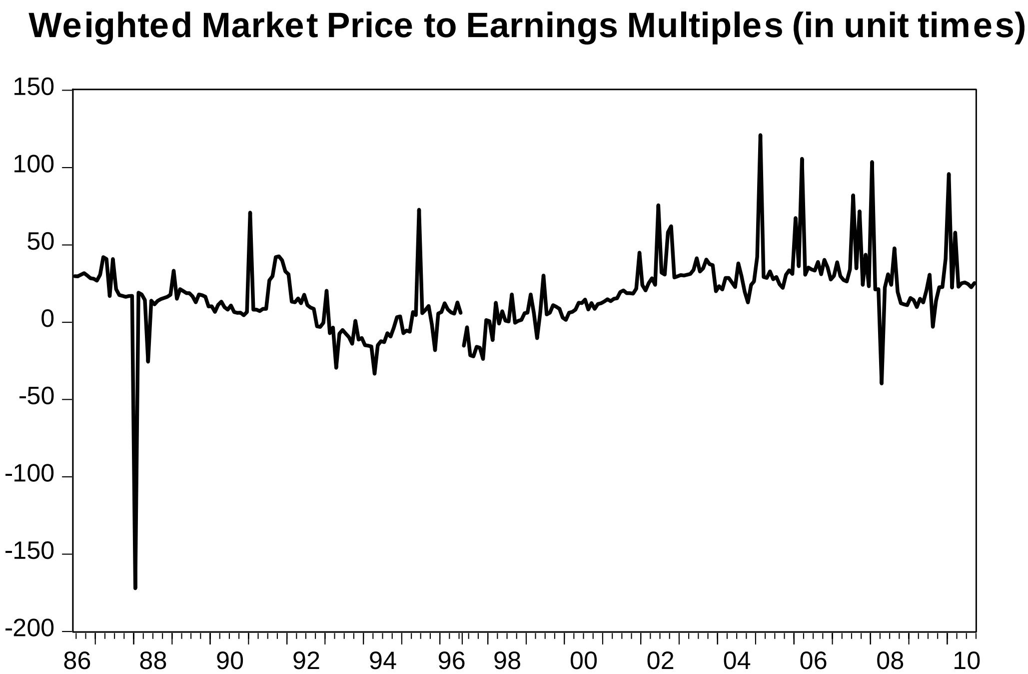
Where D_t represents an (l x 1) matrix of deterministic components, X_t represents an (m x 1) matrix of exogenous variables, and Φ and G are parameters.

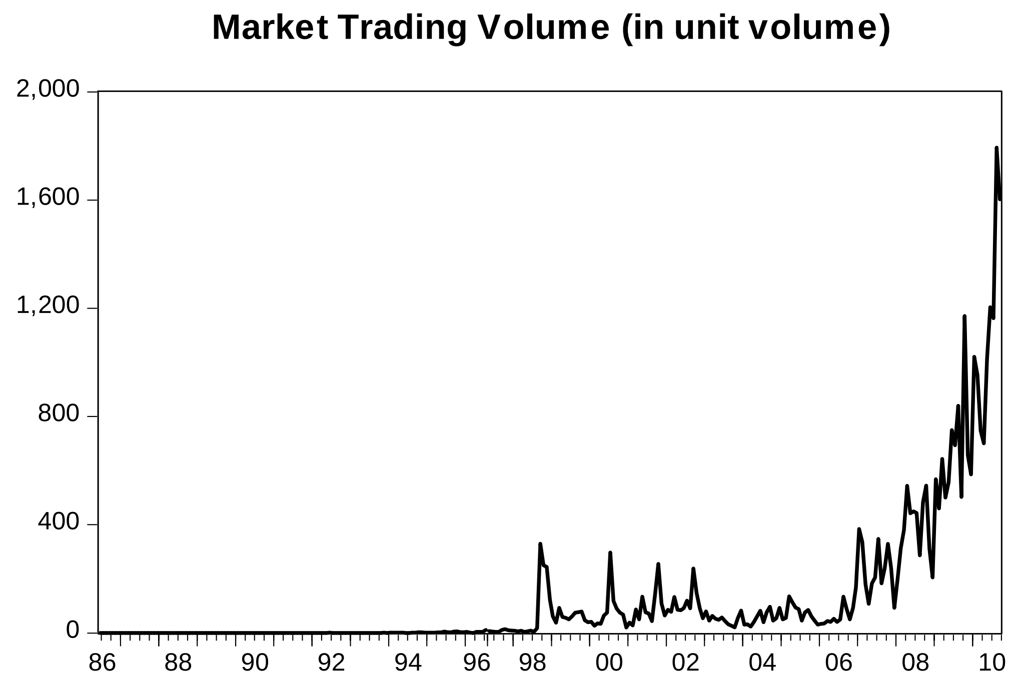
Appendix: (j)

Trend of Different Micro Variables



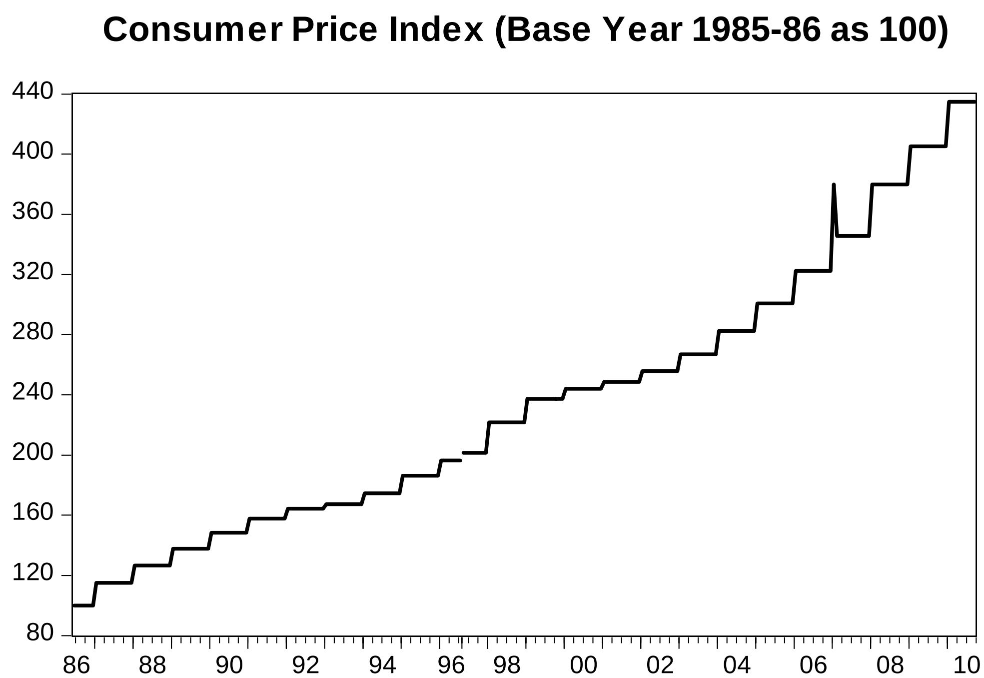

Weighted Market Earnings Per Share (in Unit Taka)
150
100
50
0
-50
-100
-150
-200
86
88
90
92
94
96
98
00
02
04
06
08
10


Weighted Market Price to Earnings Multiples (in unit times)
150
100
50
0
-50
-100
-150
-200
86
88
90
92
94
96
98
00
02
04
06
08
10



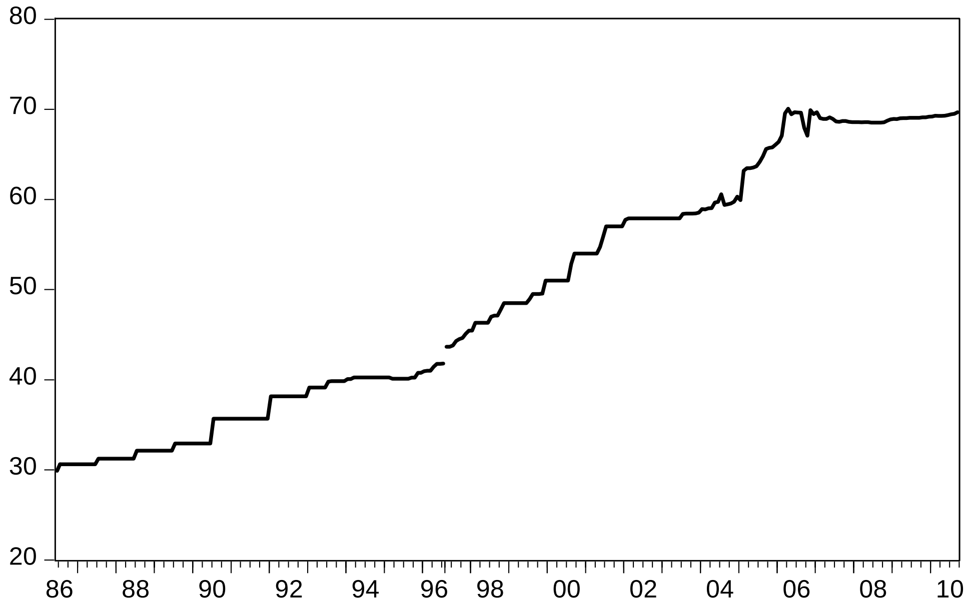
Appendix: (k)

Trend of Different Macro Variables

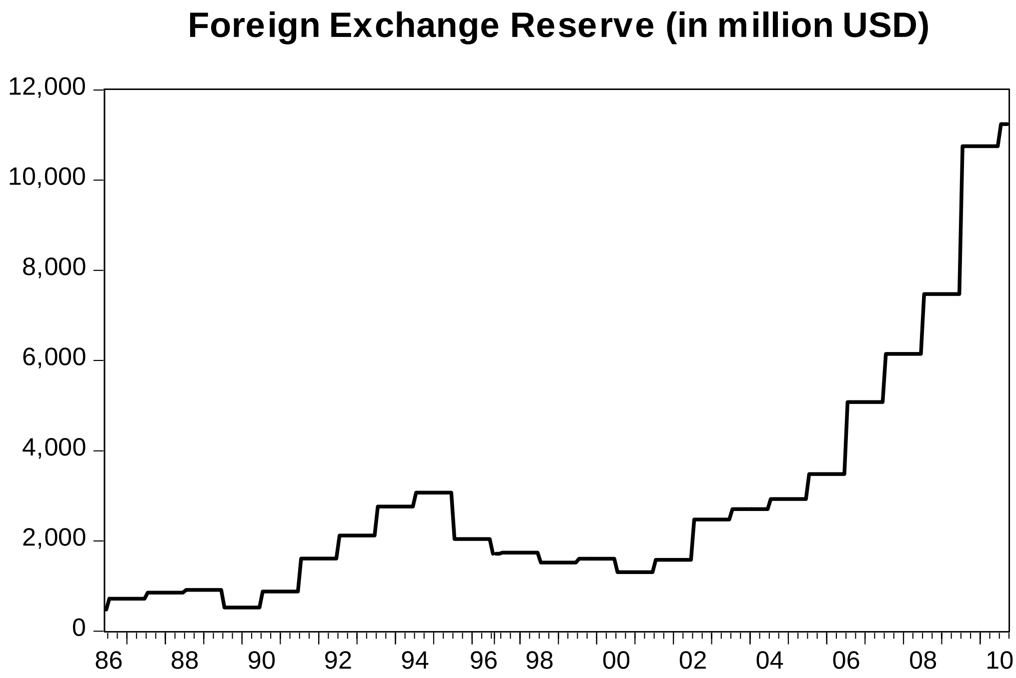


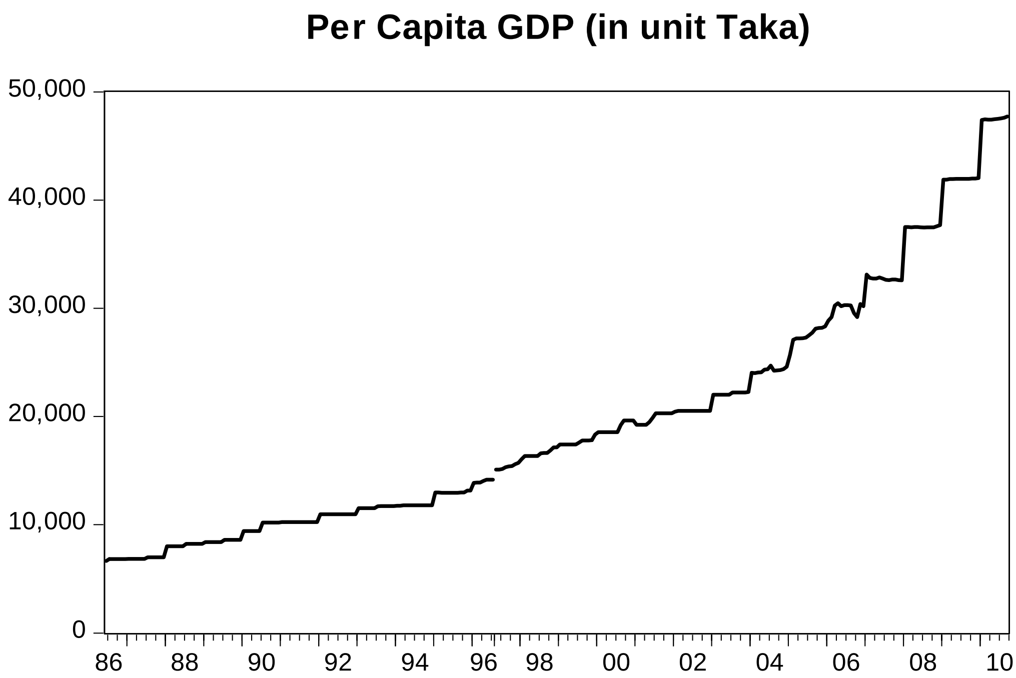
Deposit Interest Rate (in percent)

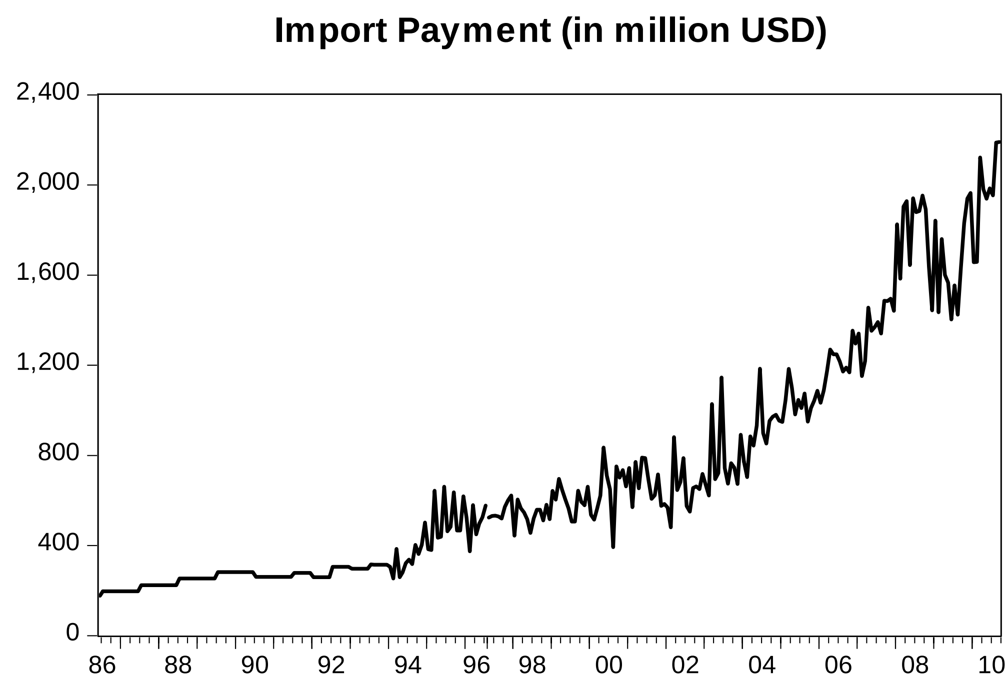
Foreign Exchange Rate (in unit Taka)

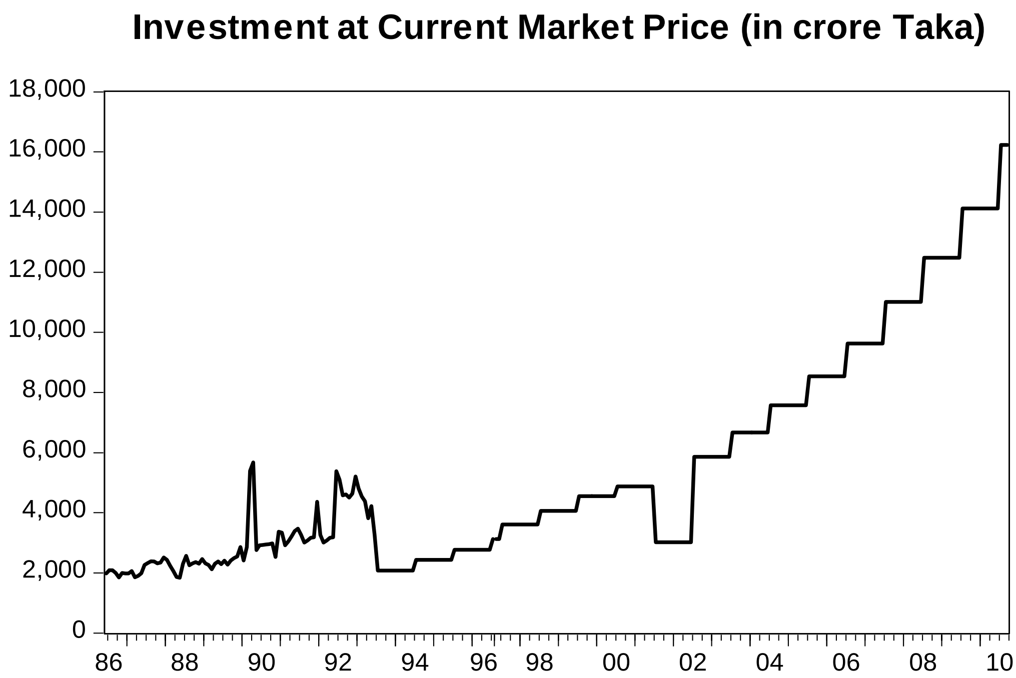


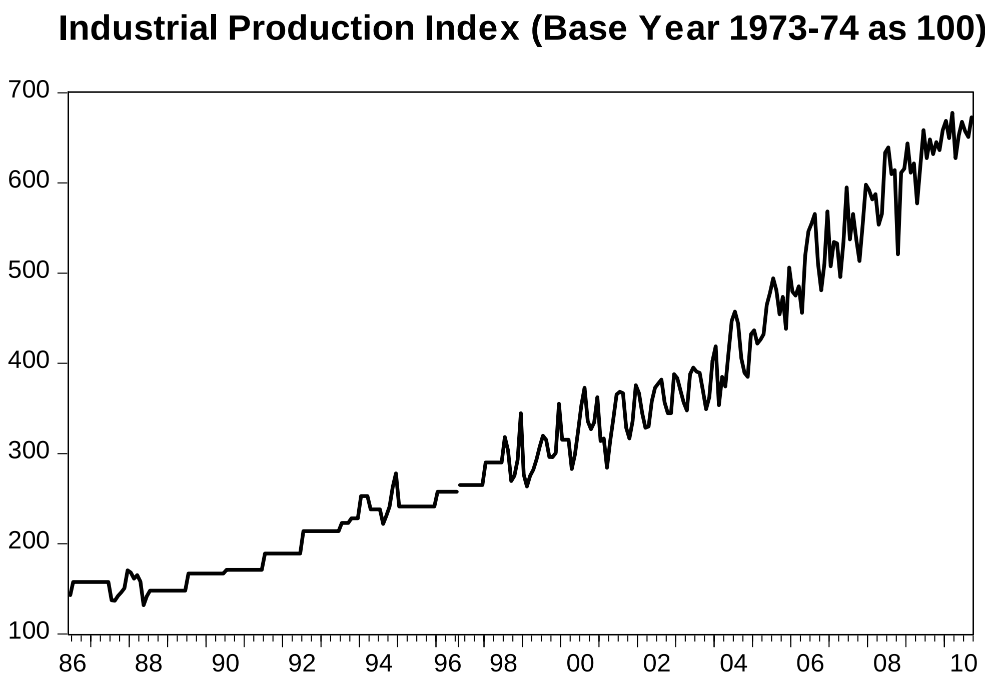

Export Receipt (in million USD)
2,000
1,600
1,200
800
400
0
86
88
90
92
94
96
98
00
02
04
06
08
10


Foreign Exchange Reserve (in million USD)
12,000
10,000
8,000
6,000
4,000
2,000
0
86
88
90
92
94
96
98
00
02
04
06
08
10

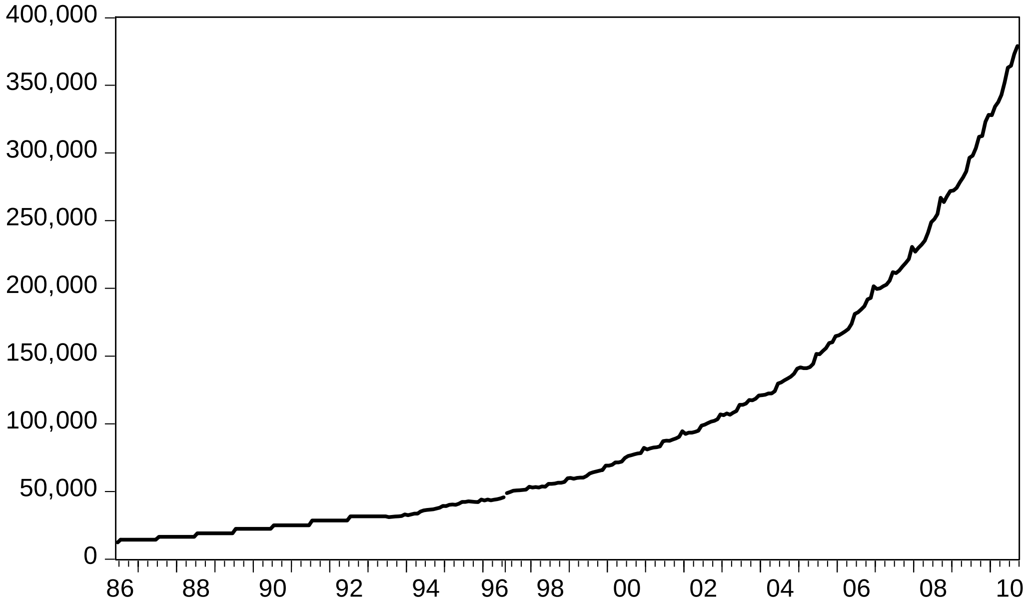

Per Capita GDP (in unit Taka)
50,000
40,000
30,000
20,000
10,000
0
86 88 90 92 94 96 98 00 02 04 06 08 10


Import Payment (in million USD)
2,400
2,000
1,600
1,200
800
400
0
86 88 90 92 94 96 98 00 02 04 06 08 10

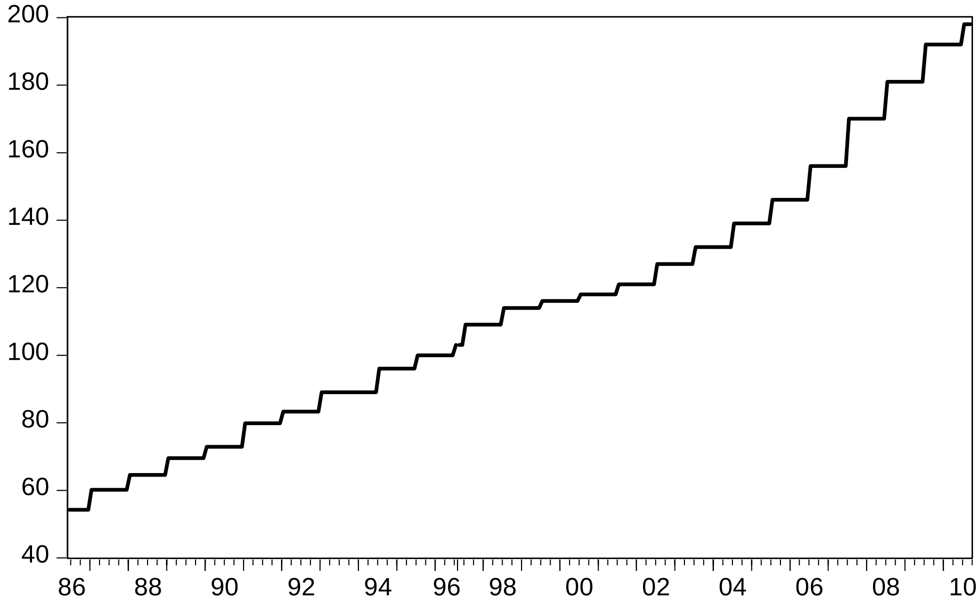

Investment at Current Market Price (in crore Taka)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
86
88
90
92
94
96
98
00
02
04
06
08
10


Industrial Production Index (Base Year 1973-74 as 100)
700
600
500
400
300
200
100
86
88
90
92
94
96
98
00
02
04
06
08
10

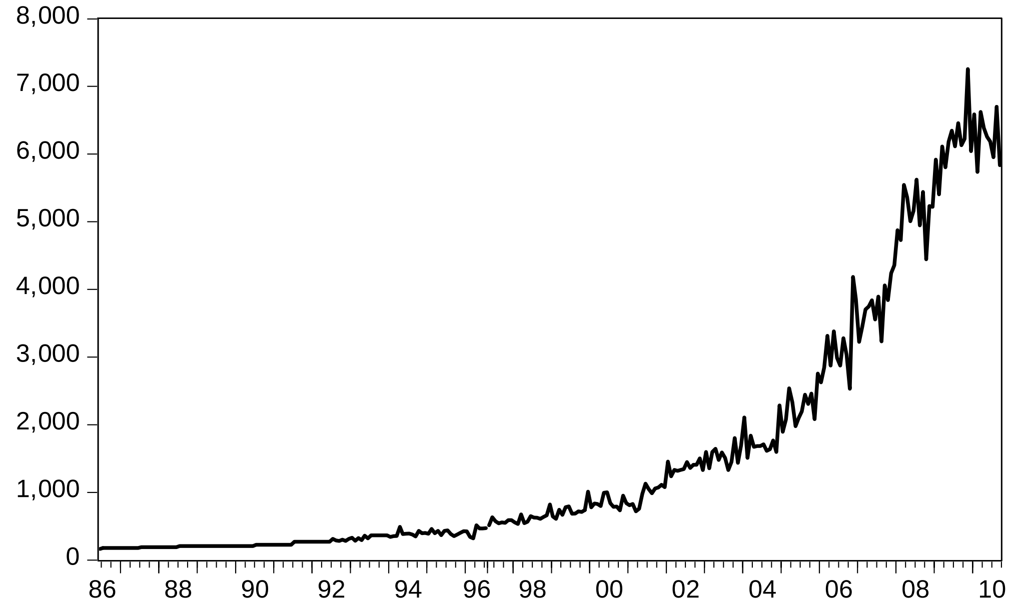
Broad Money Supply (M2) (in crore Taka)



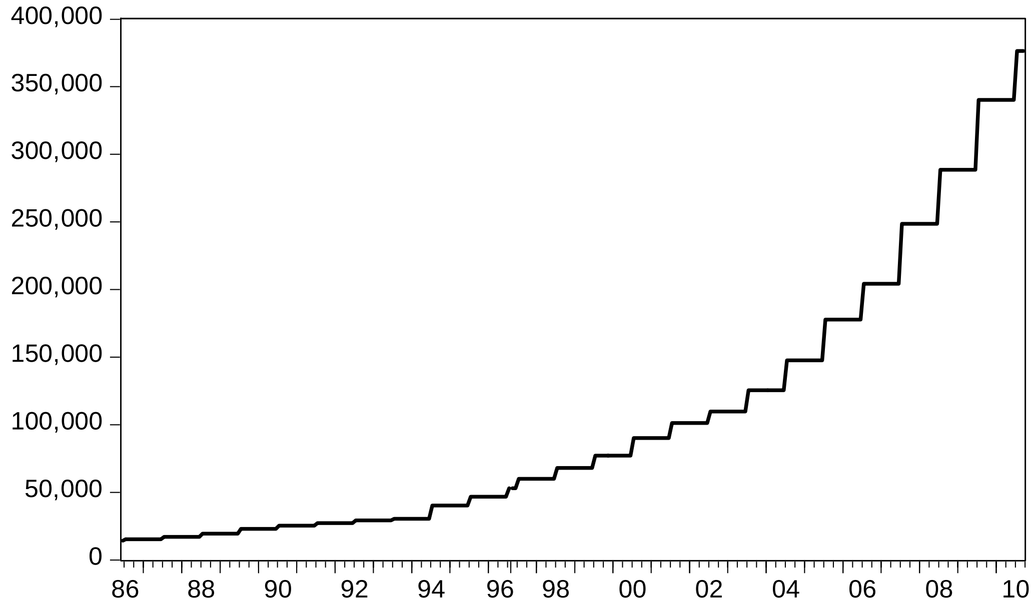
National Income Deflator (Base Year 1995-96 as 100)



Foreign Remittance (in crore Taka)



Total Domestic Credit (in crore Taka)



Appendix: (l)

Stationary Test Result between Stock Price and Segmented Micro Variables

Variables	Augmented Dickey Fuller Test				Phillips-Parron Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.020	1.00	-13.02	0.00	2.95	1.00	-13.74	0.00	I(1)	I(1)
FINCAP	4.308	1.0	-3.03	0.12	4.89	1.00	-14.3	0.00	I(1)	I(1)
FINDY	4.841	0.00	------	------	-11.41	0.00	------	------	I(0)	I(0)
FINEPS	-3.33	0.06	-16.99	0.00	-11.95	0.00	------	------	I(1)	I(0)
FINPE	-6.28	0.00	------	------	-8.52	0.00	------	------	I(0)	I(0)
MFCCAP	7.608	1.0	-1.02	0.93	8.27	1.0	-16.94	0.00	I(1)	I(1)
MFCDY	-15.70	0.00	------	----	-15.7	0.00	------	------	I(0)	I(0)
MFCEPS	-13.18	0.00	------	-----	-13.95	0.00	------	------	I(0)	I(0)
MFCPE	-10.92	0.00	------	-----	-10.92	0.00	------	------	I(0)	I(0)
MTV	7.22	1.00	-17.38	0.00	0.09	0.99	-27.56	0.00	I(1)	I(1)

Appendix: (m)

Stationary Test Result between Stock Price and Macro Variables

Variables	Augmented Dickey Fuller Test				Phillips-Parron Test				Order of Integration	
	I(0)		I(1)		I(0)		I(1)			
	t-stat	Prob.	t-stat	Prob.	Adj. t stat	Prob.	Adj. t stat	Prob.	ADF	PP
DSI	3.02	1.00	-13.02	0.00	2.95	1.00	-13.74	0.00	I(1)	I(1)
CPI	1.60	1.00	-3.87	0.01	-1.03	0.93	-28.03	0.00	I(1)	I(1)
DIR	-1.55	0.80	-19.65	0.00	-1.81	0.69	-19.42	0.00	I(1)	I(1)
EXR	-2.04	0.57	-16.5	0.00	-2.04	0.57	-16.58	0.00	I(1)	I(1)
EXRPT	0.11	0.99	-5.53	0.00	-5.36	0.00	-59.67	0.00	I(1)	I(1)
FXRES	-0.16	0.99	-3.37	0.05	1.15	0.99	-18.13	0.00	I(2)	I(1)
PCAPGDP	3.649	1.00	-3.07	0.11	1.37	1.00	-20.20	0.00	I(2)	I(1)
IMPMT	0.02	0.99	-6.89	0.00	-3.10	0.10	-59.93	0.00	I(1)	I(1)
INVMP	-0.40	0.98	-14.82	0.00	-0.35	0.98	-19.26	0.00	I(1)	I(1)
IPD	-0.24	0.99	-12.28	0.00	-4.38	0.00	-44.60	0.00	I(1)	I(1)
LIR	-1.99	0.59	-16.73	0.00	-2.93	0.15	-25.56	0.00	I(1)	I(1)
M2	4.10	1.00	-1.31	1.00	22.23	1.00	-18.58	0.00	I(1)	I(1)
NID	-0.62	0.97	-3.16	0.09	-0.65	0.97	-20.95	0.00	I(2)	I(1)
REMIT	-0.24	0.99	-18.95	0.00	-1.21	0.90	-39.65	0.00	I(1)	I(1)
TDC	1.27	1.00	-2.43	0.35	2.41	1.00	-21.36	0.00	I(2)	I(1)

Appendix: (n)

Market Statistics of Chittagong Stock Exchange

Year	Turnover (in crore Tk.)	No. of Listed Securities	Initial Public Offering (IPO)	Issued Capital (in Crore Tk.)	Market Capitalization (in crore Tk.)	Cash Dividend
2000	1293.38	165	3	2726.6	5776.55	138.88
2001	1479.62	177	9	2965.27	5636.35	139.21
2002	1358.61	185	9	3107.99	6046.77	140.45
2003	668.86	199	10	4196.76	8531.23	141.35
2004	1755.13	195	3	4697.87	21501.08	142
2005	1404.27	210	16	5551.93	21994.28	149
2006	1589.31	213	6	6937.84	27051.07	145
2007	5259.03	227	13	8917.39	61258	142
2008	9980.37	238	12	12160.32	80768.4	149
2009	16256.26	217	18	15512.49	147080.7	151
2010	21520.4	232	18	20111.56	253439.33	150
2011	18633.8	214	6	32212.9	197242.3	152

Appendix: (o)

Descriptive Statistics of Weighted Market Micro Variables

	WMKTCAP	WMKTDY	WMKTEPS	WMKTPE
Mean	105817.6	9.328569	18.98271	22.63626
Median	29764.20	8.220621	20.39230	18.30656
Maximum	1330840.	122.2119	96.54429	100.0585
Minimum	2248.693	1.426000	-101.2442	6.182270
Std. Dev.	219334.3	8.484211	20.82950	13.23476
Skewness	3.549618	9.106778	-0.608594	2.223465
Kurtosis	16.35421	114.5834	9.872144	10.19262
Jarque-Bera	2697.155	150727.9	574.3475	843.2105
Probability	0.000000	0.000000	0.000000	0.000000
Sum	29946369	2639.985	5372.106	6406.061
Sum Sq. Dev.	1.36E+13	20298.88	122350.8	49394.79
Observations	283	283	283	283

Appendix: (p)

Descriptive Statistics of Segmented Micro Variables

	FINCAP	MFCCAP	FINDY	MFCDY	FINEPS	MFCEPS	FINPE	MFCPE	MTV
Mean	93968.12	113717.2	7.077614	10.82921	39.92643	5.020220	19.14027	24.96691	119.6771
Median	9032.782	40463.00	6.764000	8.554752	35.13857	3.308280	11.88000	21.44520	26.84039
Maximum	1115622.	1474319.	45.83290	196.3065	233.1536	142.1026	156.6150	142.3857	1793.431
Minimum	581.4500	3351.895	0.730000	1.890000	-84.30636	-184.2337	-12.96048	4.012581	0.001000
Std. Dev.	192691.1	241550.7	3.924243	13.66820	35.62021	22.84045	21.54401	16.92184	251.9547
Skewness	2.946808	3.848965	3.697961	9.745967	1.223219	-2.292603	2.497724	2.846996	3.488349
Kurtosis	12.54486	18.19602	36.02131	124.2640	9.395636	32.37518	11.01893	15.01484	17.28646
Jarque-Bera	1483.852	3421.672	13502.71	177876.0	552.9020	10422.95	1052.498	2084.506	2980.665
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	283	283	283	283	283	283	283	283	283

Appendix: (q)

Descriptive Statistics of Macro Variables

	CPI	DIR	EXR	EXRPT	FXRES	PCAPGDP	IMPMT	INVMP	IPD	LIR	M2	NID	REMIT	TDC
Mean	234.25	7.66	49.42	514.59	2864.5	19445.30	713.22	5468.4	329.36	13.149	96836.4	113.9	1535.5	10268
Median	221.73	7.90	48.50	417.93	2039.0	17134.57	570.20	4063.1	290.08	12.970	59349.0	114.0	659.26	68003
Maximum	434.84	9.98	70.05	1822.5	11240	47719.07	2190.6	16232	677.84	15.230	379096.	198.0	7259.2	376548
Minimum	100.00	4.86	29.88	75.748	476.00	6669.083	177.16	1839.1	131.81	9.9100	12338.0	54.19	161.67	14182
Std. Dev.	88.953	1.46	13.61	410.30	2538.9	10830.51	510.72	3635.0	155.20	1.3193	90622.6	38.14	1835.3	95031
Skewness	0.5710	-0.41	0.168	1.0625	1.8727	0.956775	1.1352	1.1692	0.7110	-0.2822	1.32859	0.440	1.5453	1.2393
Kurtosis	2.4208	1.83	1.579	3.3090	5.9683	3.035312	3.3250	3.3193	2.3675	2.4009	3.85365	2.338	4.1759	3.5288
Jarque-Bera	19.336	23.9	25.12	54.380	269.31	43.19195	62.034	65.687	28.564	7.9878	91.8492	14.29	128.93	75.741
Probability	0.0000	0.00	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0184	0.00000	0.000	0.0000	0.0000
Observation	283	283	283	283	283	283	283	283	283	283	283	283	283	283