

# **Investor Sentiment and Stock Price Volatility in Bangladesh**

By

**Samina Haque**

A DISSERTATION

Submitted in partial fulfillment of the requirements for the degree of

**DOCTOR OF PHILOSOPHY**

under the Department of Finance, Faculty of Business Studies,  
University of Dhaka

September, 2020

Dhaka, Bangladesh

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Supervisor

M. Sadiqul Islam, *Ph.D.*

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## **Dedication**

I dedicate this thesis to my beloved mother Ms. Shoheli Hoq. This would never be possible without her unconditional love and interminable faith in me.

## Certification

September 2020

I hereby certify that the Ph.D. thesis titled “Investor Sentiment and Stock Price Volatility in Bangladesh” submitted by Ms. Samina Haque under the Department of Finance, University of Dhaka is a record of trustworthy research work. She conducted the research work and prepared the thesis under my supervision. In my opinion, the thesis is original and has fulfilled the criteria for the award of the degree of Doctorate of Philosophy (PhD) in accordance with the rules and regulations of the University of Dhaka. The results embodied in her thesis have not been submitted elsewhere for the award of any degree.

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## Declaration

I do hereby declare that I have prepared the thesis titled “Investor Sentiment and Stock Price Volatility in Bangladesh” under the Department of Finance, Faculty of Business Studies, University of Dhaka in partial fulfillment of the requirement for the Degree of Doctor of Philosophy.

I also declare that the research has been carried out by me under the supervision of Professor Dr. M. Sadiqul Islam, Department of Finance, Faculty of Business Studies, University of Dhaka. To the best of my knowledge, belief and confidence, the thesis does not contain any materials previously written or published by any other person(s) except the duly incorporated references. It was made ready for submission after making the plagiarism test through a special software.

The thesis has not been submitted to any universities/institutions for any other degree.

Dhaka, Bangladesh  
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## **Abstract**

Although investor sentiment was ignored in the past, its importance was gradually felt after 1990, as the fundamental asset pricing theory was unable to explain actual market anomalies. During that time, the researchers were in search for an explanation, as a result the term investor sentiment emerged. Despite the skepticism regarding the acceptability of investor sentiment, empirical evidence shows that investor sentiment does influence the expected market returns and volatility. Therefore, it is important to find out whether such impact of investor sentiment exists in Bangladesh stock market as well. Bangladesh capital market has gone through many ups and down in the last 30 years. Within a very short span of time this market has experienced two major bubbles and bursts. The severity of these two incidents taught us how important it is to model stock market volatility with appropriate prediction power. Considering its importance, the major objectives of this study are to identify (1) the impact of investor sentiment on the stock market return and conditional volatility, (2) the leverage effect of investor sentiment on conditional volatility, which means positive and negative return shocks have different impacts on conditional volatility and (3) the asymmetric property of conditional volatility, that is to say, earning shocks have more influence on conditional volatility when sentiment is high compared to that of low sentiment periods. In this study, GARCH-M model and GJR-TGARCH model have been applied. The study is based on three individual sentiment proxies, namely, the change in trade volume per security ( $\Delta TVOL$ ), change in closed-end fund discount ( $\Delta CEFD$ ) and change in modified relative strength index ( $\Delta MRSI$ ). Based on weekly data for the period between 1990 and 2018, this study finds that investor sentiment has significant impact on excess market return in Bangladesh stock market. Secondly, an inverse relationship between market variance and excess market return is found. Thirdly, there is a strong evidence of volatility persistence effect in Bangladesh stock market. This means that the volatility takes a long time to perish following a certain incident that triggers market volatility. Fourthly, negative leverage effect is also found in this market. That is, negative shock is more likely to push volatility upward as opposed to positive shock of similar magnitude. Lastly, the asymmetric impact of sentiment is found significant in both bull and bear market. The study attempts to forecast market volatility which is crucial to formulate optimum investment strategies. Therefore, this research is expected to be useful to retail investors, institutional investors, professional investment analysts, the market regulators and the policy makers in forecasting the direction of the market.

## **Table of Contents**

<b>Contents</b>	<b>Page No.</b>
<b>Dedication</b> ... ..	<b>i</b>
<b>Certification</b> ... ..	<b>ii</b>
<b>Declaration</b> ... ..	<b>iii</b>
<b>Acknowledgement</b> ... ..	<b>iv</b>
<b>Abstract</b> ... ..	<b>vii</b>
<b>Table of Contents</b> ... ..	<b>ix</b>
<b>List of Figures</b> ... ..	<b>xiv</b>
<b>List of Tables</b> ... ..	<b>xvi</b>
<b>List of Abbreviations</b> ... ..	<b>xviii</b>
<b>Chapter # 1</b>	
<b>1. Introduction</b> ... ..	<b>1</b>
1.1 Background ... ..	2
1.2 Objectives of the Study ... ..	2
1.3 Motivation of the Study ... ..	2
1.4 Contributions of the Research ... ..	5
1.5 Structure of the Thesis ... ..	7
<b>Chapter # 2</b>	
<b>2. Literature Review and Research Questions...</b> ... ..	<b>9</b>
2.1 Literature Review on Models used for Investor Sentiment, Stock Market Return and Volatility ... ..	10
2.2 Literature Review on Proxies of Investor Sentiment... ..	16
2.3 Research Questions ... ..	24
<b>Chapter # 3</b>	
<b>3. Methodology</b> ... ..	<b>26</b>
3.1 Research Design ... ..	27
3.2 Estimated Variables ... ..	32
3.2.1 Market Index ... ..	32
3.2.2 Excess Market Return ... ..	33
3.2.3 Stock Market Volatility ... ..	33
3.3 Sentiment Proxies ... ..	34
3.3.1 Change in Trading Volume per Security ... ..	35

<b>Contents</b>	<b>Page No.</b>
3.3.2 Change in Closed-end Fund Discount... ..	35
3.3.3 Change in Modified Relative Strength Index... ..	36
3.4 Data ... ..	38
3.5 Robustness Check ... ..	38
3.6 Diagnostic Tests ... ..	39
<b>Chapter # 4</b>	
<b>4. Securities Market in Bangladesh ... ..</b>	<b>40</b>
4.1 Historical Background of Securities Market in Bangladesh ... ..	41
4.2 Institutional Framework ... ..	42
4.2.1 The Bangladesh Securities and Exchange Commission ... ..	42
4.2.2 The Dhaka Stock Exchange... ..	43
4.2.3 The Chittagong Stock Exchange ... ..	44
4.2.4 The Central Depository Bangladesh Limited... ..	45
4.2.5 Merchant Banks ... ..	46
4.2.6 Asset Management Companies ... ..	46
4.2.7 Credit Rating Agencies ... ..	47
4.2.8 Fund Managers ... ..	47
4.3 Legal Framework ... ..	47
4.3.1 The Securities and Exchange Commission Rules and Regulations... ..	47
4.3.2 The Central Depository Bangladesh Limited Regulations ... ..	60
4.3.3 The Dhaka Stock Exchange Regulations ... ..	61
4.4 Growth of the Securities Market in Bangladesh ... ..	66
4.5 Capital Market Indicators ... ..	68
4.5.1 Market Capitalization to GDP Ratio ... ..	68
4.5.2 Share Price Index ... ..	70
4.5.3 IPO Issues ... ..	72
4.5.4 Capital Raised through IPOs ... ..	73
4.5.5 Average First-day Return on IPOs ... ..	74
4.5.6 Market P/E Ratio ... ..	75
4.5.7 Sector-wise Market Capitalization ... ..	76
4.5.8 Comparison of Market Cap. to GDP ratio of selected countries ... ..	77

<b>Contents</b>	<b>Page No.</b>
<b>Chapter # 5</b>	
<b>5. Stock Market Bubbles in Bangladesh</b> ... ..	<b>79</b>
5.1 International Scenario of Bubble and Burst ... ..	80
5.2 Stock Market Bubbles of Selected Countries ... ..	82
5.2.1 Stock Market Bubble in India, January 2008 ... ..	82
5.2.2 Stock Market Bubble in Sri Lanka, September 2007 ... ..	82
5.2.3 Stock Market Bubble in Japan, December 1989 ... ..	83
5.2.4 Stock Market Bubble in China, October 2007 ... ..	83
5.2.5 Stock Market Bubble in Saudi Arabia, February 2006 ... ..	84
5.2.6 Stock Market Bubble in the USA, March 2000 ... ..	85
5.2.7 Stock Market Bubble in Bangladesh, November 1996 ... ..	86
5.2.8 Stock Market Bubble in Bangladesh, December 2010 ... ..	87
5.3 Market Indicators during stock market bubbles in Bangladesh ... ..	90
5.3.1 Stock Market Index ... ..	90
5.3.2 Transaction Volume ... ..	92
5.3.3 Market Capitalization ... ..	93
5.3.4 Market Volatility ... ..	95
5.3.5 Capital Raised through IPOs ... ..	96
5.3.6 Number of IPOs and Average First-day Return on IPOs ... ..	98
<b>Chapter # 6</b>	
<b>6. Empirical Results and Discussion</b> ... ..	<b>101</b>
6.1 Summary Statistics and Empirical findings for the entire study period...	102
6.1.1 Summary Statistics for the entire study period ... ..	102
6.1.2 Correlation among the key variables for the entire study period ...	105
6.1.3 Results of Base-line model with three sentiment proxies ...	105
6.1.4 Results of Base-line model with one sentiment proxy ... ..	110
6.2 Summary Statistics and Empirical Findings for the bubble periods... ..	113
6.2.1 Summary Statistics for the first bubble period ... ..	114
6.2.2 Correlation among the key variables for the first bubble period...	116
6.2.3 Results of the first bubble period ... ..	117
6.2.4 Summary Statistics for the second bubble period... ..	120
6.2.5 Correlation among the key variables for the second bubble period...	122

<b>Contents</b>	<b>Page No.</b>
6.2.6 Results of the second bubble period ... ..	123
6.3 Robustness Check ... ..	126
6.3.1 Summary Statistics for the first sub-period ... ..	126
6.3.2 Correlation among the key variables for the first sub-period ...	128
6.3.3 Results of the first sub-period ... ..	129
6.3.4 Summary Statistics for the second sub-period .....	131
6.3.5 Correlation among the key variables for the second sub-period ...	133
6.3.6 Results of the second sub-period ... ..	134
6.4 Discussion ... ..	136
<b>Chapter # 7</b>	
<b>Conclusion</b> ... ..	<b>138</b>
<b>List of References</b> ... ..	<b>141</b>
<b>Appendix</b> ... ..	<b>147</b>

# List of Figures



<b>Figures</b>	<b>Page No.</b>
Figure 4.1: Year-wise Market Capitalization to GDP Ratio ... ..	69
Figure 4.2: Year-wise Stock Price Indices ... ..	70
Figure 4.3: Year-wise Number of IPOs ... ..	72
Figure 4.4: Year-wise IPO Volume ... ..	73
Figure 4.5: Year-wise Average First-day Return on IPO ... ..	74
Figure 4.6: Year-wise Market P/E Ratio ... ..	75
Figure 4.7: Sector-wise Market Capitalization ... ..	76
Figure 5.1: Indices of Selected Countries during the time of Bubble ... ..	81
Figure 5.2: All Share Price Index during Stock Market Bubble 1996 ... ..	86
Figure 5.3: DGEN Index during Stock Market Bubble 2010 ... ..	88
Figure 5.4: Daily Index during Stock Market Bubble of 1996 ... ..	90
Figure 5.5: Daily Index during Stock Market Bubble of 2010 ... ..	91
Figure 5.6: Transaction Volume during Stock Market Bubble of 1996 ... ..	92
Figure 5.7: Transaction Volume during Stock Market Bubble of 2010 ... ..	93
Figure 5.8: Market Capitalization during Stock Market Bubble of 1996 ... ..	94
Figure 5.9: Market Capitalization during Stock Market Bubble of 2010 ... ..	94
Figure 5.10: Market Volatility during Stock Market Bubble of 1996 ... ..	95
Figure 5.11: Market Volatility during Stock Market Bubble of 2010 ... ..	96
Figure 5.12: IPO Volume during Stock Market Bubble of 1996 ... ..	97
Figure 5.13: IPO Volume during Stock Market Bubble of 2010 ... ..	98
Figure 5.14: Number of IPOs during Stock Market Bubbles of Bangladesh... ..	99
Figure 5.15: Average First-day Return on IPO during Stock Market Bubbles of Bangladesh... ..	100

# List of Tables

<b>Tables</b>	<b>Page No.</b>
Table 4.1: Market Capitalization to GDP Ratio in Selected Countries ... ..	77
Table 5.1: Bubble episodes of selected stock markets ... ..	80
Table 5.2: IPO scenario during Stock Market Bubbles ... ..	98
Table 6.1: Summary Statistics for the period 1990-2018 ... ..	104
Table 6.2: Correlation among the key variables for the period 1990-2018 ... ..	105
Table 6.3: Base-line models with three sentiment proxies for the period 1990-2018 ... ..	107
Table 6.4: Base-line models with one sentiment proxy (MRSI) for the period 1990-2018... ..	112
Table 6.5: Summary Statistics during the first bubble period... ..	115
Table 6.6: Correlation among the key variables during the first bubble period... ..	117
Table 6.7: Models for the first bubble and burst period (1993-1998) ... ..	119
Table 6.8: Summary Statistics during the second bubble period ... ..	121
Table 6.9: Correlation among the key variables during the second bubble period ... ..	122
Table 6.10: Models for the second bubble and burst period (2008-2013) ... ..	124
Table 6.11: Summary Statistics during the first sub-period ... ..	127
Table 6.12: Correlation among the key variables during the first sub-period... ..	129
Table 6.13: Models for robustness check during the first Sub-period (1990-2004) ... ..	130
Table 6.14: Summary Statistics during the second sub-period ... ..	132
Table 6.15: Correlation among the key variables during the second sub-period... ..	134
Table 6.16: Models for robustness check during the second Sub-sample (2004-2018) ... ..	135
<b>Table A.1: Year-wise Stock Market Indicators ... ..</b>	<b>148</b>
<b>Table A.2: Monthly Stock Market Indicators during Market Bubble of 1996 ... ..</b>	<b>149</b>
<b>Table A.3: Monthly Stock Market Indicators during Market Bubble of 2010 ... ..</b>	<b>150</b>
<b>Table A.4: Market Cap. to GDP Ratio of Selected Countries (1990-2003) ... ..</b>	<b>151</b>
<b>Table A.5: Market Cap. to GDP Ratio of Selected Countries (2004-2018) ... ..</b>	<b>151</b>

# **List of Abbreviations**

AGM – Annual General Meeting

ARMS Index - A market indicator that shows the relationship between advancing and declining issues.

ARCH - Auto Regressive Conditional Heteroscedasticity

ARIMA - Auto-Regressive Integrated Moving Average

ASPI – All Share Price Index, Colombo

ASI – Saudi Arabian Stock Index

BO Account – Beneficiary Owner Account

BSI - Bombay Stock Index

BSEC - Bangladesh Securities and Exchange Commission

CAC40 - A benchmark French stock market index

CC - Consumer Confidence

CA/CL – Current Asset by Current Liability

CF - Cash Flow

CRSP - Centre for Research in Security Prices

CEFD – Closed-end fund discount

CSE – Chittagong Stock Exchange

CDBL - Central Depository Bangladesh Limited

CEO – Chief Executive Officer

CASPI – Chittagong All Share Price Index

CSE30 – CSE selected index

CSCX - CSE Selective Categories' Index

CSI - CSE Shariah Index

CSE50 – CSE 50 Index

CRO - Chief Regulatory Officer

CFO - Chief Financial Officer

CSE - Colombo Stock Exchange

CRR – Cash Reserve Ratio

CAPM – Capital Asset Pricing Model

DAX - A blue chip stock market index of Frankfurt Stock Exchange, Germany

DPS - Dividend per Share

DOW – Dow Jones Industrial Average  
DJIA – Dow Jones Industrial Average  
DSE - Dhaka Stock Exchange  
DSES – Dhaka Stock Exchange Sharia Index  
DSE X –Dhaka Stock Exchange Broad Index  
DP - Depository Participant  
DGENI – Dhaka Stock Exchange General Index  
ESI - Economic Sentiment Indicator  
EGARCH – Exponential generalized autoregressive conditional heteroskedasticity  
EGB2 - Exponential Generalized Beta-2  
EMR – Excess Market Return  
ETF - Exchange Traded Fund  
EU – European Union  
EMV – Estimated Market Volatility  
FTSE100 - The Financial Times Stock Exchange 100 Index for London Stock Market  
GARCH - Generalized Autoregressive Conditional Heteroskedasticity  
GARCH-M - Generalized Autoregressive Conditional Heteroskedasticity in mean  
GJR-GARCH - Glosten, Jagannathan and Runkles' Generalize Autoregressive Conditional Heteroskedasticity  
GM – General Manager  
GDP – Gross Domestic Product  
GP - Grameen Phone  
HANG SENG – Hong Kong Stock Market Index  
IPO – Initial Public Offering  
IMF – International Monetary Fund  
ISO – International Operation for Standardization  
IM test- Cameron & Trivedi's decomposition of Heteroskedasticity Test  
LM test – Lagrange Multiplier test for autoregressive conditional heteroskedasticity  
LSE - London Stock Exchange  
MTRIN – Modified Trading Index  
MRSI – Modified Relative Strength Index  
MPI – Global Multidimensional Poverty Index  
Min – Minimum  
Max – Maximum

NASDAQ – American Stock Market Index  
NYSE – New York Stock Exchange  
NIKKEI225 - Stock market index for the Tokyo Stock Exchange  
OTC - Over-the-Counter  
OEX – Symbol for Standard & Poor’s 100 index  
PCA – Principal Component Analysis  
PER – Price Earnings Ratio  
PCR – Put-call ratio  
PCO - Put-call open interest ratio  
PCV - Permanent Capital Vehicle  
ROA - Return on Asset  
RSI - Risk Sentiment Index  
SEC – Securities and Exchange Commission  
SLR – Statutory Liquidity Reserve  
SD – Standard Deviation  
SSE - Shanghai Stock Exchange  
S&P500 – American Stock Market Index  
SWARCH - Markov-Switching Autoregressive Conditional Heteroskedasticity  
TVOL – Trade Volume  
TREC – Trading Right Entitlement Certificate  
TC – Trading Certificate  
TGARCH - Threshold Generalized Conditional Heteroskedasticity  
TRIN - Trading Index  
TASI - Tadawul All Share Index  
VAR - Vector Autoregressive  
VAR-GARCH - Vector Generalized Autoregressive Conditional Heteroskedasticity  
WFE – The World Federation of Exchanges  
XU100 - The Borsa Istanbul 100 Index, Turkey

# **Chapter #1**

## **Introduction**



## **1.1 Background**

Investor sentiment had long been ignored in the past. However, its importance had been felt gradually when the fundamental theories were failing to explain many stock market anomalies across the globe. This called for looking at asset pricing from a different angle, as a result investor sentiment emerged as a significant factor contributing to the formation of asset prices. Moreover, from empirical studies, investor sentiment was found to have significant impact on both stock market return and market volatility. If sentiment is presumed to have significant impact on market volatility, overlooking sentiment would result in an inaccurate forecast of asset price and would lead to an ineffective investment strategy. Therefore, considering its importance, an attempt has been made in this study to identify the impact of investor sentiment on Bangladesh stock market return and volatility.

## **1.2 Objectives of the Study**

The major objectives of this research are:

- (a) To identify the impact of investor sentiment on both the stock market return and the conditional volatility.
- (b) To identify the negative leverage effect of earning shocks on conditional volatility.
- (c) To examine the asymmetric property of investor sentiment on market volatility.

## **1.3 Motivation of the Study**

Traditionally termed as “myth” by the classical economists, investor sentiment was unable to draw the attention of researchers prior to 1990. Researchers, during that time, had the preconceived idea that temporary discrepancy in pricing due to suboptimal investment decisions (caused by sentiment) would be balanced by aggressive arbitrageurs in no time. However, it was based on the assumption that financial markets are highly competitive, which is not the case for most of the financial markets. Consequently, this implication was gradually proven wrong with time, as it did not have much link with the actual historical trends. Researchers were in search for an explanation, as a result the term investor sentiment emerged. These researchers termed sentiment in many different ways. According to Karakatsani & Salmon (2008), investor sentiment is defined as the extent of optimism or pessimism that exists

in the market which cannot be justified by economic fundamentals. Baker and Wurgler (2006) defined sentiment as an expectation about future return and corresponding investment risk that is beyond the purview of economic fundamentals. According to Brown and Cliff (2004), sentiment is termed as the expectation regarding market return by the market participants. Considering the explanations of both classical and modern economists, it can be safely stated that stock price can be explained by two factors: fundamentals and investor sentiment. Fundamentals which is based on historical performance is reflected through different financial indicators. Here, the economic value is measured by the discounted value of future cash flows. While investor sentiment represents the unexplained part of asset price which is caused by investors' over and under reaction to a piece of information. (Baur et al. 1996)

The traditional asset-pricing theories of classical finance argue that asset prices are objective evaluation of expected future cash flows and there is no scope for investor sentiment to influence. According to these theories, a change in asset price is a result of any updates on future returns and interest rates (Zhang, 2008). An alternative approach widely regarded as behavioral finance, suggests instead that investor sentiment may significantly control investor's action and thereby affect asset prices in equilibrium. According to Zhang, (2008), this behavioral approach is linked to the noise trader model which states that noise unrelated to fundamentals, such as sentiment, may lead asset prices to diverge. This theory is based on the assumption that there are limits to arbitrage and investor beliefs are correlated. The model further explains that such actions of noise traders can lead to increase in the systematic risk of the assets in the markets which need to be priced.

Despite the skepticism surrounding the acceptability of investor sentiment as a significant factor of asset pricing, recent empirical evidence shows that investor sentiment does influence the expected returns and volatility (Uygur and Tas, 2014, Chuang, Ouyang and Lo, 2010, Wang, Li and Lin, 2009, Lee, Jiang and Indro, 2002). Therefore, in order to accurately price financial instruments, the proper estimation of both stock return and volatility is crucial. In addition, volatility estimation is also important for formulating portfolio strategies over time by diversifying sequential risk. If investor sentiment is assumed to have major impact on the change in conditional volatility, ignoring sentiment would result in an erroneous estimation of asset price and would lead to sub-optimal investment decisions.

From the empirical research done so far three major findings can be portrayed. Firstly, sentiment has a greater influence on asset price in an optimistic market compared to that of a pessimistic market. This is due to the fact that sentiment traders are more aggressively involved in trade during high sentiment periods compared to low sentiment periods when these traders are hesitant to take short-positions (Karlsson et al. 2008; Yuan 2015; Uygur & Tas, 2013). Secondly, sentiment traders, who are typically novice and incapable of interpreting implications of financial indicators, would find it difficult to measure stock market risk. These traders would weaken the significantly positive mean- variance relationship which is expected to prevail under rational asset pricing theory (Uygur & Tas 2013). Thirdly, sentiment traders are driven more by negative return shocks as these traders get easily panicked by any negative shocks compared to their excitement for any positive market movement. As a result, bad news leads to more volatility than good news which is termed as negative leverage effect (Wang et al. 2009; Uygur and Tas 2013). In view of the aforementioned indications, it is clear that investor sentiment has a pivotal role in the mean-variance relation of asset pricing. By combining the first two implications it can be depicted that, when sentiment is low, sentiment traders are less active, this results in a positive relation between the market's excess return and variance. On the contrary, when sentiment is high, there is a greater participation of sentiment traders, causing little mean-variance trade-off.

Investor sentiment is also considered as one of the major factors leading to stock market bubble. Across the globe, both in developed and developing countries bubble and burst episodes are not a rare phenomenon. These episodes teach us about the severe consequences that investor sentiment can have on asset prices. The initiation of such bubbles and the exact factors that cause such price hikes of assets are yet to be explored by the academic researchers or the investment analysts. However, a number of previous researches identified a significantly strong co-relation between investor sentiment and stock market return (Finter et al. 2010). These researchers pointed out that profitable trading strategies can be formulated only if stock price movements caused by investor sentiment could be forecasted. Most of these empirical works are based on developed stock markets. However, the same may not be true for emerging stock markets. Emerging markets always possess distinct features compared to developed markets in terms of financial uncertainties, volatility, risk-return trade-off etc. (Kumari and Mahakud, 2015). Therefore, it is important to examine whether such findings are relevant for other emerging stock markets as well. This is particularly true for the Bangladesh stock market

which has a different market composition and dynamics compared to other developed or emerging stock markets.

Bangladesh stock market is not well developed yet. Short-comings from market regulators has also been evident in many instances, in terms of protecting investor rights or monitoring and controlling the activities of market participants. The major players of this market are retail investors. They are the ordinary people who are neither able to access important investment information, nor able to interpret them. They are the non-privileged people who cannot even seek expert advice of financial analysts (Chowdhury, Sharmin and Rahman, 2014). As a result, the investment decisions of a general investors are more likely to be driven by rumors, intuitions which lead to irrational sentiment. Unlike developed markets or many emerging markets, opportunities for arbitrage are limited in Bangladesh stock market due to the absence of derivative market to create artificial positions. Moreover, in the Bangladesh stock market there are restrictions on short sale (Chowdhury, Sharmin and Rahman, 2014).

Within a very short span of time Bangladesh stock market experienced two major bubbles and bursts, one in 1996 and another in 2010. The severity of their impact on the retail investors were horrifying. These two experiences taught us how important it is to model stock market volatility with appropriate prediction power. If market movements can be forecasted, investors can be warned and protected from such devastating situations. Market regulators can formulate appropriate rules and policies to prevent such situations. Most importantly prudent investment strategies can be developed to take full advantage of the forecasted market movement. However, in Bangladesh, after each episode of bubble and burst, many discussions were made, committees were formed for investigation, and many sporadic steps were taken by the regulators. Moreover, a number of reports were published following each bubble and burst. But these reports focused on investigating and identifying the market players who were at fault. Little or no attention was given on the behavioral aspect of the investors or more specifically on investor sentiment. Therefore, this research attempts to develop models to forecast both stock market return and stock market volatility from the behavioral perspective.

## **1.4 Contributions of the Research**

This research makes five contributions. First, so far very limited work has been done in the field of behavioral finance or more specifically on investor sentiment in Bangladesh. Therefore,

this research aims at bringing a new dimension to the research arena of Bangladesh stock market. The findings of the study are expected to be useful to the investors, the regulators, the policy makers as well as the future researchers. This study is expected not only to bring the topics of behavioral finance closer to the research community but also to highlight the challenges in this field.

Second, this research contributes to the identification of proxies for investor sentiment that are appropriate for the Bangladesh stock market. A number of sentiment proxies have been contemplated for the purpose of this research. Data are collected on a number of sentiment proxies which could not be used later in the research due to unexpected sign, misleading results and infrequent occurrence. For example, in Bangladesh market, it is observed that dividend premium has negative sign, which is irrational and misleading. Moreover, sentiment proxies related to IPOs could not be used due to insignificant number of IPOs in Bangladesh stock market. Furthermore, in this study, the sentiment proxies are found uncorrelated which is also unique compared to other studies on investor sentiment. Empirical studies on other stock markets found high correlation among the sentiment proxies, these studies used Principal Component Analysis (PCA) to find communalities among the proxies.

Third, emerging markets always exhibit distinct characteristics compared to developed markets in various aspects. In this respect, current research contributes to identify the unique relationship that exists between excess market return and market variance. In most of the empirical studies a negative relationship was identified between excess market return and market variance. This means that market volatility is not considered as systematic risk. This study is expected to capture the exact relationship between the excess market return and the market variance for the Bangladesh stock market.

Fourth, the study identifies the impact of sentiment by separating the two bubble and burst episodes that Bangladesh stock market had experienced. By running both generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model and Glosten, Jagannathan and Runkle's threshold generalized conditional heteroskedasticity (GJR-TGARCH) model on the two bubble and burst periods, the study attempts to find whether the same patterns of relationship among sentiment, market return and volatility prevailed during those two episodes.

Fifth, the study attempts to forecast market volatility which is crucial to formulate optimum portfolio strategies. This will, on one hand, guide many marginal investors in making right investment decisions and on the other hand, help institutional investors to optimally utilize their excess capital. Moreover, volatility is the major input in pricing financial assets. If sentiment has significant impact on conditional volatility, excluding sentiment while forecasting asset price would result in suboptimal investment decision. In this respect, the current study expects to contribute significant knowledge that would benefit different stakeholders of the Bangladesh stock market.

## **1.5 Structure of the thesis**

The study begins with a detailed discussion on empirical studies that have been done previously. The review of literatures has been done based on two aspects. The first set of literatures reviewed is based on the methodology that had been followed to find the relationship among investor sentiment and stock market return and volatility. The second set of literatures that have been reviewed is aimed at identifying the different sentiment proxies that have been considered by empirical researchers. Lastly, considering all the sentiment proxies and the methodologies that had been used in the literature reviewed, the major research questions for the study has been developed.

The methodology of the study is discussed at length in chapter three. It starts with a discussion on research design. Next the models of the research have been discussed which includes both Generalized Autoregressive Conditional Heteroskedasticity in mean (GARCh-M) model and Glostén, Jagannathan and Runkle's threshold Generalized Autoregressive Conditional Heteroskedasticity (GJR-TGARCh) model. Next, a detailed discussion on each and every variable in the models is presented. Moreover, this chapter also explains the sentiment proxies that have been used in this study. Finally, the chapter ends with discussion on data, the diagnostics tests that are used and a brief discussion on how the robustness of the results are checked.

Chapter four is on the major reforms in the Bangladesh stock market over time. It begins with an overview of different institutions of the Bangladesh securities market, which includes the Bangladesh Securities and Exchange Commission (BSEC), stock exchanges, merchant banks,

mutual funds, portfolio managers and others. Next comes the legal framework where a summary of all the major rules, regulations and by-laws of Bangladesh Stock Market have been incorporated. This is followed by a detailed discussion on growth of securities market in Bangladesh. At the end of this chapter, the trends of the major market indicators of the securities market of Bangladesh have been stated.

Chapter five describes the stock market bubble in Bangladesh along with a comparative study between international bubbles and Bangladesh stock market bubbles. The chapter proceeds with a short summary of all significant bubbles in stock markets around the globe. The chapter ends with highlighting all major market indicators during the two bubble and burst episodes in the history of the Bangladesh stock market.

In chapter six a detailed discussion on analysis and findings of the study is presented. The chapter starts with a discussion on the summary statistics of all the variable that have been considered in this research for the entire study period. Next the empirical findings of different models have been incorporated. Firstly, the results of the entire study period have been discussed both with three sentiment proxies and then with one sentiment proxy. Following this the summary statistics and the results of the two bubble and burst periods have been discussed at length. The chapter ends with the results of the robustness check.

Chapter seven summarizes the entire study. First, the key findings of the study are stated. The chapter also includes the major contributions of the study. It ends with implications for different stakeholders and opportunities for future research.

## **Chapter # 2**

# **Literature Review and Research Questions**



The traditional rational financial asset-pricing models were gradually being unable to explain many important economic events in the past, namely, the Great Depression in 1929, the stock market crash in October 1987, and the market bubble of the early 1970s. (Baker and Wurgler, 2006). As a result, the essence of behavioral finance started to get into the lime light of research in finance. Needless to say, investor sentiment became one of the focal topics of behavioral finance. At present, a good number of research works can be found in the arena of investor sentiment and stock market volatility with different results. Of them, some research traces out a strong and substantial influence of investor sentiment on both stock market return and stock market volatility, while others fail to establish any such association. However, most of the previous works were conducted on developed stock markets. Therefore, it is important to examine whether such implications are relevant for other stock markets as well. Especially, in stock markets like Bangladesh which has a completely different composition and dynamics and many different characteristics compared to other developed or emerging stock markets. In this chapter, literature has been reviewed in two stages. Firstly, literature on stock market volatility, especially those using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) type models have been reviewed. Secondly, to identify the appropriate proxies of investor sentiment, different literature from both emerging markets and developed stock markets, has been scrutinized. Based on the literature reviewed the research questions for this study have been developed at the end of this chapter.

## **2.1 Literature Review on Models used for Investor Sentiment, Stock Market Return and Market Volatility**

A good number of research works have been done in the field of investor sentiment and stock market volatility with different results. Of them, some research traces out a significant influence of investor sentiment on stock market volatility. While others fail to establish any such association. However, most of the studies on sentiment focuses on developed stock market and are based on the assumption that the retail investors who are driven by sentiment cause the market boom. Unfortunately, these retail investors are the ones who are mostly affected by such market bubble and burst. (Kumar and Lee, 2006).

The study by Glosten, Jagannathan and Runkle (1993) examine whether the standard GARCH-M model is enough to capture the time series properties of excess market return and volatility.

The study is conducted on Center for Research in Security Prices (CRSP) value-weighted index of NYSE equities, for the period between April, 1951 and December, 1989. In this study, three modifications are made on GARCH-M model. First, dummy variables are added in the mean model to capture seasonal variation in volatility. Second, additional variables are incorporated in the variance model to identify asymmetric impact of conditional volatility. Third, nominal interest rate is included in conditional variance equation. The study finds negative relation between excess market return and conditional variance of excess return. Moreover, the study reveals that positive unexpected return negatively influences conditional volatility whereas negative unexpected returns positively influence conditional volatility.

Lee, Jiang and Indro (2002) in their study examine the impact of risk associated with noise traders on the conditional volatility and the expected market return. The study is done on weekly data of three different market indices, namely, the DJIA, S&P500, and NASDAQ covering the period between January, 1973 and October, 1995. Here, Investors' Intelligence sentiment index is used as proxy for investor sentiment. The study applies both GARCH-M model and TGARCH model to test the impact of noise trader risk on both the formation of conditional volatility and expected return. To attain better result the mean model is modified by adding seasonal dummy variables. In addition to that, in the variance model dummy variables are incorporated to identify both the negative leverage effect of earning shocks and the asymmetric property of investor sentiment. The study findings reveal a positive relationship between shift in sentiment and excess market return. Moreover, a significant negative relationship is found between investor sentiment and market volatility. The study also indicates existence of both negative leverage effect and asymmetric property of investor sentiment on stock market volatility.

Baker and Wurgler (2006) examine the impact of investor sentiment on return of the cross-sectional stocks. The study is based on monthly data of all common stocks listed with NYSE, for the period ranging from 1962 to 2001. The sentiment index is constructed based on six proxies: the number of IPOs, the trading volume, first-day returns on IPOs, the dividend premium, the equity shares in fresh issues and the closed-end mutual fund discount. The study identifies that the traditional rational financial asset-pricing models are not sufficient to explain many significant financial events in the past, namely, the Great Depression in 1929, the stock market crash in October 1987, and the stock market bubble in early 1970s. The study uses a model that incorporates concepts of behavioral finance theory to accurately identify the impact

of sentiment. The model is developed based on the premise that mispricing arises due to an incorporation of two factors: a change in sentiment from the irrational traders and limited arbitrage opportunities from the rational investors. Their study concludes that there is an asymmetric impact of sentiment on asset price and the market as a whole.

Wang, Keswani and Taylor (2006) identify the direction of causality among investor sentiment, market return and estimated volatility and examine the prediction power of different sentiment measures for volatility forecasting. The study is based on both daily and weekly data, for the period between 1990 and 2001. In their analysis with daily data, three sentiment proxies are used, namely, S&P100 (OEX) put-call trade volume ratio (PCV), NYSE ARMS index and the OEX put-call ratio of open interest (PCO). However, for the analysis with weekly data, two other sentiment ratios collected through survey, are added with PCO and PCV. The study finds an inverse causality effect among sentiment, return and volatility and reveals that sentiment measures are caused by market returns and conditional volatility. The study further concludes that all the sentiment proxies have extremely limited predictive power.

Kling and Gao (2008) examine the prediction power of sentiment to forecast market movement and the existence of negative leverage effect of sentiment. The daily survey data of Chinese institutional investors' forecast is used as the proxy for investor sentiment. For this study, both EGARCH, TGARCH models are used to analyze the asymmetric response of investor sentiment. Moreover, in order to find relation between investor sentiment and stock return, bivariate GARCH model is used. In addition to that, Granger causality test is applied to examine volatility-spillover effect. The study reveals that there exists no long-run relationship between share prices and investor sentiment. However, in the short-run, a positive relationship has been found between lagged return and sentiment. This study findings show asymmetric responses of sentiment on conditional volatility. However, no volatility-spillovers effect is traced between stock market returns and investor sentiment.

Kaplanski and Levy (2009) analyze the factors that affect investor sentiment and examine the relationship of sentiment with well-known stock market anomalies. The study uses Risk Sentiment Index (RSI) as the sentiment proxy. The research is based on the fact that investors are more risk averse whenever there is a media coverage of any catastrophe. The study suggests a method of measuring the RSI and finds negative correlation between real return and RSI. Moreover, the study reveals that investors are observed to become risk averse for short-term

after any catastrophe, which affects stock price, however, after a certain period investors attitude towards risk reverses. The effect is found more prominent in case of small and riskier stocks.

Nektaria, Karakatsani and Salmon (2008) in their study investigate the influence of both institutional investor sentiment and individual investor sentiment on excess market return and estimated volatility and study the persistence of such effect during regime shift. Here monthly data of the US stock market is used for the period between 1965 and 2003. The study takes Investors Intelligence Survey as proxy for the institutional sentiment and the change in sentiment index proposed by Glushkov (2005) as proxy for the individual sentiment. For the purpose of this research, four regimes are considered to analyze the influence of investor sentiment in different situations. The study findings reveal that both institutional and individual investors can influence price volatility, however, the degree of influence varies with changes in stages.

Finter, Ruenzi and Ruenzi (2008) investigate whether investor sentiment has impact on stock returns in the German stock market and whether it can forecast future returns. The study is conducted on monthly data of German stock exchange for the period between 1993 and 2006. The study is based on a composite sentiment index consisting of several popular sentiment proxies, namely, the consumer confidence, the number of IPOs, the aggregate net flows into equity, closed-end-mutual funds, , the IPO returns, the ratio of equity to debt of new issuances, the put-call ratio and the total trading volume. For this research, stocks are categorized based on some criteria such as size, earnings etc. The study reveals that certain categories of stocks are sensitive to sentiment. However, the study is unable to find predictive power of sentiment for future stock returns. Therefore, the study conclude that investor sentiment has insignificant influence on stock return in the German stock market.

Wang, Li and Lin (2009) examine the impact of investor sentiment on stock market return and volatility. They also analyze the ability of sentiment to predict future return and volatility. The study is conducted on daily data of Taiwan Futures Exchange for the period between August, 1999 and January, 2008. The study employs an investor sentiment index based on open interest position and maximum-minimum position of the Taiwan derivative market. To get accurate results, stock returns are adjusted to remove influence of inflation and day-of-the-week effect. Glosten, Jagannathan and Runkles' Generalize Autoregressive Conditional Heteroskedasticity

(GJR-GARCH) model, Exponential Generalized Beta-2 (EGB2) model and Markov-switching ARCH (SWARCH) model are applied in the study. The study includes two regimes, namely, high and low volatility period to analyze the magnitude of shift in sentiment during different stages of volatility. The study finds significant positive relationship between investor sentiment and futures market returns in short-term. Moreover, the study discovers significant asymmetric impact of sentiment. In addition to that, the study further identifies low forecasting power of sentiment and finds significant impact of negative income shock on future volatility.

Schmitz, Glaser and Weber (2009) in their study analyze the relationship between investor sentiment and stock market return. The study is based on daily transaction data of a big German on-line broker for the period between January, 1997 and April, 2001. For the purpose of this study the entire data set is divided into sub-samples. Daily transaction on warrants is taken as sentiment proxy with the assumption that call warrant represents optimistic sentiment whereas put warrant resembles pessimism among the investors. The study uses Vector Autoregressive (VAR) model to find out whether there exists any lead-lag relationship between sentiment and stock market return. Moreover, to identify the direction of causality between sentiment and return, Granger Causality Tests (Granger, 1969) is applied in the study. The study identifies that there exists a negative relationship between sentiment and stock market returns, applicable only in short-run. However, the result of causality test reveals that the influence of stock return on sentiment is stronger than influence of sentiment on stock return.

Chuang, Ouyang and Lo (2010) analyze the impact of investor sentiment on excess market return and conditional volatility. The study is based on weekly data of the Taiwan stock exchange for the period between January, 1990 and December, 2004. The study uses weekly change in trading volume as proxy for investor sentiment. The study applies Generalized Autoregressive Conditional Heteroskedasticity in mean (GARCH-M) model as well as Threshold Autoregressive Conditional Heteroskedasticity (TGARCH) model. Seasonal dummy is incorporated in mean model to capture the seasonal effect of the Taiwan stock market. Moreover, in volatility model, sentiment dummy variables are used to capture the asymmetric influence of sentiment and risk-free rate variable is included to detect influence of inflation on volatility. The study finds that investor sentiment has a positive and significant influence on excess market return. However, conditional volatility and excess market returns have significant negative relationship. The study identifies that investor sentiment has significant influence on the stock return in the Taiwan stock market.

Uygun and Tas (2014) investigate the impact of changes in the investor sentiment on market returns and volatility. The study is based on weekly market index returns of U.S. (NASDAQ, S&P500, DOW), Hong Kong (HANG SENG), Japan (NIKKEI225), Germany (DAX), U.K. (FTSE100), Turkey (XU100) and France (CAC40), for the period between 2000 and 2011. In this study, changes in the weekly trading volume data of nine market indexes are used as a proxy for investor sentiment. To isolate the sentiment proxies from the impact of macroeconomic factor, the trade volume data is regressed against a group of macroeconomic variables: Industrial Production, Consumers Price Index, Producers Price Index, Capacity Utilization Rate and Gross Domestic Product and the residuals are used as proxies for investor sentiment. In this study, initially, Threshold GARCH (TGARCH) model is used. However, to overcome the negativity constraints in the TGARCH model, Exponential GARCH (EGARCH) model is also incorporated in the study. In both the models, sentiment dummy variables are included to examine the asymmetric impact of sentiment on conditional volatility. The study observes a strong relationship between investor sentiment and market returns. The study finds traces of negative leverage effect, which mean, bad news leads to more volatility than good news.

Rahman, Shien and Sadique (2013) investigate the impact of investor sentiment on stock market returns and volatility in the context of Bangladesh. The study is based on daily data for the period between January, 2001 and December, 2012. To check the consistency of results, the entire data is divided into two sub-samples. The study uses two sentiment proxies. Firstly, modified trading index (TRIN), which measures the strength of the trading volume. Secondly, Amihud liquidity index, which is a measure of price response against order flows. Both generalized autoregressive conditional heteroskedasticity (GARCH) in-mean framework and threshold generalized autoregressive conditional heteroskedasticity (TGARCH) model are used in the study. However, the basic mean model is modified to accommodate day-of-the-week effect of Bangladesh stock market. The empirical results reveal that shifts in investor sentiment have significant and positive correlation with excess market returns. Moreover, the study indicates that there exists an asymmetric influence of sentiment on conditional volatility.

Kumari and Mahakud (2015) analyze the relationship among investor sentiment and stock returns and volatility in emerging stock market. Their study is based on monthly data of Indian stock market for the period between January, 2000 and December, 2013. For the purpose of this research, a broad-based sentiment index is developed following the top down approach of

Baker and Wurgler (2007) and Verma and Soydemir (2009). This sentiment index comprises of ten aggregate market related sentiment proxies under four broad categories namely, market performance, different trading activity, derivative variables and other sentiment proxies. The study uses generalized autoregressive conditional heteroskedasticity (GARCH) model. Moreover, Nelson's (1991) exponential GARCH (EGARCH) and Zakoian's (1994) threshold GARCH (TGARCH) model are applied to capture asymmetric impact of sentiment and the negative leverage effect. In addition to that, vector autoregressive GARCH (VAR-GARCH) model is also used to identify the impact of sentiment on stock market volatility and market returns. The study identifies a significant and positive impact of investor sentiment on stock market volatility with the impact being asymmetric. There is also evidence of negative leverage effect in the market. Finally, investor sentiment is found to have strong predictive power to determine future stock returns and volatility in Indian stock market.

## **2.2 Literature Review on Proxies of Investor Sentiment**

Investor sentiment is a behavioral issue, therefore, there is no straightforward measure for investor sentiment. Sentiment has been measured by a wide range of proxies in previous studies by eminent researchers. However, the appropriateness of sentiment proxy is conditional to the specific characteristics of the stock market where the research is done and is constrained by the availability of the data.

Brown and Cliff (2004) has found a strong correlation between frequently used indirect sentiment proxies and survey based direct measures of sentiment. The study is conducted on both weekly and monthly data of NYSE, with monthly data ranging from March, 1969 to December, 1998 and weekly data from July, 1987 to December, 1998. For this study different sentiment proxies are used under four broad categories. These are, market performance, types of trading activity, derivative variables and other sentiment. Their findings show that investor sentiment is strongly correlated with current stock return, the research has identified little forecasting power of sentiment on stock returns. In addition to that, no evidence is found to support the empirical assumption that the effect of sentiment is limited to individual investors and weak stocks.

Baker and Wurgler (2006) examine the impact of investor sentiment on return of the cross-sectional stocks. The study is based on monthly data of all common stocks listed with NYSE,

for the period ranging from 1962 to 2001. The sentiment index is constructed based on six proxies: the number of IPOs, the trading volume, first-day returns on IPOs, the dividend premium, the equity shares in fresh issues and the closed-end mutual fund discount. The study identifies that the traditional rational financial asset-pricing models are not sufficient to explain many significant financial events in the past, namely, the Great Depression in 1929, the stock market crash in October 1987, and the stock market bubble in early 1970s. The study uses a model that incorporates concepts of behavioral finance theory to accurately identify the impact of sentiment. The model is developed based on the premise that mispricing arises due to an incorporation of two factors: a change in sentiment from the irrational traders and limited arbitrage opportunities from the rational investors. Their study concludes that there is an asymmetric impact of sentiment on asset price and the market as a whole.

Nektaria, Karakatsani and Salmon (2008) analyze the interaction and regime shift of investor sentiment and price formation. The study is based on monthly data for the period between 1965 and 2003. The study uses two separate proxies for institutional and retail investor sentiment. For institutional investor sentiment, recommendations received from monthly Investor Intelligence survey are considered, as these recommendations generally are written by specialized market experts who resemble the characteristics of institutional investors. On the other hand, a composite index comprising of eight different sentiment proxies is used as an indicator of individual investor sentiment. These eight proxies are first-day returns of IPOs, dividend premium, closed-end fund discount, mutual fund flows, the percentage change in margin borrowing, the bull-bear spread, the ratio of specialists' short sales to total short sales, and the number of IPOs. The rationale of the study is based on the ground that institutional investor sentiment is somewhat different from individual investor sentiment. Institutional investors are more sophisticated, are able to calculate fair price based on fundamental information and have relatively higher access to company-specific information. Therefore, they are less likely to overreact as opposed to individual investors. The study considers four regimes to identify the impact of sentiment on separate stages of market returns. The main finding of the study is that there exists a statistically significant interactive relationship between sentiment and market return in both bull and bear market situation.

Schmitz, Glaser and Weber (2009) in their study analyze the relationship between investor sentiment and stock market return. The study is based on daily transaction data of a big German on-line broker for the period between January, 1997 and April, 2001. For the purpose of this



study the entire data set is divided into sub-samples. Daily transaction on warrants is taken as sentiment proxy with the assumption that call warrant represents optimistic sentiment whereas put warrant resembles pessimism among the investors. The study uses Vector Autoregressive (VAR) model to find out whether there exists any lead-lag relationship between sentiment and stock market return. Moreover, to identify the direction of causality between sentiment and return, Granger Causality Tests (Granger, 1969) is applied in the study. The study identifies that there exists a negative relationship between sentiment and stock market returns, applicable only in short-run. However, the result of causality test reveals that the influence of stock return on sentiment is stronger than influence of sentiment on stock return.

Wang, Li and Lin (2009) examine the impact of investor sentiment on stock market return and volatility. They also analyze the ability of sentiment to predict future return and volatility. The study is conducted on daily data of Taiwan Futures Exchange for the period between August, 1999 and January, 2008. The study employs an investor sentiment index based on open interest position and maximum-minimum position of the Taiwan derivative market. To get accurate results, stock returns are adjusted to remove influence of inflation and day-of-the-week effect. Glosten, Jagannathan and Runkles' Generalize Autoregressive Conditional Heteroskedasticity (GJR-GARCH) model, Exponential Generalized Beta-2 (EGB2) model and Markov-switching ARCH (SWARCH) model are applied in the study. The study includes two regimes, namely, high and low volatility period to analyze the magnitude of shift in sentiment during different stages of volatility. The study finds significant positive relationship between investor sentiment and futures market returns in short-term. Moreover, the study discovers significant asymmetric impact of sentiment. In addition to that, the study further identifies low forecasting power of sentiment and finds significant impact of negative income shock on future volatility.

Baker, Wurgler and Yuan (2009) investigate the effect of local and global components of sentiment on major international stock markets. The study uses annual data of different stock exchanges, namely, Japan, the United States, France, the United Kingdom, Germany and Canada for the period between 1980 and 2005. For the purpose of this analysis, six indices of investor sentiment are constructed for the six major stock markets and finally a global index is built by combining them. For each local sentiment index four sentiment proxies are incorporated namely, the market turnover, the number of IPOs, the volatility premium and the initial returns on IPOs. Moreover, to identify the impact of sentiment on the return of cross-sectional stocks, stocks are categorized based on four characteristics, namely, the firm size,

total risk, the book-to-market equity ratio and the sales growth. The major finding of the study is that both global and local investor sentiments can predict return on specific market as well as return on cross-sectional stocks.

Fernandes, Gama and Vieira (2010) examine whether future aggregate stock market returns and industrial indices returns can be predicted by investor sentiment. The study is done on Portugal stock market, for the period between September 1997 and April 2009. It uses the Consumer Confidence (CC) and the Economic Sentiment Indicator (ESI) as proxies for investor sentiment. In order to get better results, both ESI and CC are regressed with a number of macroeconomic factors and the residuals are considered as sentiment proxies. The study indicates that the sentiment is negatively correlated to the future stock market return. Moreover, it is also found that the investor sentiment has some predictive power on the future returns of some industrial indices like utilities and telecommunication. Therefore, it is concluded that the Portugal market is somewhat prone to the influence of investor sentiment.

Cornell, Landsman and Stubben (2011) analyse the way in which investor sentiment influence asset price. The study emphasizes on whether the impact of investor sentiment is limited to noise traders or is it market wide. Annual data of NYSE is used in this research for the period between 1993 and 2007. The study uses a composite sentiment index following the research design of Baker and Wurgler (2006). The index comprises of six sentiment proxies, namely, the dividend premium, the closed-end fund discount, the equity shares in new issues, the number of IPOs, the trading volume and average of first-day returns on IPOs. The study findings indicate that investor sentiment affects the trading activities of individual investors as well as institutional investors.

Stambaugh, Yu and Yuan (2011) examine the role of investor sentiment on the return of cross-sectional stocks. The study is based on two premises. Firstly, the investor sentiment influence stock price throughout the market. Secondly, limits to short-selling helps sentiment-driven overpricing to persist. In this study, the influence of investor sentiment is tested on 11 asset-pricing anomalies for the period between 1965 and 2007 in the US stock market. Here the Baker and Wurgler (2006) sentiment index with six sentiment proxies are used. The index is formed by taking the first principal component of six proxies. The six proxies are the closed-end-fund discount, New York Stock Exchange (NYSE) turnover, the number of initial public offerings (IPOs), the dividend premium, the first day returns on IPOs and the equity share in

total new issues. The study findings reveal that sentiment-driven overpricing partially influence the broad set of anomalies in asset pricing.

Bennet (2011) conducts a survey-based study to analyse whether investor's attitude towards investing is influenced by media coverage of the stock, intuition, collective behaviour among investors and rumours. Stock specific factors are used as proxy for investor's attitude. These factors are the impact of financial characteristic, namely, turnover ratio, quality of asset, interest cover ratio, return on asset (ROA), cash flow (CF) per share, dividend per share (DPS), debt-equity (D/E) ratio and current asset to current liability ratio (CA/CL). Moreover, psychological factors are also considered in this study, for example, past price performance, recommendation of the financial community, financial characteristics, price earnings, expected events surrounding the stock, quality of management, price cut off rules and familiarity with products, and book value and who else is buying. The required data are collected from the retail investors living in Tamil Nadu, India, through a structured interview schedule. The study concludes that the overall stock specific factors do not have much influence on the investor sentiment in India.

Rahman, Shien and Sadique (2013) investigate the impact of investor sentiment on stock market returns and volatility in the context of Bangladesh. The study is based on daily data for the period between January, 2001 and December, 2012. To check the consistency of results, the entire data is divided into two sub-samples. The study uses two sentiment proxies. Firstly, modified trading index (TRIN), which measures the strength of the trading volume. Secondly, Amihud liquidity index, which is a measure of price response against order flows. Both generalized autoregressive conditional heteroskedasticity (GARCH) in-mean framework and threshold generalized autoregressive conditional heteroskedasticity (TGARCH) model are used in the study. However, the basic mean model is modified to accommodate day-of-the-week effect of Bangladesh stock market. The empirical results reveal that shifts in investor sentiment have significant and positive correlation with excess market returns. Moreover, the study indicates that there exists an asymmetric influence of sentiment on conditional volatility.

Uygun and Tas (2014) investigate the impact of changes in the investor sentiment on market returns and volatility. The study is based on weekly market index returns of U.S. (NASDAQ, S&P500, DOW), Hong Kong (HANG SENG), Japan (NIKKEI225), Germany (DAX), U.K. (FTSE100), Turkey (XU100) and France (CAC40), for the period between 2000 and 2011. In

this study, changes in the weekly trading volume data of nine market indexes are used as a proxy for investor sentiment. To isolate the sentiment proxies from the impact of macroeconomic factor, the trade volume data is regressed against a group of macroeconomic variables: Industrial Production, Consumers Price Index, Producers Price Index, Capacity Utilization Rate and Gross Domestic Product and the residuals are used as proxies for investor sentiment. In this study, initially, Threshold GARCH (TGARCH) model is used. However, to overcome the negativity constraints in the TGARCH model, Exponential GARCH (EGARCH) model is also incorporated in the study. In both the models, sentiment dummy variables are included to examine the asymmetric impact of sentiment on conditional volatility. The study observes a strong relationship between investor sentiment and market returns. The study finds traces of negative leverage effect, which mean, bad news leads to more volatility than good news.

The research by Mclean and Zhao (2014) examine the relationships among business cycle, investor sentiment and external finance. The study is done on the NYSE for the period between 1965 and 2010. For this study, two proxies are used for both economic condition (a dummy for growing industrial production and a dummy for expansion) and investor sentiment (the Baker and Wurgler's sentiment index and the consumer sentiment index from University of Michigan). Here, both the sentiment indices are regressed with several business cycle variables, and the residuals from these regressions are used as the investor sentiment proxies. The study concludes that the business cycle and investor sentiment have significant and independent impact on external financing cost.

Stambaugh, Yu and Yuan (2014) assess whether investor sentiment's predictive ability can be achieved by a spurious regressor. The study is done for a sample period between August 1965 and January 2008, for majority of the anomalies. The study uses Baker and Wurgler (2006) sentiment index (six proxy) as sentiment proxy. Moreover, 11 anomalies are examined to get to the conclusion. The study findings confirm that it is extremely improbable that the observed role of investor sentiment in stock return anomalies can be filled by a spurious regression. Out of 200 million regressors that were simulated none is found consistent with the hypothesis.

Bank and Brustbauer (2014) review the literature on investor sentiment in economics and finance. The study evaluates various proxies which are applied to capture sentiment, such as the closed-end fund discount, the insider trading, the market volatility, the IPO volume, the

trading volume, the IPO first-day return and the equity issues. The study finds that the applied proxies serve as a tool for arbitrageurs to take advantage of the irrational activities of retail investors. The study concludes that although sentiment proxies are beneficial, they do not impact investors' assessment of asset characteristics.

Chowdhury, Sharmin and Rahman (2014) analyze the impact of investor sentiment on asset pricing considering firm size. The study is done on Bangladesh stock market based monthly data. Five indirect sentiment proxies are used here, namely, the TRIN index, the opening to closing ratio of beneficiary owners accounts (BO), the change in four-month moving average, trade volume and the number of IPOs per month. Rather than constructing a composite sentiment index, the study uses individual proxies, as there exists very low correlation among sentiment proxies in Bangladesh stock market. The study concludes that the performances of this market depend on sentiment of general investors and large firms are more prone to sentiment than small firms.

By focusing on constructing an investor sentiment index, Hui and Li (2014) investigate the predictive power of investor sentiment. The study is based on monthly data of Chinese stock market for the period between January, 2006 and December, 2012. The study considers six sentiment proxies, namely, the relative degree of active trading in equity market, the closed-end fund discount, the average first-day returns on IPOs, the Shanghai Stock Exchange (SSE) share turnover, the number of Chinese A share added and the number of IPOs. The study is done in three stages, firstly, the relation between sentiment proxies and stock market index is examined, secondly, using multivariate regression analysis, the impact of these sentiment measures on stock market return is examined. Finally, a number of sentiment index is constructed with different combination of these six proxies to determine the best model. The study concludes that a lead-lag relationship exists between sentiment variables and stock price. The study results further demonstrate that the sentiment index constructed in this study, has good forecasting power on Chinese Index (HS300 index) and it is robust.

Yang and Copeland (2014) investigate the relationship among sentiment and market return and market volatilities. The study is based on monthly data of UK stock market for the period between March 1987 and December 2012. The sentiment index constructed here, is based on the sentiment index of Brown and Cliff (2004) and Baker and Wurgler (2006). The index comprises of five proxies, namely, the share turnover by value on London Stock Exchange

(LSE), the consumer confidence, the average first-day return on IPOs and the number of first-day sale of IPOs. In this study, a sentiment component has been included in EGARCH model to identify the relationship among sentiment, market return and market volatilities. The study concludes that incorporation of sentiment enhanced the predictability of both short and long-run volatilities of EGARCH model.

Kumari and Mahakud (2015) analyze the relationship among investor sentiment and stock returns and volatility in emerging stock market. Their study is based on monthly data of Indian stock market for the period between January, 2000 and December, 2013. For the purpose of this research, a broad-based sentiment index is developed following the top down approach of Baker and Wurgler (2007) and Verma and Soydemir (2009). This sentiment index comprises of ten aggregate market related sentiment proxies under four broad categories namely, market performance, different trading activity, derivative variables and other sentiment proxies. The study uses generalized autoregressive conditional heteroskedasticity (GARCH) model. Moreover, Nelson's (1991) exponential GARCH (EGARCH) and Zakoian's (1994) threshold GARCH (TGARCH) model are applied to capture asymmetric impact of sentiment and the negative leverage effect. In addition to that, vector autoregressive GARCH (VAR-GARCH) model is also used to identify the impact of sentiment on stock market volatility and market returns. The study identifies a significant and positive impact of investor sentiment on stock market volatility with the impact being asymmetric. There is also evidence of negative leverage effect in the market. Finally, investor sentiment is found to have strong predictive power to determine future stock returns and volatility in Indian stock market.

Yang and Zhou (2015) examine the impact of both investor trading behaviours and investor sentiment on asset prices. The study is based on daily sentiment proxies of Chinese stock market for the period between April, 2005 and June, 2014. Four sentiment proxies are considered in this research, namely, the adjusted turnover rate, the psychological line index, the relative strength index and the trading volume. The study reveals that both investor trading behaviour and investor sentiment have statistically significant influence on excess market returns. However, the study identifies that investor trading behaviour can cause higher impact on excess market return than that of investor sentiment.

Rahman et al. (2017) examines the spillover effect of investor sentiment on stock return from regional developed country to regional developing countries on stock. The study is based on

weekly data for the period between 2004 and 2014. For comparative analysis Japan and Germany are considered as developed countries and Pakistan and Turkey are considered as developing country. The study used principal component analysis to construct a sentiment index based on four proxies, namely, stock exchange turnover, money flow index, interbank offer rate and relative strength index (RSI). The study concludes that there exists a strong relation between the pattern of association of sentiment and stock market return of developed countries with that of developing countries

## 2.3 Research Questions

As mentioned earlier this research is based on the Bangladesh stock market. Within a very short span of time, the Bangladesh stock market experienced two major bubbles and bursts. General investors were devastated by their impact. Even the regulatory authority could not anticipate that such big bubbles were forming. As a result, no precautionary measures could be taken to pacify the market boom. These two experiences taught us how important it is to model stock market volatility with appropriate predictive power. If market movements can be forecasted, investors can be warned and protected from such horrifying situations. Market regulators can formulate appropriate rules and policies to prevent such situations. Most importantly prudent investment strategies can be developed to take full advantage of the forecasted market movement. In this backdrop this research attempts to forecast stock market volatility by identify the impact of investor sentiment on both stock market return and market volatility. In order to achieve the research objective, the following research questions have been constructed

### Research Question 1

*Can the investor sentiment explain the return volatility in Bangladesh stock market?*

For any stock market a proper characterization of the variations of conditional volatility is important. A precise volatility estimate is not only useful in determining the price of various financial assets but also critical in formulating out portfolio strategies over time. If sentiment has a significant impact on the conditional volatility of stock return, leaving sentiment out is likely to lead to inaccurate forecast of asset prices and suboptimal investment decisions. Therefore, the present study attempts to identify the relationship between excess market return and contemporaneous investor sentiment and investigate the impact of lagged investor sentiment on the conditional volatility of stock return.

## Research Question 2

*Does a negative return shock cause more volatility than a positive return shock?*

The study aims to investigate whether bad news cause more volatility than good news. In a number of previous studies, a negative leverage effect of return shocks on conditional volatility is found. In this respect it is important to investigate whether such an effect can be traced out in the stock market volatility of Bangladesh.

## Research Question 3

*Does the investor sentiment have a greater impact on the conditional volatility in a bullish market compared to that of a bearish market?*

Most empirical studies done previously find evidence that stock markets are not as persistent as it is thought; rather it is found that in high investor sentiment periods, the mean-variance relationship is undermined as suggested by noise traders' theory. This research intends to examine whether such asymmetry exists in the Bangladesh stock market as well.

As discussed previously there is an abundance of research works done on investor sentiment. However, most of them were done either to include investor sentiment in the modeling of asset pricing or to trace out the impact it has on stock price. Very recently the topic of investor sentiment and stock market volatility has come to focus by the academicians and researchers. From the point of view of Bangladesh stock market, investor sentiment is still a concept yet to be explored by the researchers. Very few studies have been done in the current topic. However, few studies that are found in this area have a very narrow study period. The current study aims to use the research results to explain the two bubble and burst periods of the Bangladesh stock exchange. In this context this study will definitely pave the way for future researchers to have a concrete idea about the influence and impact of investor sentiment on the return and volatility in the Bangladesh stock market.



# **Chapter # 3**

## **Methodology**

The research aims to identify the impact of investor sentiment on Bangladesh stock market return and volatility. This chapter presents the entire methodology of the study. It starts with research design, where the research models have been discussed at length. In the next two sections, the estimated variables and the sentiment proxies have been explained. Following this, a detailed discussion on the data has been presented. The last two sections of this chapter are on robustness check and diagnostic tests that have been applied in this study.

### **3.1 Research Design**

The main objective of this the study is to investigate the impact of investor sentiment on stock return and volatility in Bangladesh stock market. To facilitate the research, three individual sentiment proxies have been used. To test the impact of investor sentiment and lagged value of sentiment on the excess market return and conditional volatility respectively, generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model and Glosten, Jagannathan and Runkle's threshold generalized autoregressive conditional heteroskedasticity (GJR-TARCH) model have been applied.

In a time-series data, if the variances of the error terms are not uniformed and varies reasonably among different ranges, the data is termed as heteroskedastic (Uygur and Tas, 2014). In such cases the regression coefficients of an ordinary least square regression would still be unbiased. However, the confidence intervals and the standard errors may become too restricted, which may give misleading results. For heteroskedastic data autoregressive conditional heteroskedasticity (ARCH) and generalized autoregressive conditional heteroskedasticity (GARCH) models are appropriate as these models consider such heteroskedasticity as a variance.

From the empirical research it is found that, GARCH model with conditional normal distribution, is the most desired specification of generalized ARCH. The model includes contemporaneous shifts in investor sentiment in the mean equation and lagged shifts in sentiment in the conditional volatility equation. The underlying assumption being that the present value of security returns depends on its own lagged values, which in turn, implies that the volatility is dependent on the previous values. Therefore, by applying the lagged sentiment in the GARCH framework, it can be concluded that investor sentiment has considerable effect

on the mean-variance adjustments. However, due to a few limitations of the GARCH model, as identified by Nelson (1991), a number of modifications were made to the original GARCH model. Later Threshold GARCH (TGARCH) model was introduced by Glosten, Jagannathan and Runkle to overcome the limitations of GARCH model.

An interesting characteristic of asset pricing is that bad news appears to have a more prominent impact on volatility than good news, indicating an asymmetric property of earning shocks. GJR-TGARCH model, introduced by Glosten, Jagannathan and Runkle (1993), aims at capturing this asymmetric impact of negative and positive return shocks on conditional volatility. GJR-TGARCH model assumes that the same magnitude of the positive and negative shocks will have a different impact on conditional volatility. This is termed as the leverage effect (Black and Fischer, 1976). By adding multiplicative dummy variables, GJR-TGARCH model is able to recognize whether there exists any statistically significant difference when shocks are negative.

To find the impact of investor sentiment on stock market return and market volatility, different models have been used in empirical research. Lee, Jiang and Indro (2002) applied both GARCH-M model and TGARCH model on the US stock market. Wang, Li and Lin (2009) in their study, used Glosten, Jagannathan and Runkles' Generalize Autoregressive Conditional Heteroskedasticity (GJR-GARCH) model, Exponential Generalized Beta-2 (EGB2) model and Markov-switching ARCH (SWARCH) model on the Taiwan stock market. Here it is worth mentioning that both EGB2 and SWARCH have been used in this study to deal with high volatility, significant movement in kurtosis and skewness and structural changes in the research data. EGB2 model has an advantage of dealing with skewness problems. It is able to fit fat tails and skewness into the model. Moreover, Markov-switching ARCH (SWARCH) model, proposed by Hamilton and Susmel (1994), allows for regime switches in conditional variance. Therefore, these two additional models were applied in this research as they were more capable of fitting the data. Chuang, Ouyang and Lo (2010) in their study applied generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model as well as threshold generalized autoregressive conditional heteroskedasticity (TGARCH) model to analyze the impact of investor sentiment on excess market return and conditional volatility on the Taiwan stock market. Uygur and Tas (2014) applied Threshold GARCH (TGARCH) model and Exponential GARCH (EGARCH) model. The study was done on nine different indices, namely, U.S.A. (NASDAQ, S&P500, DOW), U.K. (FTSE100), Japan

(NIKKEI225), France (CAC40), Turkey (XU100), Hong Kong (HANG SENG) and Germany (DAX). Here it is worth mentioning that, the study applied EGARCH model as the research is based on nine different indices. One advantage of EGARCH model is that it uses the level of standardized value. As standardized value is a unit free measure, it allows for a more natural interpretation of size and persistence of stocks. Rahman, Shien and Sadique (2013) investigate the impact of sentiment on stock market returns and volatility in the context of Bangladesh by applying both generalized autoregressive conditional heteroskedasticity (GARCH) in-mean framework and threshold generalized autoregressive conditional heteroskedasticity (TGARCH) model

The current research is based on weekly data of the Dhaka Stock Exchange for the period between January, 1990 and December, 2018. There are a total of 1495 weekly observations. As mentioned earlier, three sentiment proxies are considered here, namely, the change in trading volume per security ( $\Delta TVOL$ ), the change in closed-end-fund-discount ( $\Delta CEFD$ ) and the change in modified relative strength Index ( $\Delta MRSI$ ). To attain the objectives, the study has employed both Generalized autoregressive conditional heteroskedasticity (GARCH-M) in mean model and Glosten, Jagannathan and Runkle's threshold generalized autoregressive conditional heteroskedasticity (GJR-TGARCH) model. These two models were chosen in this study as they were able to fit the data accurately with the required prediction power. Moreover, the current study is based on a single adjusted stock market index, therefore, standardization of unit, which is an advantage of EGARCH model is not deemed necessary.

Two studies which are methodologically close to the current study are those of Chuang, Ouyang and Lo (2010) and Rahman, Shien and Sadique (2013). Both of the studies apply GARCH-M model and TGARCH model. Whereas the current study is based on a time span much longer than those two. The study period of the current research is twenty-eight years whereas the other two are based on fourteen years and twelve years respectively. In case of sentiment proxies, change in trading volume per security is considered by Chuang, Ouyang and Lo (2010) and modified TRIN index is considered by Rahman, Shien and Sadique (2013), however the current study considers three sentiment proxies as mentioned earlier. Many of the previous studies consider sentiment index constructed by a combination of sentiment proxies. However, the sentiment proxies considered here have very low correlation. Therefore, sentiment index could not be constructed here by applying principal component analysis (PCA). Moreover, due to unavailability of macro data on a weekly basis, the proxies could not

be regressed with macro indicators to isolate the proxies from the common influence of macro variables. The current study applies GARCH-M model and GJR-TGARCH model. In some literature, GARCH-M model is modified with an additional seasonal dummy variable. However, such seasonal effect is not significant in the Bangladesh stock market for the entire study period, therefore, such adjustment is not deemed necessary. Considering the fact that Bangladesh stock market is weakly efficient, lags are considered in GJR-TGARCH model to identify lagged effect of sentiment and return on volatility. The following mean and conditional volatility models have been used in this research:

**Mean Model:**

$$R_{it} - R_{ft} = \alpha_0 + \alpha_1 h_{it} + \alpha_2 EMR_{t-n} + \alpha_3 \Delta TVOL_t + \alpha_4 \Delta MRSI_{it} + \alpha_5 \Delta CEFD_t + \varepsilon_{it} \dots\dots\dots(1)$$

$$\varepsilon_{it} \sim N(0, h_t)$$

Where,

$R_{it}$  = Weekly market return

$R_{ft}$  = Risk-free rate

$R_{it} - R_{ft}$  = Excess market return

$h_{it}$  = Conditional variance

$EMR_{t-n}$  = Lag n of excess market return

$\Delta TVOL_t$  = Change in trading volume per security

$\Delta MRSI_{it}$  = Change in modified relative strength index

$\Delta CEFD_{it}$  = Change in closed-end fund discount

$\varepsilon_{it}$  = Residual return

$i$  = units

$t$  = time

Here,  $R_{it}$  is the weekly return on the adjusted price index of DSE,  $R_{ft}$  is the risk-free rate, for which three-month T-bill rate has been taken as a proxy,  $h_{it}$  is the weekly variance of the return on adjusted DSE market index and  $\Delta TVOL_t$ ,  $\Delta MRSI_t$ ,  $\Delta CEFD_t$  are the weekly shift in

sentiment represented by change in trading volume per security, change in modified relative strength index and change in closed end fund discount respectively.

In the mean equation, the coefficient  $\alpha_1$  shows the volatility feedback effect. Therefore, the coefficient  $\alpha_1$  is expected to be negative which indicates that higher volatility has negative impact on return. The coefficient  $\alpha_2$  indicates the impact of lagged earnings on current excess market return and is generally expected to have a positive correlation. Both the coefficients  $\alpha_3$  and  $\alpha_4$  show the impact of change in trading volume per security ( $\Delta TVOL$ ) and impact of change in modified relative strength index ( $\Delta MRSI$ ) respectively, on the excess market return and are expected to be positively correlated with the excess market return. However, the coefficient  $\alpha_5$  is expected to have a negative sign as the change closed end fund discount ( $\Delta CEFD$ ) is presumed to be negatively correlated with the excess market return.

**The Conditional Volatility Model:**

$$h_{it} = \beta_0 + \beta_1 \varepsilon_{it-1}^2 + \beta_2 \varepsilon_{it-1}^2 I_{t-1} + \beta_3 h_{it-1} + \beta_4 (\Delta S_{t-1})^2 D_{t-1} + \beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1}) \dots\dots\dots(2)$$

Where,

$\varepsilon_{it-1}^2$  = Squared ith return shock at time t

$\Delta S_{t-1}$  = Change in investor sentiment at time t-1

$h_{it-1}$  = ith conditional variance at time t-1

$I_{t-1} = 1$ , if  $\varepsilon_{it} < 0$ , which indicates negative shock and  $I_{t-1} = 0$ , if  $\varepsilon_{it} \geq 0$ , which indicates positive shock.

$D_{t-1} = 0$ , if  $\Delta S_{t-1} \leq 0$ , which indicates bearish sentiment and  $D_{t-1} = 1$ , if  $\Delta S_{t-1} > 0$ , which indicates bullish sentiment.

i = units

t = time

In equation (2), by incorporating the dummy variable  $I_{t-1}$ , the attitude of investors towards positive and negative earning shocks have been taken into account. The dummy variable  $I_{t-1}$  takes a value of one when there is bad news in the previous period ( $\varepsilon_{it} < 0$ ) and zero in case of the opposite ( $\varepsilon_{it} \geq 0$ ). Here, the coefficient  $\beta_2$  represents a negative shock and is expected to push volatility upward as opposed to positive shock of similar magnitude.

In addition, the dummy variable  $D_{t-1}$  recognizes the asymmetric impact of sentiment depending on its magnitude and direction.  $D_{t-1}$  takes a value of one when a bullish shift in sentiment occurs ( $\Delta S_{t-1} > 0$ ) and it takes the value of zero in case of bearish shift ( $\Delta S_{t-1} \leq 0$ ). Here, the magnitude of the change in sentiment is measured by the absolute change in the sentiment. The direction is determined by the sign. This indicates whether the sentiment is moving on in an upward direction (bull market) or a downward direction (bear market). From empirical studies, it has been observed that individual investors may react differently to the same extent of shifts in sentiment depending on whether the market is bullish and bearish.

In the conditional volatility model, the coefficient  $\beta_2$  indicates the leverage effect and is expected to be negative, as discussed earlier. The coefficient  $\beta_3$  measures the persistence in conditional volatility. Where, a large  $\beta_3$  indicates that the volatility takes a long time to perish following a certain incident that triggers market volatility. Lastly the coefficients  $\beta_4$  and  $\beta_5$  are the parameters showing the effect of same extent of the change in investor sentiment during high and low sentiment periods. It is expected that  $\beta_4$ , which is a coefficient for bull market, should be positive and  $\beta_5$ , which is a coefficient for bear market, should be negative, because in the bull market volatility is expected to rise with a change in investor sentiment whereas, in the bear market, volatility is expected to fall with a change in sentiment.

## **3.2 Estimated Variables**

For the purpose of this research a number of variables have been estimated, namely, the adjusted market index, the excess market return, the stock market volatility, the change in trading volume per security, the change in closed-end fund discount and the change in modified relative strength index. In this section each of these variables are discussed at length.

### **3.2.1 Market Index**

There is no single stock market index in Bangladesh that covers the entire period of study. For the purpose of this research, three different indices have been used for the period under study, which are, DSE All Share Price index (1990 to 2000), DSE General Index (2001 to 2012) and DSE X index (2013 to 2015). Since these three indices were found to be disjointed, it was not possible to use any of them individually on a continuous basis. Moreover, even within a single

index, there were events that caused unrealistic fluctuations in the index which could provide misleading research result. Therefore, based on these three indices an adjusted DSE price index has been constructed, by using adjustment factors where it was deemed necessary and rational. The newly constructed adjusted index facilitates the smooth transition from one index data to another.

### 3.2.2 Excess Market Return

For this study weekly log return of adjusted market index has been considered as market return. The return has been calculated based on adjusted DSE stock price index. To calculate the return the closing index of each Thursday has been considered as the weekly index. The log return of each consecutive weekly index has been taken as weekly market return. To get the excess market return (EMR) weekly risk-free rate has been deducted from the weekly market return. Here it is worth mentioning that 91 days T-bill rate has been taken as the risk-free rate. The yearly T-bill rate has been converted into weekly rate, dividing it by the number of weeks per year.

$$\text{Stock Market Return} = \ln \left( \frac{\text{Adjusted stock market index at time } t}{\text{Adjusted stock market index at time } t - 1} \right)$$

$$\text{Excess Market Return} = \text{Stock Market Return} - \text{Risk Free Rate}$$

### 3.2.3 Stock Market Volatility

Stock market volatility (MVAR) has been calculated as the variance of log return on adjusted DSE stock price index. To derive weekly stock price volatility, first, the daily log return on adjusted index has been calculated and then the weekly variance of these log returns has been considered as weekly volatility.

*Stock Market Volatility*

$$= \text{Weekly Variance} \left[ \ln \left( \frac{\text{Adjusted stock market index at time } t}{\text{Adjusted stock market index at time } t - 1} \right) \right]$$



### 3.3 Sentiment Proxies

As mentioned earlier, there are enormous studies done on the investor sentiment. Among them, the most commonly used investor sentiment proxies are based on the stock trading behavior such as the average turnover, the dividend premium, the closed-end fund discount, the measures related to option market etc. However, these measures can sometimes give misleading representation of investor sentiment due to different procedural restrictions imposed on investors' trading. For example, due to restrictions on short selling, it becomes difficult to express negative sentiment. As a result, the data tend to be biased towards positive sentiment. Moreover, there are also some shortcomings of using data on aggregate transaction as sentiment proxies. Sometimes due to the composition of investors, it becomes important to separate the individual investors transaction from that of the institutional investors. In such instances, it becomes very difficult when aggregate data is used. There are even difficulties when direct survey-based sentiment measures are used, because investors' response to a survey questionnaire may be driven by their mood or market outlook on that particular day. However, that may vary widely on the day of taking specific investment decision. Therefore, investors response to survey may differ from their investment actions. However, the availability of appropriate data, narrows the choice of sentiment proxies. In many emerging stock markets, it is difficult to get very old data, this impair researchers from using useful information. Most studies use time-series data and it is important to get the proxy data for the entire study period.

A number of literature has been reviewed for this study to select the appropriate proxies for investor sentiment. Media related proxies for example, media coverage of aviation disaster by Kaplanski and Levy (2009), recommendations on investment newsletters by Nektaria, Karakatsani and Salmon (2008) etc, could not be considered for the current study as data on media coverage in Bangladesh may be disjointed and may hinder the findings of the study. Moreover, direct survey-based sentiment measures which is done by Bennet (2011), could not be considered as the current study is done on time-series data from 1990 to 2018. Therefore, such survey may not be able to identify the past investor sentiment and so may have limited benefit. In many empirical studies, data related to derivative markets are taken as sentiment proxies, for example, data on bank issued warrants on derivatives by Burghardt, Czink and Riordan (2008), transaction of bank-issued warrants by Schmitz, Glaser and Weber (2009). However, due to non-existence of the derivative market, those proxies could not be taken.

Moreover, as there is no bond market in Bangladesh, proxies related to bond, could not be contemplated either.

Considering the advantages and disadvantages of the sentiment proxies that have been reviewed, their availability for the entire study period and their relevance from the context of Bangladesh stock market, three sentiment proxies have been selected for the current study, namely, the change in trading volume per security ( $\Delta TVOL$ ), the change in closed-end fund discount ( $\Delta CEFD$ ), the change in modified relative strength index ( $\Delta MRSI$ ).

### 3.3.1 Change in Trading Volume per Security

Trading volume is popularly used as a proxy for investor sentiment in a number of previous studies (e.g., Scheinkman and Xiong, 2003, Baker and Wurgler, 2006, Nektaria, Karakatsani and Salmon, 2008, Cornell, Landsman and Stubben, 2011). In this study, following the work of Baker and Waugler (2006), the trading volume per security is calculated as the average weekly turnover (in number of shares) divided by the number of securities of all listed securities with the stock exchange during that year. Here, an increase in trading volume indicates investors' optimism and a decrease in trading volume indicates investors' pessimism.

*Trading volume per security (TVOL)*

$$= \left( \frac{\text{Average Weekly Tading Volume}}{\text{Number of securities listed with the stock exchange}} \right)$$

Change in Trading Volume per security ( $\Delta TVOL$ ) =  $TVOL_t - TVOL_{t-1}$

Where,

$TVOL_t$  = Trading volume per security at time t

$TVOL_{t-1}$  = Trading volume per security at time t-1

### 3.3.2 Change in Closed-end fund Discount

The closed-end fund discount has been calculated as the average difference between the net asset value (NAV) of closed-end fund shares and their market price. The change in the average discount on closed-end funds is considered as sentiment proxy. It is expected that in the bull

market investors would push up the market price of these funds and reduce the discount. Therefore, an inverse relationship is expected between the closed-end fund discount and the investor sentiment. For this calculation NAV based on the market price has been considered. It is worth mentioning here that the weekly NAV is not available in Bangladesh as mutual funds are instructed by the Bangladesh Securities and Exchange Commission (SEC) to declare NAV on a monthly basis. Therefore, the declared month-end NAV has been considered for all the weeks of that specific month. For the purpose of calculating closed-end fund discount, weekly closing price of mutual funds has been deducted from monthly declared NAV.

$$\text{Closed end Fund Discount(CEFD)} = \text{Average (NAV of Closed End Funds – Market Price of Closed End Funds)}$$

$$\text{Change in Closed-end Fund Discount } (\Delta\text{CEFD}) = \text{CEFD}_t - \text{CEFD}_{t-1}$$

Where,

$\text{CEFD}_t$  = Closed-end fund discount at time t

$\text{CEFD}_{t-1}$  = Closed-end fund discount at time t-1

### 3.3.3 Change in Modified Relative Strength Index

The relative strength index indicates whether the market is oversold or overbought. Following the work of Rehman et al. (2017) and Yang and Zhou (2015), relative strength index has been considered as one of the proxies for investor sentiment for the current study. However, the index has been modified in this study to avoid having undefined values. The modified relative strength index (MRSI) has been estimated as follows:

$$\text{MRS}_t = \frac{\sum_{i=1}^n \max(P_t - P_{t-1}, 0)}{\sum_{i=1}^n \max(P_t - P_{t-1}, 0) + \sum_{i=1}^n \max(P_{t-1} - P_t, 0)}$$

$$\text{MRSI}_t = 100 \times \text{MRS}_t / (1 + \text{MRS}_t)$$

$$\text{Change in Modified Relative Strength Index } (\Delta\text{MRSI}) = \text{MRSI}_t - \text{MRSI}_{t-1}$$

$P_t$  = Market Price at time  $t$

$P_{t-1}$  = Market Price at time  $t-1$

$t$  = Time

$n$  = Maximum number of time period

$MRSI_t$  = Modified Relative Strength Index at time  $t$

$MRSI_{t-1}$  = Modified Relative Strength Index at time  $t-1$

Where  $P_t$  is the closing value of the adjusted DSE stock price index  $i$  at time  $t$  and  $P_{t-1}$  is the closing value of the adjusted DSE stock price index  $i$  at time  $t-1$ . The value of MRSI varies from 0 to + 50. If the modified relative strength index is closer to 0, it generally means that the stock's losses are greater than the gains, which indicates a pessimistic sentiment. When relative strength index is near 50, it generally means that the gains are greater than the losses, indicating an optimism among the investors.

Following the work done by Cornell, Landsman and Stubben (2011) and Baker and Wurgler (2006), the study short-listed three more sentiment proxies, namely, the number of IPOs per week, the average first-day return on IPO and the dividend premium. Eventually these could not be used due to the following reasons. Generally, dividend premium is expected to have a positive value. This means that dividend paying companies are expected to have higher market to book value ratio than non-dividend paying companies. However, in Bangladesh stock market, it is observed that dividend premium has negative sign which could be misleading. So, it had to be dropped from the study. Moreover, in the Bangladesh stock market around 11 IPOs entered the market in a year on an average during the period under study. This indicates that most of the IPO data would remain zero as the current study is based on weekly data. Therefore, due to insignificant number of IPOs in the Bangladesh stock market, the variables related to IPOs are not used.

Since sentiment proxies are taken from trading activity, it is very likely that each of these proxies include a sentiment component as well as an idiosyncratic, non-sentiment-related component (Baker and Wurgler, 2006). From previous studies, it is evident that, a Principal Component Analysis (PCA) is generally used to isolate these common components. However, in the Bangladesh stock market, sentiment related proxies are mostly uncorrelated. Consequently, PCA is not useful to identify the common variation. Despite the fact that many other studies used composite sentiment index from PCA analysis, this study discarded the

sentiment index. Therefore, individual sentiment proxies had to be used in the GARCH –M model instead of a composite sentiment index.

It is worthwhile to mention that many empirical studies have also regressed the sentiment proxies with macro variable as it is likely that certain sentiment proxies are related with macro-economic phenomenon. In these empirical studies, the proxies were regressed with a number of macro-economic variables and the residuals were taken as sentiment proxies. However, due to unavailability of weekly data of certain macro-economic variables this analysis was dropped.

### **3.4 Data**

The study examines the influence of investor sentiment on the stock market volatility in Bangladesh. The study is done for the period between 1990 and 2018. As the study considers weekly data, there is a total of 1495 weekly observations. The scope of the analysis is limited to stocks listed with the Dhaka Stock Exchange (DSE). For the purpose of this research the Chittagong Stock Exchange (CSE) has not been included as almost all shares listed with the CSE are also listed with the DSE. Moreover, the DSE has higher liquidity as compared to that of the CSE, therefore the DSE indices have been used for this study. It is worth mentioning here that to capture the volatility of the entire study period three indices have been considered. This is due to the fact that a single stock price index for the entire study period is not available in the Bangladesh stock market. From 1990 to 2000 the DSE All Share Price index, from 2001 to 2012 the DSE General Index and from 2013 to 2015 the DSE X index have been considered. Since data from three different indices have been used in the research, certain adjustments had to be made for the smooth transition from one index data to another. The study has not collected primary survey data from individual investors as the current sentiment of the investors would have no relationship with the stock market volatility of the time period under study. Therefore, the entire research is based on secondary data on indirect sentiment proxies.

### **3.5 Robustness check**

To check the robustness of the empirical results the entire data (1990-2018) has been divided into two sub-periods of equal lengths. The duration of the sub-periods is January 4, 1990–June 10, 2004 and June 17, 2004–December 27, 2018. For each subperiod, the basic GARCH-M

and GJR-TGARCH models are applied. Moreover, the models have been repeated separately on the two bubble and burst periods to check the acceptability of the results during market bubbles. For this purpose, five years around the peak bubble period has been taken as sub-sample. The duration of the first bubble period is from 1993 to 1998 and the second bubble period is from 2008 to 2012. Again, for each bubble period, the basic GARCH-M and GJR-TGARCH models are repeated.

### **3.6 Diagnostic Tests**

The study has applied a variety of diagnostic tests to determine whether various aspects of different models are correctly specified. In order to apply GARCH-M and GJR-TGARCH model, the data need to have ARCH effect. The ARCH effect is often termed as serial correlation of the heteroskedasticity. In order to test whether the data has ARCH effect the Lagrange Multiplier (LM) test for autoregressive conditional heteroskedasticity (ARCH) has been applied. The ARCH effect is examined under the null hypothesis. Another pre-condition of GARCH-M and GJR-TGARCH model is that the data needs to have clustering volatility, which means the tendency of large changes in prices of financial assets to cluster together, which results in the persistence of these magnitudes of price changes. In other words, by clustering volatility it means, large changes tend to be followed by large changes and small changes tend to be followed by small changes. In order to test whether the data has clustering volatility, Cameron & Trivedi's decomposition of IM-test (Heteroskedasticity Test) has been applied to the data set. The test has been conducted with the null hypothesis that there is no clustering volatility or heteroskedasticity in the data.

In order to test whether the models are capable of making forecast the residual of the model must be free from auto-correlation and the residuals must be normally distributed. In order to test whether the residuals of the estimated models are free from auto correlation, the Durbin-Watson d-statistic has been applied. In addition to that, to check whether the residuals of the estimated models are normally distributed, skewness and kurtosis (SK test) test of normality has been carried out on the standardized residuals. Properly specified GARCH-M and TGARCH models should be able to significantly reduce the excess skewness and kurtosis which is evident in normal distribution. The skewness and kurtosis are examined under the null hypothesis.

# **Chapter # 4**

## **Securities Market in Bangladesh**

This study aims at identifying the impact of investor sentiment on excess market return and market volatility of Bangladesh Stock Market. For the purpose of this study, it is important to know the exact nature of this market. To facilitate the understanding of the Bangladesh stock market, this chapter provides the historical background of the Bangladesh stock market. This is followed by institutional framework, legal framework and the growth of stock market in Bangladesh.

#### **4.1 Historical Background of Securities Market in Bangladesh**

On April 28, 1954, through the establishment of the East Pakistan Stock Exchange Association Ltd. the journey of Bangladesh stock market began. Trading of the East Pakistan exchange started in 1956. During that time the paid-up capital of East Pakistan exchange was Taka 4 billion and it had 196 listed securities. The East Pakistan Stock Exchange went through a number of transitions before it was finally renamed as Dhaka Stock Exchange on May 13, 1964. But, due to liberation war and economic instability, as the aftermath of the war, trading on the Dhaka Stock Exchange (DSE) was halted from 1971 to 1976. However, in 1976, the Dhaka Stock Exchange resumed its trading. During this time DSE had a paid-up capital of Taka 137.52 million and it had 9 listed securities. Initially the Controller of Capital Issues (CCI) was the regulatory authority of the securities market in Bangladesh. However, after the enactment of Securities and Exchange Commission Act, 1993, this regulatory authority was bestowed upon the Bangladesh Securities and Exchange Commission (BSEC). It is worth mentioning here that the Dhaka Stock Exchange operates under its own Articles of Association rules and regulations; however, its activities are also regulated by the Securities and Exchange Ordinance-1969, the Companies Act-1994 and the Securities and Exchange Commission Act,1993.

From its inception the DSE has achieved a number of milestones. In 1998, it started all share price index calculation. Automated trading commenced in 1998. DSE introduced two more index in 2001, namely, DSE-20 Index and DSE General Index. The introduction of central Depository System through the Central Depository Bangladesh Limited (CDBL) took place in 2004. DSE introduced a modern IPO process known as the book-building system in 2010. In 2012, the DSE became a correspondent member of the World Federation of Exchanges (WFE). Moreover, in 2013, two milestones were achieved. Firstly, both DSEX and DSE30 index was



initiated by S&P. Secondly, DSE was transformed into a demutualized exchange. 2014 was remarkable for the initiation of DSES index and inauguration of next generation automated trading system in Dhaka Stock Exchange. Moreover, the DSE launched a mobile app “DSE INFO” in 2015. In 2016, “New Book-Building Software” was inaugurated by the DSE. In 2017 it achieved ISO 9001:2008 and became full member of WFE. Lastly, in 2018, DSE achieved ISO 9001:2015. In the same year 25 percent share of DSE was transferred to Chinese consortium, which is a Strategic partner of DSE.

## **4.2 Institutional Framework**

Capital market or securities market is a network of institutions that work hand in hand. The development of this market depends on how smoothly each of these institutions executes its functions. The major institutions in the securities market of Bangladesh include the Dhaka Stock Exchange (DSE), the Chittagong Stock Exchange (CSE) - the two stock exchanges of the country, the Bangladesh Securities and Exchange Commission (BSEC) - the regulatory authority of Bangladesh securities market and then different intermediaries such as the Central Depository Bangladesh Limited (CDBL), merchant banks, asset management companies, credit rating agencies, fund managers etc.

### **4.2.1 The Bangladesh Securities and Exchange Commission**

The Bangladesh Securities and Exchange Commission (BSEC), the main regulatory body of the Bangladesh capital market, started its operations on June 8, 1993. The BSEC is an autonomous body under the Ministry of Finance. It is empowered to function independently without government intervention under the Securities and Exchange Commission Act, 1993. The main objective of BSEC is to protect the interest of the investors. The BSEC has the right to oversee the entire activities of Bangladesh securities market and amend all the securities laws and regulations. According to the Securities and Exchange Ordinance, 1969 BSEC has also been authorized to control even self-regulatory institutions for instance the Stock Exchanges. The commission consists of a chairman and four members, duly appointed by the government of Bangladesh.

The BSEC aims at protecting the interest of investor, developing securities market, facilitating appropriate issuance of securities, providing guidance to the exchanges through issuance of different securities laws, rules and regulations. The BSEC is also responsible to educate investors and provide trainings to different market intermediaries. The BSEC is responsible to oversee the activities of certain institutions and intermediaries, namely, the Dhaka Stock Exchange (DSE), the Chittagong Stock Exchange (CSE), the Central Depository Bangladesh Limited (CDBL), stock brokers, merchant banks and assets management companies. Other functions of the BSEC include conducting transparent trading, stopping fraudulent activities like market manipulation, short selling, insider trading, ensuring submission of duly audited financial statements, reports and returns, inquiring against irregularities and taking legal actions where it is deemed necessary.

#### **4.2.2 The Dhaka Stock Exchange**

The Dhaka Stock Exchange, the main stock exchange of the country is a public limited company. The DSE is a self-regulated, non-profit organization. Its activities are mainly regulated by its own rules, regulations and by-laws contained in its Articles of Association. However, the operations and activities of the DSE is also guided and controlled by the Securities and Exchange Ordinance, 1969, the Companies Act, 1994 and the Securities and Exchange Commission Act, 1993. The DSE started its journey as a physical stock exchange with an open out-cry trading system, however it initiated automated trading system in 1998 which was required for the swift and effective operation of the market. With time the system was upgraded to keep up with the pace of the market.

Currently the Dhaka Stock Exchange has 250 members and 358 listed securities. DSE is open five days a week except for Friday and Saturday from 10:30 am to 2:30 pm. However, on Government holidays and public holidays it remains closed. DSE has a number of indices to measure the movement of the market, namely, DSEX, DS30, DSES. The functions of DSE is regulated by the Bangladesh Securities and Exchange Commission (BSEC) under the supervision of the Ministry of Finance.

DSE became a demutualized exchange in the year 2013. After demutualization there has been changes in two key features, firstly, separation of ownership from its management and secondly, separation of trading right from ownership. After demutualization, majority of the

members of the Board of Directors, including the chairman, are independent directors. A major purpose of such change is to ensure a strong role of independent directors in decision making. This is expected to have a positive impact on impartial decision making, enhancement of corporate governance and protection of investors' interest. At present the board structure of DSE is as follows: (i) there are a total of 13 directors out of which 7 are independent directors and (ii) 5 are from the Shareholders and (iii) a Managing Director and CEO as Ex-Officio member of the Board with voting rights.

The Dhaka Stock Exchange has a number of functions to perform. Of them the listing of companies is one of the main functions as it facilitates the companies to raise capital from the stock market. Apart from that, providing automated trading facilities, settlement of trading are also regular activities of DSE. In certain instances, DSE needs to approve transactions outside the trading system of the exchange. The DSE also has the responsibility to oversee the entire activity of the market as a whole for which it needs to perform certain functions for example, market administration, monitoring, and control, market surveillance, following and investigating the activities of listed companies etc. To protect the rights and interest of its investors DSE has an investor's grievance cell to receive complaints from the investors and take necessary actions and has an investors protection fund to compensate the investors in case of any loss due to the exchange. The DSE publishes a number of reports to make the investors as well as the other counterparties aware of the activities and position of the market from time to time. These includes, the monthly review, the quarterly review and other periodic reports. In addition, they have online portal to provide news and other information to different stakeholders. Announcement of price sensitive and other information about the listed companies through its website is also one of its major functions.

#### **4.2.3 The Chittagong Stock Exchange**

Chittagong Stock Exchange, the second stock exchange in Bangladesh, started operation in 1995 as a not-for-profit public limited company. It is also a self-regulated organization and is administered under the Chittagong Stock Exchange (Board and Administration) regulation, 2000. However, the Bangladesh Securities and Exchange Commission is its regulatory authority with the right and power to control its activities. Initially in CSE trading was done through open cry-out system; however, gradually it introduced leading age technology and advanced logistic support and evolved as the state-of-the art exchange of the country.

Chittagong Stock Exchange has certain objectives. Its main focus is to facilitate financing of competent companies so that they can contribute to the overall development of the economy. To keep pace with the global advancement, the CSE introduced a fully automated trading system, a clearing house, securities depository center, system to collect, preserve and disseminate data and information on stock exchange. In addition to that, it has also developed a research cell for analyzing status of the market and the economy.

The CSE is open five days a week except for Friday and Saturday from 10:30 am till 2:30 pm. It remains closed on government holidays and public holidays. Currently CSE has 324 listed securities and 129 members. CSE became a demutualized exchange on November 21, 2013. After demutualization the management of CSE is entrusted on a 13-member board, comprising of 7 independent directors and 5 shareholder directors. The chairman of the board is elected from independent directors. It has a separate secretariat for independent policymaking. The board comprises of brokers and non-brokers directors to ensure the transparency.

Chittagong Stock Exchange has 5 indices to calculate the movement of the market, namely, All Share Price Index (CASPI), CSE Selective Index (CSE30), CSE Selective Categories' Index (CSCX), CSE Shariah Index (CSI), CSE 50 index (CSE50). The CSE has its own Memorandum and Articles of Association, regulations and by laws to regulate its activities. However, it is also legally obligated to follow the rules, regulations and notifications of Bangladesh Securities and Exchange Commission.

#### **4.2.4 The Central Depository Bangladesh Limited**

Central Depository Bangladesh Limited (CDBL) was incorporated on August 20, 2000. CDBL has added value to the stock market of Bangladesh by facilitating paperless trading. Before the establishment of CDBL, process of transferring and delivering ownership was too lengthy and risky. Introduction of an automated trading system coupled with a central depository system have helped the stock market of Bangladesh reach a new height in terms of efficiency and credibility. The participants of CDBL are called Depository Participant (DP). The CDBL charges a certain fee from its participants depending on the level of services provided.

The main functions of the CDBL are operating the central depository system, maintaining securities accounts and registering transfer of securities, ensuring paperless transfer of

securities, monitoring and supervising the activities of depository participants. In addition to these, the CDBL also provides a platform for the secondary market trading of Treasury Bills and Government bonds issued by Bangladesh Bank. By ensuring paperless trading, the Central Depository System (CDS) has made the entire trading system more convenient, efficient and smooth.

The activities of the CDBL is regulated by a number of acts, rules and regulatives including, Depositories Act, 1999, Depository (User) Regulations, 2003 and CDBL Bye-Laws, 2003. These state the regulatory authority and its right and power to supervise the actions of CDBL. These regulations also stipulate the rules concerning the operation of the depository. Moreover, the regulations iterate the criteria for companies to establish depository systems like DSE, CSE etc.

#### **4.2.5 Merchant Banks**

Merchant banks offer their services to companies to make a convincing public offering of shares on a large exchange. These banks carry out a number of functions, they provide underwriting services for new issues. These services include, advice related to timing of public issue, the size and pricing of IPO, issue manager services. Issue manager services, provided by merchant bank includes, helping companies to prepare applications for listing and allotting securities, helping companies with right issue, providing corporate advisory service, facilitating structured finance etc. Currently there are 62 merchant banks in Bangladesh. These merchant banks in Bangladesh have license from Bangladesh Securities and Exchange Commission (BSEC).

#### **4.2.6 Asset Management Companies**

Asset management companies manage funds for companies. These companies are specialized in making speculative investment decisions on behalf of their clients to grow their finances and portfolios. These companies have the advantage to exercise economies of scale as they work with a group of several investors and are better able to diversify their clients' portfolios and mitigate the associated risks. Currently there are 39 asset management companies operating in Bangladesh under the supervision of Bangladesh Securities and Exchange Commission.

#### **4.2.7 Credit Rating Agencies**

A credit rating agency provides an independent evaluation of the creditworthiness of corporations. These agencies assess the financial strength and stability of companies, emphasizing on their ability to meet principal and interest payments of their debts. The rating assigned to a given company indicates the level of confidence of the agency that the borrower will honor its debt obligations as agreed. Currently there are 8 credit rating agencies operating in Bangladesh.

#### **4.2.8 Fund Managers**

A **fund manager** is an investment company that oversees the investments within a portfolio. Usually a fund manager performs research on investments and makes buy/sell recommendations. Currently there are 16 companies working as fund managers in Bangladesh.

### **4.3 Legal Framework**

Securities market in Bangladesh has a strict regulatory regime under which it operates. Initially the Controller of Capital Issues (CCI) was the regulatory authority of the securities market in Bangladesh. This regulatory power was handed over to Bangladesh Securities and Exchange Commission (SEC) after the enactment of Securities and Exchange Commission Act, 1993. Dhaka Stock Exchange, the biggest stock exchange of the country operates under its own Articles of Association rules and regulations; however, its activities are also regulated by Securities and Exchange Ordinance-1969, Companies Act-1994 and Securities and Exchange Commission Act-1993.

#### **4.3.1 The Securities and Exchange Commission Laws, Rules and Regulations**

##### **The Securities and Exchange Commission Act, 1993**

The objective of this regulation is to create a regulatory authority for capital market to protect the interest of the investors and parties concern and to take up the entire liabilities and responsibilities of capital market on behalf of the government. According to this regulation the government shall establish a statutory body called Bangladesh Securities and Exchange

Commission to develop and regulate the capital and securities market and protect the interests of the investors. The commission will have the responsibility to determine and regulate the function of stock brokers, bankers of issues, merchant bankers, underwriters, portfolio managers, credit rating companies and such other intermediaries associated with the securities market. Moreover, it will have the sole authority to monitor and control the activities of the securities exchanges and its related organization. In addition to that, the commission will have the power to prohibit fraudulent and unfair transactions, develop educational training relating to investment, prohibit insider trading, and regulate clearing and settlement of securities transaction. Without the registration certificate granted by the commission, no stock brokers, share transfer agents, bankers of issues and other intermediaries will be allowed to transact in the securities market. After the establishment of the commission, it will take over all liabilities and responsibilities of the Government under the Capital Issues. As per this regulation, the commission shall be entitled to use a fund for its day to day operation; such fund shall consist of contributions from the Government, the local authorities or other related institutions.

### **Securities and Exchange Rules, 1987**

The objective of this regulation is to state the role and responsibilities of both the exchange and the members towards the commission to facilitate the role of the commission as a regulatory body of the stock market. According to this regulation, a person shall be eligible as a member of a stock exchange if he/she is more than twelve years of age, and is in sound mind, or, in the case of a firm or company, has not been adjudicated as insolvent by a competent court or got involved in any fraudulent activity. However, the commission shall have the right to cancel the membership if the member has incurred any of the disqualification mentioned above. A member shall be liable to execute an order only if he has received the order in person and in writing. Moreover, a member shall have the responsibility to execute the orders of customers before buying or selling the same securities for his own account. According to this regulation both the stock exchange and the members shall have to prepare and maintain proper books of accounts, display a clear picture of its business and make sure that the accounts are be duly audited. Moreover, such reports along with other required documents must be submitted to the commission on an annual basis by both the exchange and the members.

## **The Securities and Exchange Commission (Prohibition of Insider Trading) Regulations, 1995**

To ensure investor's interest this regulation prohibits insider trading and states the procedures of investigation and magnitude of punishment to non-compliant companies. According to this regulation, listed companies are prohibited to provide any price sensitive information to any of its director, sponsor or any other party related to it. However, the commission will have the right to formulate proper procedure to disseminate price sensitive information in this regard. Those companies that are not complying with the regulation will have their registration cancelled or halted by the commission. However, such action will be taken only after thorough investigation done by the investigation committee formed for this purpose by the commission. The decision of the commission will be based on the investigation report submitted by the committee.

## **The Securities and Exchange Commission (Merchant Banker and Portfolio Manager) Rules, 1996**

The objective of this regulation is to iterate the eligibility criteria of a merchant banker and a portfolio manager, the registration process, their duties and responsibilities and their code of conduct. By providing a clear guideline this regulation makes sure that only competent and eligible companies are undertaking these important roles. Under this regulation, a company, a registered organization or an institution approved by the commission, having a minimum required paid-up capital, can be a merchant banker or a portfolio manager by getting certificate from the commission. Detailed procedures of registration for both a merchant banker and a portfolio manager are stated in this regulation. Application must be done in required format and certain fees have to be paid. After receiving the application, the commission will thoroughly examine and enquire about the company. In case if the commission is satisfied with the application it will grant the application and hand over a certificate of registration.

A merchant banker shall have certain responsibilities, for example it shall not hold any shares of the company that it is working for, on its own account, a merchant banker who is playing the role of an issue manager will have to submit required document and due diligence certificate to the commission, it will not use any price sensitive information which is not available to public, for investment in its own account etc. As per this rule, a portfolio manager will enter



into a contract with its client that must clearly state the rights, responsibilities and roles of each party. Under this regulation, a client can withdraw its portfolio securities or fund under its own responsibility but must follow certain procedures. However, a portfolio manager will invest client's funds according to the conditions of the contract. It will not be permitted to do any speculative transaction with the client's fund. Moreover, a report must be submitted by the portfolio manager regarding the transactions on its client's account after a certain interval. This regulation also provides guideline on cancellation and halt of registration, code of conduct by merchant banker and portfolio manager, appointment, cancellation and power of both merchant banker and portfolio manager.

### **Credit Rating Companies Rules, 1996**

The objective of this regulation is to state in detail the criteria and procedure to be followed by a company operating as a credit rating company. The main purpose for this regulation is to make sure that only competent companies are doing the credit rating. In order to issue shares or debt to the public, a company needs its issue to be rated by a credit rating company and such rating must be stated in the prospectus. According to this regulation, only financially sound and competent public limited companies with paid-up capital of not less than fifty lac taka, shall be eligible to register as a credit rating company. After receiving such application if the commission deems it to be compliant with the conditions, it shall grant a certificate of registration. However, the commission will have the power to cancel or suspend such registration in case if the company fails to comply with the regulations. Moreover, the commission may, if it deems necessary, give certain direction to the credit rating companies. A credit rating company must submit a quarterly report on credit rating within 15 days of the close of the quarter.

### **The Bangladesh Securities and Exchange Commission (Margin Rules) 1999:**

The main objective of this rule is to extend credit facilities to the investors. To protect both the member and the investor from any kind of risk arising from margin transaction, this rule provides strict guidelines to make sure that there are no loopholes. For the purpose of smooth operation of this account an investor shall have to authorize the member to mortgage, pledge or hypothecate his/her securities or property for an amount equal to the dues in the margin account. This rule stipulates that there should be a written document where a member has to be

duly authorized for such transactions. In addition to that, it also specifies a minimum equity margin that needs to be maintained to safeguard the member. No transaction on this account will be allowed unless such amount is deposited. Such deposit can be made in cash or government securities. On the other hand, to protect the equity of the client this rule also lays down the maximum percentage of deficit that a member is permitted to incur on this account.

### **The Securities and Exchange Commission (Stock Dealer, Stock Broker and Authorized Representative) Rules, 2000**

The objective of this regulation is to touch all the aspects of stock dealers, stock brokers and authorized representatives. It provides details about the eligibility criteria, the application process, the duties, the requirements regarding the books of accounts etc., to make sure that there is no room for confusion regarding any of these matters. Under this regulation, for any company to be registered as a stock broker or dealer or any person to be an authorized representative, certain eligibility criterion have to be fulfilled. To get a registration certificate a company has to make an application to the commission in a specific form by submitting necessary documents as required by this regulation. After proper examination if the commission is satisfied it may approve the application and hand over the certificate to the eligible applicant. A registered stock dealer, stock broker or authorized representative shall have the responsibility to work with utmost honesty and integrity and have to abide by all the requirement of this regulation. In case if the commission feels that any stock dealer, stock broker or authorized representative is not complying any of the regulations or is not operating in utmost good faith, it may cancel or halt the registration certificate. A stock dealer or stock broker shall have to maintain proper books of accounts, registrar and other documents as per the requirements of this regulation. The commission shall have the right to inspect any of these stock dealers, stock brokers or authorized representatives if it deems necessary.

### **The Securities and Exchange Commission (Over-the-Counter) Rules, 2001**

The objective of this regulation is to mobilize OTC market by facilitating unlisted and delisted companies to transact securities in this informal channel. To ensure the interest of both the investors and the capital market as a whole, this regulation gives specific guidelines for the companies operating in this market to follow. According to this regulation, the issuer of an unlisted or delisted security having paid-up capital of at least taka one crore; may avail OTC

service, provided that it has no accumulated losses and it is regular in holding AGM. Such eligible companies shall have to apply to the exchange, as designated by the Commission, through a stock-dealer/stock-broker by paying certain fees to the exchange. Both the exchange and the commission shall have the right to discontinue, halt or suspend the buy or sale of any security at OTC, if it is required for the betterment of the investors and the capital market. According to this regulation, the exchange shall prominently display a full list of the securities available at OTC and the quantity of each security available for sale and the unit price offered. As per this regulation, certain rules need to be followed for the payment and delivery of securities in the OTC market.

### **The Securities and Exchange Commission (Mutual Fund) Rule, 2001**

The objective of this regulation is to facilitate the formation and management of mutual fund. According to this rule, registration is a prerequisite for formation of a mutual fund. For this an application must be submitted to the commission with necessary documents after making payment of registration fee specified under this regulation. A mutual fund must be formed as a trust and should be duly registered. A trust will have certain rights and responsibilities such as, right to get information related to the operation of the fund from the fund manager, responsibility to take necessary actions and inform the commission, if it feels that the fund is not in compliance with the regulation etc.

### **The Securities and Exchange Commission (Asset Backed Securities Issue) Rules, 2004**

The objective of this regulation is to facilitate the issuance of asset backed securities by specifying the procedure for registration, appointment of a trustee and the definite right and responsibility of the trustee to make sure that all activities are done in accordance with the regulation and the interest of the investors are being protected. Without being registered by the commission no one can issue or work as a trustee of any asset backed security. An issuer of such security needs to follow certain procedures, under this regulation, to apply for registration. However, if the security is partially sold by public offer, a different procedure has to be followed under Public Issue Rules, 1998.

A trustee must be appointed by the issuing company for issuing asset backed securities. For this a deed of engagement of trustee must be approved by the commission. A bank or other

financial institutions can play the role of a trustee provided that it fulfills certain conditions under this regulation. A trustee shall have the right to get any information related to the management of the trust and also ask for certain information if it deems necessary under this regulation. Moreover, it shall have the right to take necessary actions if it thinks that issuing company is not complying with the rules. For any acquisition or transfer in favor of the trust, the trustee will have the responsibility to make necessary arrangements and complete the transaction in the way required by the law. The trustee shall also be responsible to supervise all the transactions of the trust fund and make sure that they are done in accordance with this regulation.

### **The Securities and Exchange Commission (Right Issue) Rules, 2006**

The objective of this rule is to facilitate right share issue of listed companies by providing specific guidelines on pre-conditions to be fulfilled, pricing method, detail process to be followed for right issue etc. For right issue, a company must fulfill certain conditions such as, the approval of such issue, declaration of full utilization of previous right issue etc. In case of pricing, a company must, in consultation with its issue manager, determine the price of the issue. However, it cannot be above par value if the company has not been in operation for the last three years. Moreover, the ratio for right share cannot exceed 1:5 ratios. The company making rights issue shall appoint both an issue manager and an underwriter licensed under Securities and Exchange Commission Rules 1996. Certain process needs to be followed by the issuing company. The company must submit the application for issuing right share along with other documents to the commission in the prescribed format. It must make public announcement for right issue after getting approval from the commission. The statement of the subscription needs to be submitted to the commission as well.

### **The Exchanges Demutualization Act, 2013**

The objective of this regulation is to separate the ownership of the exchange from its management so that the exchanges can operate more smoothly and can preserve the interest of its stake holders. According to this regulation an exchange or a person can only trade if it is registered by the commission and is duly demutualized under this rule. In order to preserve the trading right, an exchange needs to demutualize by separating its ownership from the management. As mentioned in this regulation, demutualization is a step by step procedure

beginning with (1) the submission of a scheme as required under this regulation, (2) approval of the scheme by the commission, (3) circulation of the scheme among the members of the exchange, ending with (4) uploading it in its official website and publishing it in two Bengali and two English popular national daily newspapers. Moreover, certain conditions need to be met by the exchange. Which are; within 90 days of demutualization the first meeting of the management committee must be held, trading right must be separated from ownership and management, Trading Right Entitlement Certificate (TREC) must be distributed as per the instruction of this regulation. As a result of demutualization, all securities will be listed with the newly demutualized exchange. All the activities done by the exchange will be on going, provided that they are within the purview of this regulation.

### **The Securities and Exchange Commission (Research Analyst) Rules, 2013**

The objective of this regulation is to clearly iterate certain issues regarding research analyst, namely, the eligibility criteria of a research analyst, the specific guideline for disclosure and the research standard to be maintained by the analyst. According to this regulation, merchant banks, stock-dealer/broker, asset management companies, investment advisers and independent research firms can become eligible for publishing research reports, provided that it has a separate research team with at least 3 qualified members and provided that it has obtained registration certificate from Bangladesh Securities and Exchange Commission. In order to become a qualified research analyst a person must possess relevant academic and professional qualification and have at least 3 years of experience in capital market/financial market related organizations. The rule provides certain guidelines for disclosure. The research firm or analyst must make full and fair disclosure of all matters that could harm their independence and objectivity of research. Restriction is also imposed on possessing securities of the listed company for which it is writing the report. According to this regulation a minimum research standard must be maintained by the research firms. For example, such firm must exercise diligence and independence, it must have reasonable basis supporting every research, it must communicate with the client, the general process that will be followed in the research and it must retain record of analysis for at least 7 years.

## **The Bangladesh Securities and Exchange Commission (Alternative Investment) Rules, 2015**

The objective of this regulation is to give detailed guideline about alternative investment fund and detailed description of the parties involved with it and provide restrictions to make sure that the fund is being operated to protect the investor's interest. For alternative investment, a fund must be created in the form of a trust and must be registered to make particular type of investment. However, the fund shall be prohibited from public subscription. The commission shall have the power to cancel the fund's registration if it deems necessary. An alternative investment fund shall be operated by a fund manager who must be registered by the commission after fulfillment of certain eligibility criteria under this regulation. A fund manager shall have the duties and responsibilities to make sure that the fund is managed in accordance with the rules and the fund is professionally handled. Moreover, the fund manager must prepare financial statements on a yearly basis and get them audited and certified by the trustee.

A trustee shall act on behalf of the investors and make sure that the interest of the investors is protected. A competent and effective bank that fulfills certain eligibility criteria can get registered as a trustee of an alternative investment fund. A trustee shall issue units to the investors upon full payment by the investors. The trustee shall have the responsibility to take necessary actions against any complaint by the investors and inform the commission about it. The fund manager may raise capital for a fund from eligible investors through issuance of units under this regulation, for the purpose of this regulation an eligible investor shall not be someone related to the fund manager or the trustee. The Commission shall have the power to undertake enquiry on any matter or against a complaint and shall have the power to call for information if deemed necessary.

## **The Bangladesh Securities and Exchange Commission (Exchange Traded Fund) Rules, 2016**

The objective of this regulation is to elaborately state all the necessary aspects of an Exchange Traded Fund namely, its formation, its listing process, investment scope, arbitrage facility etc. By doing so it facilitates the exchange traded fund to play an important part in maintaining the stability the security market. An exchange traded fund (ETF) can only be formed and can operate if it is compliant with all the requirements of this regulation and duly registered by the

commission. An ETF shall only do the activities permitted under the registration and be in the category granted. An ETF can be offered through either private placement or initial public offering (IPO) subject to fulfillment of certain conditions. ETF shall be listed according to the provisions of mutual fund rules and the listing regulations of the exchange.

For the smooth operation of the fund a number of parties need to be appointed. This regulation clearly states the eligibility criteria and the roles and duties for all these positions namely, a registered asset manager, a trustee, a custodian, authorized participants, index provider, market maker. The rule also clarifies the scope of investment by specifying the investment conditions and restrictions. An ETF shall have the obligation to make specific disclosure to the official website and to the exchange. According to this regulation, an ETF shall be permitted to operate with an arbitrage mechanism designed to minimize the potential deviation between the market price and NAV of ETF units. However, the commission shall have the power to do enquiry and inspection if it deems necessary and shall have the power to call for information and documents.

### **The Bangladesh Securities and Exchange Commission (Market Maker) Rules 2017**

The objective of this regulation is to provide specific guidelines about market makers. By specifying the duties and responsibility of market makers this regulation pin points on its role in maintaining liquidity and overall stability of the market. According to these rules, no merchant bank or any other financial institution can be a market maker without a registration certificate given by the commission specified under this rule. A market maker cannot be a certified stock broker or stock dealer or cannot be in any other role in the exchange which is not permitted by the commission. An institution shall have to apply for registration after paying certain fees to the commission. This registration certificate shall have a maturity of one year. Every market maker will have to work with full integrity, proficiency and sincerity. It will have to inform the commission; in case any untrue or misleading information is presented to the commission or if there is any change to any information already presented to the commission. In order to maintain liquidity and price stability of the approved securities a market maker shall have to take necessary actions. If required it shall have to buy and sell approved securities on its own account.

## **The Bangladesh Securities and Exchange Commission (Public Issue) Rule, 2015**

The main objective of this regulation is to make the public offer of securities and debt instruments clear and transparent to the issuer as well as the investors. This regulation touches all the necessary areas of public offer so that the issuer company gets a clear guideline which it can follow and the authorities get a set criterion to judge each application. According to this regulation a company can issue shares to the public by two methods, namely fixed price method and book-building method. For both the methods certain requirements need to be followed, for example, (1) a company may apply for public offer only if it's financial statements have been prepared in accordance with the requirements and have been duly audited, (2) it is regular in holding its annual general meetings and (3) its financial position has not changed substantially after the date of its last financial statement. In addition to that, (4) a company needs to be in commercial operation at least for preceding 2 years and (5) at least for latest financial year its major financial indicators such as net profit after tax, net operating cash flow needs to be positive. This regulation also permits a listed company to repeat public offer, subject to compliance with certain conditions. However, for repeat public offer, the 35 percent issue needs to be underwritten under firm commitment basis.

For both the method the issuing company must submit application with all necessary documents to both the commission and the exchange and post the red-herring prospectus to its official website. The exchange, if satisfied with all the documents, will submit its primary recommendation to the commission. The commission, after some further investigation, will approve or reject the application. However, for book-building method some additional steps need to be followed, such as, conduct road show and complete the prospectus, determine the cut-off price, distribution of securities to eligible investors etc. In addition to the detailed procedures to be followed for public issue, this regulation also includes certain important aspects such as prospectus delivery requirements, limitations on the use of prospectus, lock-in period for sponsor, directors, qualification and responsibilities of an issue manager and the underwriter etc.



## **The Bangladesh Securities and Exchange Commission (Clearing and Settlement) Rules, 2017**

The objective of this regulation is to state the detailed process of clearing and settlement, registration process, eligibility criteria, the duties and responsibilities of the parties involved in this process. By imposing certain restrictions, this regulation confirms that all the parties involved in the clearing and settlement process works toward the benefit of the investors and the security market as a whole. Under this regulation a person needs to get registered as central counter party from the commission for the clearing and settlement of security transactions in an exchange. However, even a registered person cannot work as the settlement and clearing agent without business startup certificate. A central counterparty shall work for all securities under its own rules and regulations provided that it is safe, transparent, reliable and responsible. This regulation provides detailed process of getting registered as central counterparty and startup of business, for example, eligibility criteria, issuance of application and certificate, annual fee, application for startup business etc.

Two categories of participants can take part in the clearing and settlement process, namely self-clearing participants and full clearing participants. Only stock brokers and stock dealers can be self-clearing participants. This category of participants shall only have the right to clear and settle the transactions done on their own accounts or transactions done for their customers. On the other hand, companies with high net worth who has the capacity to endure high risk can play the role of full-clearing participants. This category of participants shall have the right to clear and settle the transactions of people with whom it has contractual obligation. This regulation imposes certain restrictions to make sure that central counterparties are working towards the wellbeing of the investors. Moreover, this regulation also states the responsibilities of the exchange regarding clearing and settlement process.

## **Corporate Governance Code, 2018**

The objective of this regulation is to provide specific guideline to the issuer companies regarding corporate governance. Corporate governance code sets clear standards for the issuing companies to comply with. The different criterions that are mentioned here are, the size of the board, the ratio of independent directors, their qualifications, the selection process of chairman of the board and the chief executive officer, the chairman of the audit committee. It also sets

specific rules concerning the constitution of audit committee, its role to ensure the fairness in financial reporting, the role of external auditors. This regulation also provides clear guide line for subsidiary company of the issuer for instance the constitution of the board of directors, the audit committee etc. This regulation requires a declaration from both the CEO and the CFO of the issuer company that the financial statements provides a true and impartial assessment of the company's business and is in accordance with existing accounting standards and related regulations.

### **The Securities and Exchange Commission (Substantial Acquisition and Takeover) Rules, 2018**

The objective of this regulation is to make clear the declaration and settlement process for holding significant portion of a listed company's share. It also provides specific guidelines to companies or financial institutions that want to acquire, individually or collectively, shares of a financially distressed company. According to this regulation, if a person holds or acquires more than 10 percent of the total share of a certain listed company, it must declare it to the exchange with which the company is listed through its stock broker or its merchant banker. Moreover, such shares must be owned or acquired through negotiated dealer by cash transaction. This regulation states detailed process of settling the proposal of such acquisition, cancellation of such proposal etc. Financial institutions, scheduled banks or any other company who want to acquire a significant portion of a financially distressed company either by itself or collectively must follow the guideline of this regulation. By examining the financial viability of the distressed company an appropriate price must be obtained. Moreover, the amount of financial support that may be needed for its rehabilitation must also be calculated. The entire rehabilitation package must be designed through competent management and effective and transparent process.

### **The Bangladesh Securities and Exchange Commission (Qualified Investor Offer by Small Capital Companies) Rules, 2018**

The objective of this regulation is to provide small capital companies to issue securities through qualified investor offer and thereby facilitate these small companies to raise capital from stock market. Application for qualified investor offer may be made either by fixed price method or by book-building method subject to a certain general requirement. A fixed price method must

be used when securities are offered at par value; however, when securities are offered above par value, book-building method must be followed. For issuing securities under this category an issuer shall have to submit the application to both the Commission and the Exchange for listing in the small capital platform. Immediately after submission of the application a draft prospectus must be posted in the website of the issuer as per the format and content specified under this regulation. A lock-in period of one year shall be applicable for all ordinary shares during this process. The entire process of qualified investor offer shall be managed by an issue manager registered by the commission. Such issue manager shall have the responsibility to prepare the prospectus and to disclose relevant information of issuer's business and how the proceeds received from the issue have been used. An issuer shall have to appoint an underwriter duly registered by the commission, on a firm commitment basis. This regulation also permits issuance of debt securities through qualified investor offer.

#### **4.3.2 The Central Depository Bangladesh Limited Regulations**

##### **Depositories Act, 1999**

The objective of this act is to provide clear regulation for the depositories regarding its management, operations, its powers etc. According to this act, a depository shall not be entitled to operate unless it is registered by the Commission. A depository must have its own depository system for opening and maintaining accounts. As per this act, all securities deposited here, shall be kept in dematerialized condition. Securities shall only be transferred through book entry system upon fulfilment of certain conditions. This act clearly states the duties and responsibilities of depositories participants, issuers and account holders. This act also includes an indemnity clause which ensures that in case of any action by the depository in good faith, it shall not be responsible for any loss or damage caused to the account holder. This act also provides clear guidelines regarding the power of the depository to make regulations, bye-laws, grant exemption in certain cases. It also includes a provision related to winding up.

##### **Central Depository Bangladesh Limited Bye Laws, 2003**

The objectives of this Bye laws are to provide specific guidelines regarding all the aspects of Central Depository Bangladesh Limited (CDBL). It covers the functions and powers of CDBL. It also provides specific criteria for eligible securities and issuers. The specific procedure for admission as CDBL participant is also provided here with their rights and obligations. The Bye

Law also includes the detailed description of different accounts and the procedures to be followed for opening, closing, suspension, release and closure of accounts. It also provides rules for transfer, freeze and suspension of securities. The specific procedures for the settlement of market traders are also provided here.

### **The Depository (User) Regulations, 2003**

The objective of this regulation is to provide guideline for day-to-day operations of CDBL. It includes the eligibility criteria for securities to be held in the depository, it also provides classification of eligible securities. A proper procedure for the maintenance of different types of accounts are also included here. The regulation clearly states the eligibility criteria for registration as a depository participant. It also provides specific guidelines regarding dematerialization and re-materialization of securities, change of ownership of securities etc. The guidelines for pledge facilities, securities lending and borrowing facilities, issuance of bonus and right share, distribution of dividend, are also within the purview of this regulation.

### **4.3.3 The Dhaka Stock Exchange Regulations**

#### **Dhaka Stock Exchange Automated Trading Regulations, 1999**

This regulation deems to provide specific guideline for the smooth operation of automated trading. The clauses of the regulation touch all necessary aspects of trading so that there is no room for confusion. According to this regulation, eligible members are the one with registration certificate provided by the Commission. Automated trading will be done in five sessions, pre-opening session, opening session, continuous or regular trading session, closing session, post-closing session. This regulation provides detailed description of functions of trading sessions, types of orders, matching of orders, modification of orders, order withdrawal, trade confirmation etc. This regulation also gives power to the commission to intervene the market as it deems necessary by exercising market control parameters. To remove difficulty this regulation also keeps room for the CEO to take necessary actions by taking prior approval from the council.

#### **Dhaka Stock Exchange (Member's Margin) Regulations, 2000**

The objective of this regulation is to clearly state the margin requirement of the Trading Right Entitlement Certificate (TREC) members. This rule touches each and every margin related

issue and explains it in such a way that there is no room for confusion regarding the issue. This regulation clearly states a free limit for margin deposit on each trading day based on the total buy exposure which must be paid on the same day of trading. For foreign investors, such margin shall be based on gross exposure and must be paid by the next day of trading. Such limit is applicable only for stock exchange members. As per this law, such deposit can be made in the form of cash, bank guarantee, government securities, fixed deposit with scheduled bank, savings certificate duly endorsed in the favor of the exchange. This regulation clearly states that, in case of a member's inability to settle his trade on the settlement day, the exchange will have the right to realize the value of the instruments from money deposited as member's margin and adjust the dues. If there remains any shortfall after the adjustment, the member shall be liable to pay the amount within three days of the written notice by the exchange. Moreover, it states that, clear books and records of member's margin must be kept updated and ready for inspection by both the clearing house and the members.

### **Dhaka Stock Exchange (Short-Sale) Regulations, 2006**

The main purpose of this regulation is to clarify the circumstance in which short selling shall be prohibited, the manner in which such trade shall be executed, and how records of short selling should be kept. According to this regulation, short -selling shall be prohibited in DSE. However, DSE may authorize certain stock dealer/stock broker to short sale certain securities that are considered eligible for short selling by the Exchange. Short-selling will not be allowed at a price below the last closing price of the security. A stock broker/stock dealer being duly authorized by the exchange may short sell for its own account or for the account of its client only by informing the client in writing. A stock dealer/stock broker shall maintain a ledger for short-selling containing true information and shall make it available for inspection and preserve it for further inquiry for a period not less than five years. The commission will have the power to impose restriction or exempt short-selling of any stock dealer or stock broker.

### **Dhaka Stock Exchange (Board and Administration) Regulations, 2013**

By touching the nitty-gritty aspects of the board of the Exchange, its governance structure and its regulatory function, this regulation has made sure that there is no space for ambiguity regarding any matter related to these three major aspects of the Exchange. Firstly, the regulation mentions the constitution and structure of the board of directors and the power vested on the board. It also gives clear guideline on the code of conduct and code of ethics of

the directors of the board which helps the individual directors to know his/her boundary and to have a clear understanding to operate fairly and objectively. The regulation also specifies the committees that can be formed by the board, their structure and general principle for the smooth operations of the committee. Lastly, to oversee that the rules and regulations are properly followed, this regulation states that there should be a regulatory affairs division which should be headed by Chief Regulatory Officer. According to this regulation the board shall have certain power. The board shall have the authority to make policies, to approve the business plan, make annual budget etc. In addition to these, the Board shall have the power to impose penalties for the violation of regulations. The main responsibility of the directors shall be to uphold the interest of public and encourage fair practice throughout the exchange. Moreover, this regulation also states the code of conduct for the directors of the board and the code of ethics for the directors. It also gives guideline on governance structure of the exchange.

### **Dhaka Stock Exchange (Settlement of Transactions) Regulations, 2013**

The objective of this regulation is to provide a full-fledged guideline for settling all kinds of transactions in DSE. It touches all the essential procedural detail as to how transactions shall be carried out by clearly stating the settlement of transactions, the settlement and clearing day of different transactions, the mode of payment, the clearing process, the liability in case of default etc. According to this regulation, all transactions in DSE shall be executed by an Electronic Contract Note with settlement done through the Clearing House. For regular transactions, all securities traded should be settled on the same day of transaction; however, the fund can be settled in the next day, with an exception for spot market where it must be settled on the same day. Nevertheless, the clearing day for all securities is the second day following the trading day, but for spot market it is the next day following the trading day. TREC holder must settle transactions either by delivering securities or by making the fund available for payment on the Settlement Day. Failure to do so may cause DSE to automatically square up the unsettled transaction, if necessary DSE will have the right to adjust any dues from the security deposit of the defaulting TREC holder. In case of further shortfall, the TREC holder may be declared a defaulter and lose its TREC. The TREC holders shall be allowed to execute transaction of foreign investors through a custodian bank. Such transactions must be settled within the fifth day subsequent to the trading day. A Clearing Member shall settle the transaction with the investor, by crediting securities or making payment by cheque on the day it is received from Clearing House. In case of failure, by the clearing member, the TREC holder

shall be liable to repay the loss of the investor. In case of default, TREC holder/Clearing Member shall be liable to pay a fine to DSE for each default.

### **Dhaka Stock Exchange (TREC Holder's Margin) Regulations, 2013**

The objective of this regulation is to clearly state the margin requirement of the TREC members. This regulation clearly states a free limit for margin deposit on each trading day based on the total buy exposure. For foreign investors, such margin shall be based on gross exposure. Such limit is applicable only for TREC holders. As per this law, such deposit can be made in the form of cash, bank guarantee, government securities, fixed deposit with scheduled bank, savings certificate duly endorsed in the favor of the Exchange. This regulation clearly states that, in case of a TREC holder's inability to settle his trade on the settlement day, the exchange will have the right to realize the value of the instruments deposited as member's margin and adjust the dues. If there remains any shortfall after the adjustment, the member shall be liable to pay the amount within three days of the written notice by the exchange. Moreover, it mentions that, clear books and records of TREC holder's margin must be kept updated and ready for inspection by both the clearing house and the TREC holders.

### **Dhaka Stock Exchange (Trading Right Entitlement Certificate) Regulations, 2013**

The objective of this regulation is to clearly state the requirements to deal in securities listed with the exchange. The regulation touches all important issues regarding Trading Right Entitlement Certificate (TREC) and Trading Certificate (TC). It covers the eligibility criterion which gives a clear indication as to who can apply for the certificates. Only Trading Right Entitlement Certificate (TREC) holders can provide brokerage service for certain period as may be determined by the Exchange. The regulation also stipulates disciplinary power that the exchange can exercise against both TREC and TC holders including the situations where such power can be used. In case where the Exchange wishes to carry on an inspection, the TREC holder must furnish the required information to the exchange and must fully cooperate. TC issued under these regulations shall be valid for one year with a provision for renewal, but it shall not be transferable. However, by serving a 60 (sixty) days' notice to the TREC holder, a TC holder can resign, which shall then be communicated to the exchange by the TREC holder. Proper information, records and books of accounts must be maintained by the TREC holder.

The exchange will have the power to impose fine or penalty against any TREC or TC holders, where it deems necessary.

### **Dhaka Stock Exchange (Investors' Protection Fund) Regulations, 2014**

The whole purpose of this regulation is to create a fund to protect investors from future contingencies in case a member of DSE is in default. The fund shall be created for the sole objective to safeguard the investors' interest against failure of any member to settle any dues to the investors. According to this rule, a fund will be established known as Dhaka Stock Exchange Investors' Protection Fund which will be managed by a board of trustee nominated by BSEC. To ensure the transparency of the fund, this rule also provides specific guidelines as to how the accounts of the fund will be maintained and how it will be audited. As per this regulation, the board shall have the responsibility to submit a copy of the audited report and statement of the accounts to BSEC and the council which will then be available to the members of the exchange. The rule also specifies the contribution of each party i.e., DSE itself and the members. The rule also mentions about a contingency fund to be created in case where there is an insufficient amount in the fund to satisfy the current liabilities. To make sure that there is no room for ambiguity, this regulation explains the claiming process by an investor and the strict criterion on which a decision for payment will be approved by the board of trustees.

### **Dhaka Stock Exchange (Settlement Guarantee Fund) Regulations, 2014**

The objective of this regulation is to create a Guarantee fund to reduce the risk of settlement. By clearly stating the ground rules of the fund's management and the contribution to the fund, this regulation ensures the proper utilization of fund in appropriate cases. The fund will be managed by a committee consisting of Chief Regulatory Officer (CRO), Chief Finance Officer (CFO), General Managers (GMs) and any other persons nominated by the CEO. The CRO will be in charge of the committee. The fund will consist of initial contribution and regular contribution from both the TREC holders and the exchange, with a provision for extraordinary contribution by the TREC holders in case where it is deemed necessary. Failure to pay any of these contributions may cause default interest payment on amount due. If a TREC holder fails to deposit the contribution within 30 working days, the exchange shall have the power to suspend the TREC holder's right to trade. The fund will be utilized and if possible, invested as per the decision of the management committee. In case of liquidation, the balance of the fund



will be returned to both the exchange and individual TREC holders as per the proportion of their contribution.

### **Dhaka Stock Exchange (Listing) Regulations, 2015**

The objective of this regulation is to specify the listing requirements, the detailed procedures to be followed for listing and the continuous compliance issues that need to be followed by the listed companies. To protect the investor's interest, this regulation gives away certain power to the exchange so that prompt actions can be taken if it deems necessary. According to this regulation listing of securities will be done in four steps, (1) submission of recommendation to the commission by the exchange, (2) submission of application for listing by the issuer company after paying specific fees, (3) approval of listing by the commission within 30 days of closer of subscription list and lastly, (4) submission of an undertaking by the issuer company. For direct listing of securities, the issuer company shall make application to the Exchange along with the copies of documents with an application fee and shall simultaneously furnish copies of application and documents to the Commission. In this process existing shareholders of the company shall sell their share through the exchange once it is listed. According to this regulation the listed companies shall have to be complied with certain ongoing requirements such as, preparation and audit of financial statements, submission of both quarterly and annual statement, payment of dividend, disclosure of price sensitive information, declaration of sponsors or directors for buying and selling of securities, compliance of corporate governance guidelines etc. The exchange shall have the power to halt, suspend and de-list any securities if it feels that any unusual market action occurred due to non-compliance with the requirements under this regulation. Moreover, the exchange may inspect any business of listed company, if there is necessary reason for suspicion; however, prior approval from the Commission needs to be taken.

## **4.4 Growth of the Securities Market in Bangladesh**

In Bangladesh, the financial sector was historically dominated by banks. During that time the role of capital market was minimal. At that time the concept of capital market was very new to the general people of Bangladesh. As a result, a sense of skepticism worked surrounding investment and risk pattern of capital market. In the early 1990s the operational activity of DSE (the only exchange in Bangladesh at that time) gradually started expanding in terms of volume

and value of transactions which was an indication that both the depth and breadth of the market were expanding. This positive growth of securities market at that time was mainly the outcome of favorable broad economic policies undertaken by the Government. From then onwards, the development of securities market in terms of new issues have been promising. However, despite the transaction volume, the price movement was not encouraging for the investors.

In the mid of 1990s capital market started to show vibrant behavior. During this time, the index was rising sharply which encouraged many people to invest their money in the capital market. The huge inflow of capital in the heated market formed a huge bubble and as an obvious consequence the market crashed. The benchmark index dropped 80 percent within a year (3600 points in November, 1996) and was at 700 point in November. The aftermath of the market crash was devastating, general investors were shattered, they lost everything and withdrew themselves from the capital market. After that, many steps had been taken by the regulatory authorities to stabilize the market. During this time, central depository, circuit breaker, online trading, etc. were introduced to facilitate trading. A number of reforms were initiated by both the DSE and the BSEC in terms of operational and regulatory issues. Various incentives were given by the government in national budget to boost the capital market. However, the market did not grow in a pace as was expected.

In the next few years both BSEC and DSE relentlessly worked to strengthen the supply side of the securities market. As a result, a good number of companies subscribed for IPO during that time. The market again started to show positive vibes. This was a result of three important factors. Firstly, pragmatic and effective policy support by the regulators and their timely implementation. Secondly, satisfactory level of investors' confidence due to the legal, operational and structural reforms. Thirdly, inflow of funds from the institutional investors. However, during 2009-2010 the market was again showing bullish signs, the growth of the market was again unrealistic and terrifying. To pacify the heated market the Bangladesh Securities and Exchange Commission frequently changed its rules which panicked the investors. On December, 2010, DGEN Index reached its peak at 8919 points which was a 97% increase within a year. As an apparent consequence, the bubble started to burst in December, 2010. The general investors were completely broken, they were shocked and did not know what to do. After the bull run of 2010-11, there was a period of steady growth in Bangladesh capital market with some minor glitches. This progress was again made possible through a

relentless joint effort by DSE, SEC and the government to reform and restructure DSE so that investors' lost confidence could be regained.

The sustainable development of capital market depends on market fundamentals and the fundamental strength of the market in turn depends on financial strength of the listed companies. To strengthen the supply side DSE, BSEC and the government have continued their all-out efforts, many institutional and legal reforms have taken place in DSE in the last few years to induce fundamentally strong companies to get listed. However, only fundamentally strong companies cannot ensure growth. To attain an orderly market with reasonable pace of development, the growth in supply must be matched with that of demand side. Strengthening demand side means the participation of both institutional investors and professional market analysts who have adequate knowledge about the market and it is only possible under an orderly market with strong regulatory control.

Bangladesh capital market has gone through many ups and downs in the last 30 years. After recovering from two devastating market crashes this market has become more matured, many reforms have taken place. Bangladesh securities market is now more linked to the outside world. Bangladesh securities market has gone a long way from where it started. However, this story of development has just begun; we are yet to see many positive changes in the market.

## **4.5 Capital Market Indicators**

### **4.5.1 Market Capitalization to GDP Ratio**

Market capitalization-to-GDP ratio is used to measure the contribution of the stock market to the national economy. The market capitalization to GDP ratio is also used to determine whether a market is overvalued or undervalued compared to a historical average. The market capitalization to GDP ratio of DSE was within the range of 1 percent to 3 percent before 1996 market boom.



**Figure 4.1: Year-wise Market Capitalization to GDP Ratio**

Source: DSE Data

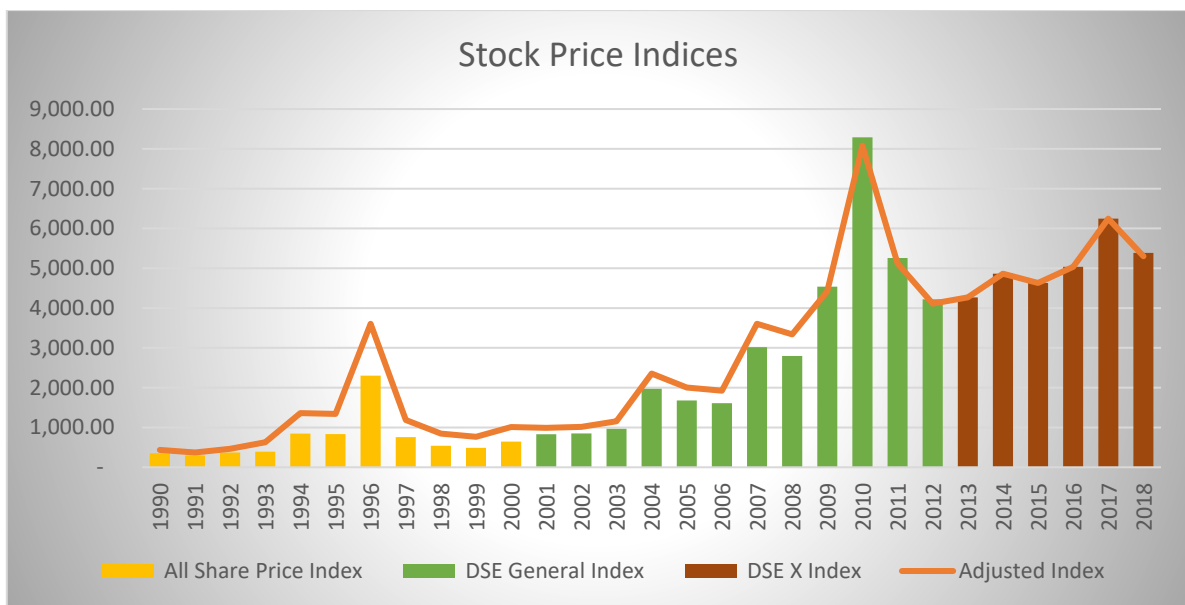
This was mainly due to the fact that the general people were mostly skeptical about the stock market as they had very little knowledge about the risk associated with investing in stock market, second, the market did not have enough depth or breadth. Third, there was a lack of fundamentally strong listed companies to invest money in.

During 1996 the ratio shot up to 10 percent which was in line with the investors optimism that was prevalent during that period. There was a hype among the investors to invest more and more money in the market, which caused the price of listed companies to shoot up without any viable basis. The market capitalization to GDP ratio during 1996, was just the outcome of that overly heated market. Right after market crash, the ratio came down to its usual level. From 2006 the ratio began to grow gradually and maintained the momentum over next few years. This was not only an indication of positive growth of the stock market but also a signal that capital market was finally able to contribute to the national economy. During this period several legal and institutional reforms were undertaken by both BSEC and DSE to strengthen the depth and breadth of the capital market as well as to strengthen the supply side of Bangladesh stock market. The ratio doubled during 2009 and reached its peak in 2010 at 52.11 percent. However, no fundamental reasons could be attributed to the rise. Unfortunately, it was the result of artificially increased price of stocks due to over enthusiasm of investors. The ratio gradually fell and was around 20 percent to 25 percent level till 2014. However, for the last couple of

years, the ratio remained at around 30 percent level, though it dropped a little in 2018 due to political uncertainty of the election year.

#### 4.5.2 Share Price Index

In general stock price index and investors sentiment goes hand in hand. The movement in market index can be partially attributed to investors sentiment. The impact of sentiment can vary from market to market, it depends on the investors’ behavior, institutional involvement and the role of regulatory authority. In Bangladesh, a large number of investors are uneducated about the market and they are driven by market hypes, they do not have access to proper and timely market information. Furthermore, although both institutional and foreign investment is comparatively higher in recent years, they are yet to reach a reasonable level to create a major impact on the movement of stock market.



**Figure 4.2: Year-wise Stock Price Indices**

Source: Estimated from DSE Data

As there was no continuous stock price index from 1990- 2018, the value of three separate index had to be displayed to cover the period from 1990 to 2018, namely all share price index from 1990-2000, DSE general index from 2001-2012 and DSE X Index from 2013-2018. However, for the purpose of smooth transition from one index figure to another an adjusted stock price index has been constructed by incorporating a number of adjustment factors for the purpose of this research. This adjusted stock price index has been shown in the figure 4.2.

During 1990 to 1995 the stock price index showed a steady growth, however, DGENI was at its historical high during 1996. Starting from 835 in December 1995, the index recorded a remarkable increase of 337 percent on November 5, 1996 compared to that of December 1995. Despite the ongoing political turmoil, country's securities market was showing positive signs. The general people became over-enthusiastic to invest their money in the capital market. A huge influx of new investors without any basic knowledge about the market started investing with the hope of making over-night fortune for themselves. However, DSE, at that time, did not have the depth or breadth to absorb such huge inflow of capital which caused a huge bubble and the market crashed. Benchmark index dropped to 700 point in November 1997 from its highest 3600 point in November 1996, the market collapsed. The price index dropped below the level of the pre-bubble period. During 1998-2003 the DGEN index was below 800 mark.

From 2004, the DGENI showed gradual signs of recovery. However, during the year 2010, the DSE General Index (DGENI) increased by 97 percent. DGEN Index reached its peak at 8919 marks point on the 5th of December 2010. This time, it was the exuberant investors' confidence coupled with huge optimistic sentiment which led new investors to invest in the market. During this time, the progress of DSE with respect to size, depth and maturity was phenomenal. This was the result of various legal and institutional reforms undertaken by different regulatory authorities over the years. However, the growth was not high enough to absorb the huge inflow of capital that was poured into the market. As an obvious consequence, the bubble started to burst in December, 2010. On 5<sup>th</sup> December 2010, DGENI was at its peak of 8919 mark, which was a 97 percent rise within a year.

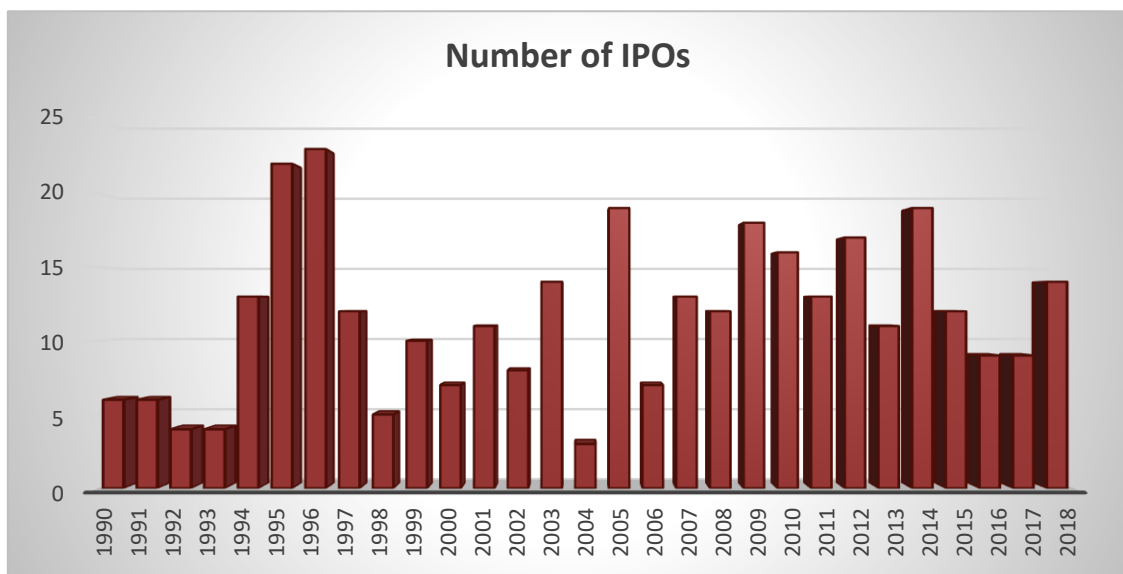
During the period 2011 to 2013 the market was in bearish trend as a result of massive price correction that took place at the end of 2010. However, the long persisted downward trend in share price finally ended in 2014, the market was somewhat stable and was in upward trend in terms of index level. Over the year 2015, the DSE went through bearish trend due to the uncertainty raised from severe political unrest which has been reflected in the index figures. However, 2016 was a stable year, the index figure was relatively better than 2015. The year 2017 can be described as a rather successful year for capital market. Throughout the year all three indices of DSE went up at remarkable rate. During 2018, the stock market went through declines in most of the market parameters including the stock price index. Number of reasons

can be attributed to the decline in the parameters, namely, political uncertainties, devaluation of Taka against the US dollar and adverse impact from the country's banking sector.

### 4.5.3 IPO Issues

The demand for initial public offerings is often said to be extremely sensitive to investor sentiment. In periods of investor optimism, the IPO issues tend to increase as there are expectations of stock price increase. As opposed to periods of pessimism which shows a decrease in IPO issues. Due to this relationship, the number of IPO sometimes display wide fluctuations in periods of frequent sentiment shifts. This is also true for Bangladesh stock market. At times of positive sentiment, a large number of companies show their interest in floating IPO shares with the expectation that the price will inflate many folds once it hits the secondary market.

During the period 1990-1993, the total number of IPO per year was within the range of 4-6. However, from 1994 there was a sharp rise in IPO number and it was at its peak during 1996 when the market was overly heated. The number rose to 23 IPOs in 1996 compared to 4 IPOs and 13 IPOs during 1993 and 1994 respectively. During this period the companies were eager to float IPOs with the expectation of getting higher issue price. After the burst of the stock market bubble in 1997 the number of IPO got back to its usual range and remained steady till 2004.



**Figure 4.3: Year-wise Number of IPOs**

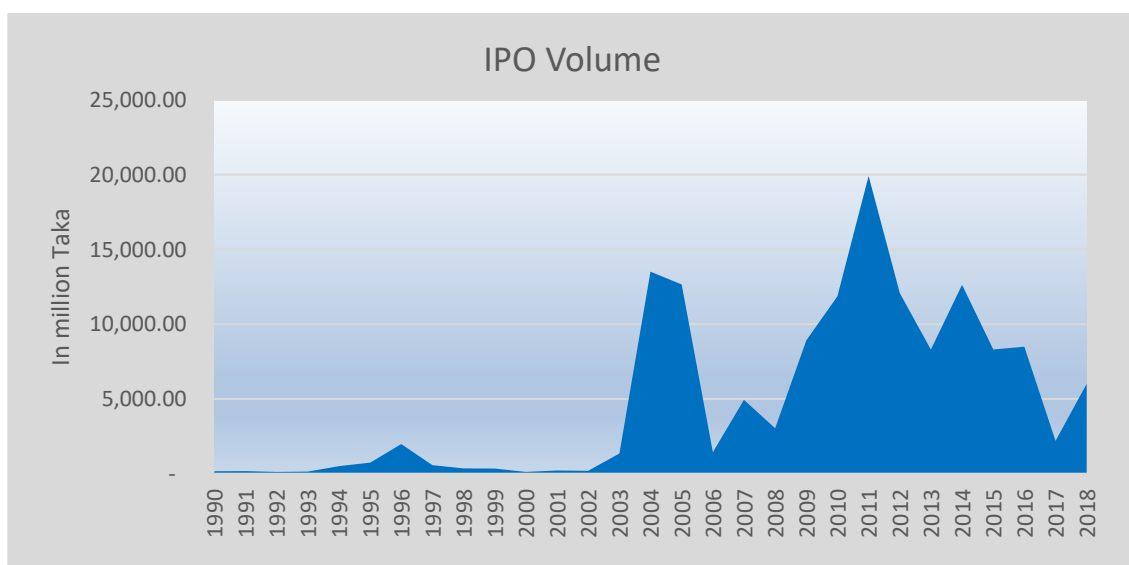
Source: DSE Data

However, year 2005 was a successful year in terms of primary market. A record number of 19 companies floated IPOs in this year which was an outcome of relentless effort of both BSEC and DSE over the last few years to strengthen the supply side of the securities market.

For the next three years the IPO number remained steady. But as the market was again gaining pace, the number of IPOs shot up and was 18 in 2009 and 16 in 2010. After the bull run of 2010-11, there was a period of steady growth in Bangladesh capital market with some minor glitches. This progress was made possible through a relentless joint effort by DSE, BSEC and the government to reform and restructure DSE. However, this time it took a while for the IPO number to go back to its previous level. During the recent past, BSEC continued its effort to maintain the pace of growth of the capital market of Bangladesh. During 2014 the number again rose up to 19. This was the year when a number of measures were taken by BSEC, for example the IPO process was made easy, policies regarding transaction fees and circuit breaker was favorably revised.

#### 4.5.4 Capital Raised through IPOs

Capital raised through IPOs (IPO volume) is one of the key indicators of market sentiment. During the stock market bubble period of 1996 and two years prior to that, the IPO volume clearly indicates that the market was gradually getting heated and was on the bull run in 1996 when the IPO volume stood at Taka 1978.08 million as compared to Taka 142.5 million in 1993.



**Figure 4.4: Year-wise IPO Volume**

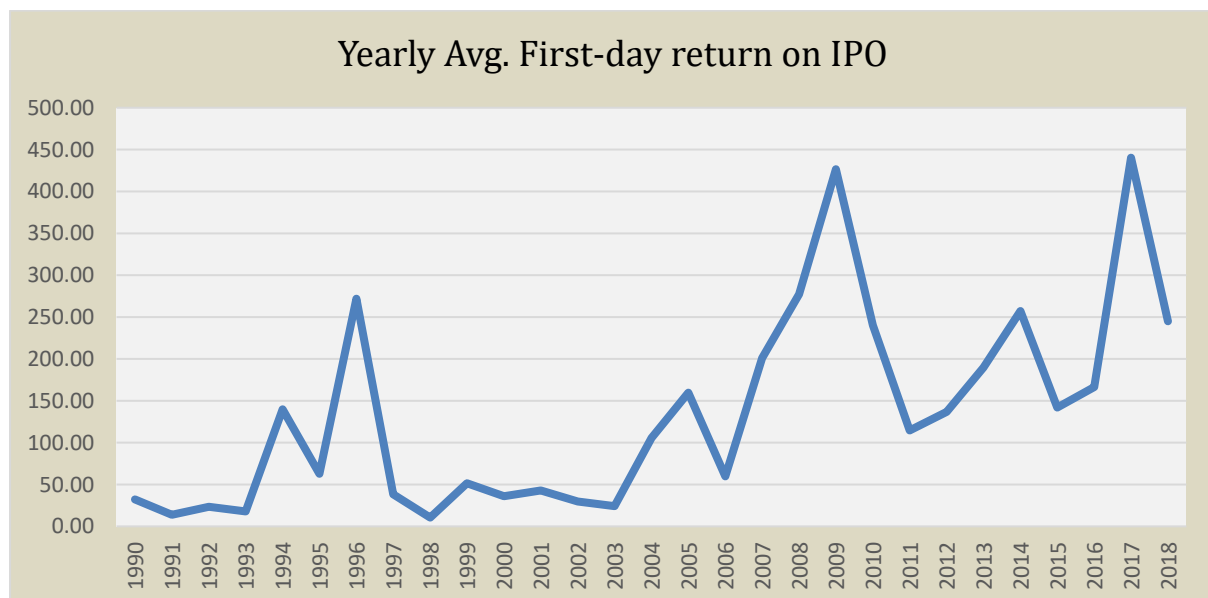
Source: DSE Data



Again from 2003 to 2005 there was a sharp surge of IPO volume, however this time it was the outcome of several legal and institutional reforms undertaken by both DSE and BSEC to strengthen the supply side of the market. During the period of 2009-2012, the IPO volume again started increasing gradually and reached its peak in 2011. During this time due to optimistic sentiment throughout the market, companies were speculating on rising price and so they were inclined to offer their shares to public through IPO, with the hope that they will get better price for their issues. After the burst of the bubble the IPO volume remained within the range of Taka 8000 million to Taka 12000 million. However due to political uncertainty around the election year the IPO volume was somewhat low during the last two years.

#### 4.5.5 Average First-day Return on IPOs

Apart from number of IPOs and IPO volume, IPO first day return can act as a very good proxy for investor sentiment. The first-day return of IPO is highly related to investor sentiment. An exceptionally high first-day return indicates that there is an ongoing investors' optimism in the market which pushed the price high. On the other hand, a low first-day return indicates periods of pessimism. This is very true in case of Bangladesh as investors' exuberance is commonly traced in the first trading day of IPO shares.



**Figure 4.5: Year-wise Average First-day Return on IPO**

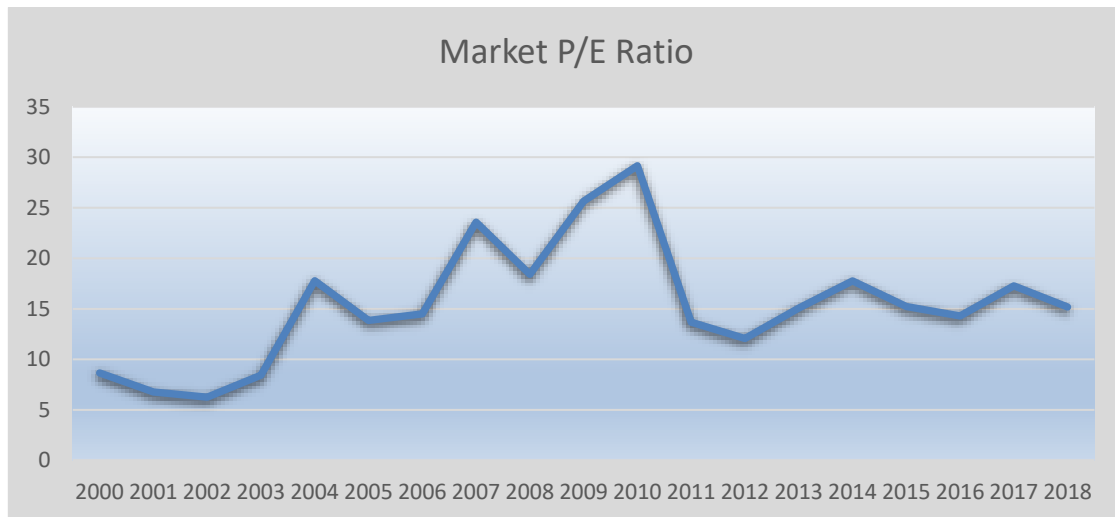
Source: Estimated from DSE Data

Historically it has been observed that the price of an IPO share in the secondary market has inflated many folds than its issue price. Definitely this was a sign of investors' enthusiasm

about the market. From the graph it is clear that the average first-day return was at its peak during the two episodes of market bubble. The third pick was in the year 2017. Throughout the year all three indices of DSE went up at a remarkable rate. Besides index, the market capitalization increased by 23.93 percent and stood at Taka. 4228.95 billion breaking all previous records of DSE. The growth in foreign investment was also impressive. Due to market optimism most of the IPOs had a first day return which was more than 100 percent. Furthermore, the average first day return was the highest on the last quarter of the year 2017.

#### 4.5.6 Market P/E Ratio

Price earnings ratio (PER) is a standard valuation indicator to measure whether the stocks are overpriced. Increase in PER beyond what could be justified by fundamentals is considered a clear sign of overvaluation of the stock. Therefore P/E ratio can be a good indicator to detect ongoing investors sentiment. A high P/E would indicate that investors are optimistic and they are speculating on rising price, on the other hand, a low P/E would indicate that investors are pessimistic and they are speculating on falling price.



**Figure 4.6: Year-wise Market P/E Ratio**

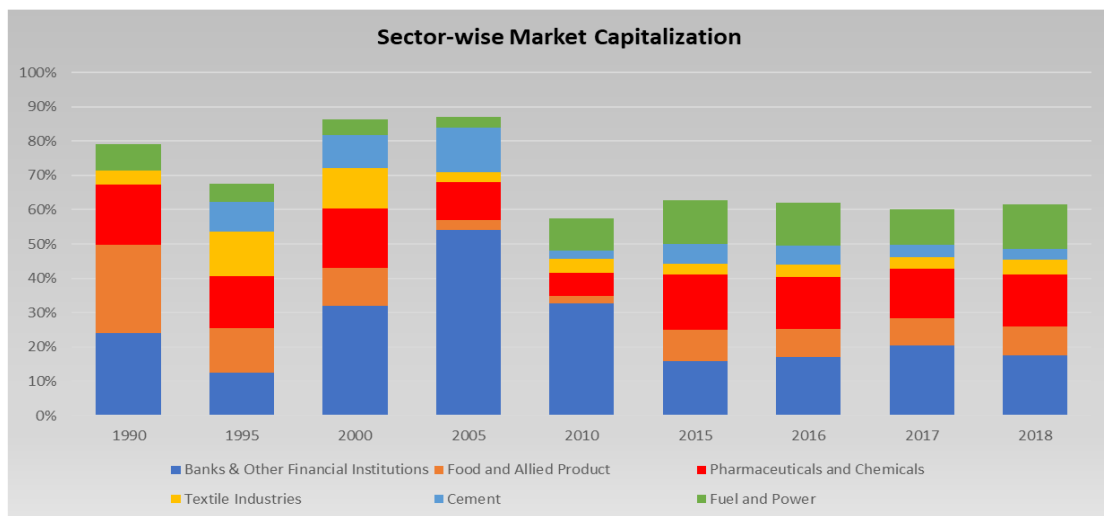
Source: DSE Data

In Bangladesh stock market, certain P/E clusters can be traced out. During 2000 to 2003 the market P/E was at an average range of 6-8. However, the ratio started to grow rapidly from 2004 and reached levels which was significantly higher than their historical levels.

P/E ratio increased drastically to a stunning level in 2009, this high P/E was due to a number of companies that were being actively traded during that time. During 2010, the ongoing bullish trend of the market was reflected on P/E ratio, when it reached its highest at 29. Immediately after the bubble burst the P/E again fell down to an average range of 12-17. This clearly indicates that no fundamental reasons could be attributed to the price hike and the resulting high level of P/E. Rather, highly optimistic investor’s behavior leading to exuberant demand instigated the increase in market price and the resultant high P/E ratio.

#### 4.5.7 Sector-wise Market Capitalization

The banking sector has always been a major contributor to the total market capitalization of the Bangladesh stock market, maintaining an average weight of 20 percent to 25 percent from 1990-1993. However, at the time of market boom, back in 1995, the banking sector was contributing less to market capitalization, during the period of 1994-1998 the banking sector contributed about 12 percent to 15 percent of total capitalization which was rather low compared to its previous average



**Figure 4.7: Sector-wise Market Capitalization**

Source: DSE Data

During this time the focus was shifted to both pharmaceutical and chemical industries and food and allied industries with a weight of 17 percent to 20 percent and 16 percent to 18 percent respectively.

However, during the period 1999-2008, banking sector again became prominent securing an average weight of 45 percent to 50 percent of total market capitalization with both food and allied and pharmaceutical industries gradually losing its prominence from total market capitalization of DSE. From 2010 till date, the average weight of banking sector has been around 15 percent to 20 percent. Furthermore, the fuel and power sector became prominent during this time with pharmaceutical sector maintaining its previous level of 15 percent to 16 percent.

#### 4.5.8 Comparison of Market Capitalization to GDP ratio of selected countries

In recent years, the size of Bangladesh capital market is increasing gradually. Right after the market bubble of 2010, the ratio dropped, however, it was able to maintain a steady growth over the year with few minor glitches. From 2016 the ratio picked up and was able to reach 34.51 percent which was quite impressive. This is a clear indication that Bangladesh Stock market is gradually stepping towards a matured market, being able to make a handsome contribution to the national economy.

**Table 4.1: Market Capitalization to GDP Ratio in Selected Countries**

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bangladesh	52.11	37.08	26.14	25.39	23.44	20.92	31.80	34.51	28.24
Indonesia	47.73	43.69	46.65	37.99	47.39	41.04	45.69	51.28	46.71
India	97.39	55.25	69.12	61.34	76.42	72.08	68.40	87.90	76.42
Japan	67.15	54.01	56.08	88.12	90.26	111.51	100.58	128.04	106.56
Sri Lanka	35.12	29.77	24.80	25.31	29.82	25.81	22.67	21.54	17.52
Malaysia	160.26	132.78	148.39	154.79	135.78	129.11	121.24	144.82	112.32
Pakistan	21.42	15.25	19.46	24.79	30.07	24.42	32.97	26.92	18.21
Philippines	78.82	73.64	91.69	79.95	92.01	81.57	78.63	92.60	78.01
Singapore	269.89	214.17	259.27	242.03	239.11	207.78	201.35	232.64	188.73
Thailand	81.42	72.40	98.04	84.31	105.67	86.92	105.00	120.54	99.16
United States	115.28	100.63	115.26	143.19	150.27	137.59	146.21	164.85	148.51

Source: World Bank Data

This growth was possible due to the combined effort by the bourses, the regulatory authority and the government. The whole effort was channeled towards identifying the loopholes of the stock market and then rectifying the lacking through various reforms- legal, technical and institutional.

Table 4.1 presents the stock market capitalization to GDP ratio of few neighboring countries and the United States from 2010 to 2018. From the table it can be observed that, when compared with the neighboring countries only Sri Lanka and Pakistan stock market is contributing less to the national economy than Bangladesh. Most of the countries stated here have a ratio which is reasonably high and is on an increasing trend which is a sign that these stock markets are gradually developing and making a positive impact towards the national economy.

# **Chapter # 5**

## **Stock Market Bubbles in Bangladesh**

Across the globe, both in developed and developing countries bubble and burst episodes are not a rare phenomenon. It can even take place in an efficient stock market under strong regulatory supervision and competitive environment. Both empirical and academic literature as well as practical knowledge have failed to forecast when and how such periods are initiated. Generally, there is an indirect link between stock market boom and credit expansion to private sector. A lenient credit policy induces the private sector to spend more which causes both the price of commodities and stocks to rise. On the other hand, burst is the ultimate consequence of a boom market. When stock price reaches a point, which cannot be justified by the market fundamentals, market correction takes place and pushes the price down till it reaches its equilibrium point. Burst is usually accompanied by decline in many other asset prices caused by large reduction in both investment and consumption.

### 5.1 International Scenario of Bubble and Burst

Generally, some common characteristics can be traced out from stock market bubble episodes around the globe. Usually stock market bubbles are attributed to an exuberant demand for stocks caused by optimistic investor sentiment, high price volatility, sharp increase in margin lending, loopholes in institutional investors' regulatory regime, inadequate financial knowledge and lack of investment information of retail investors and speculators.

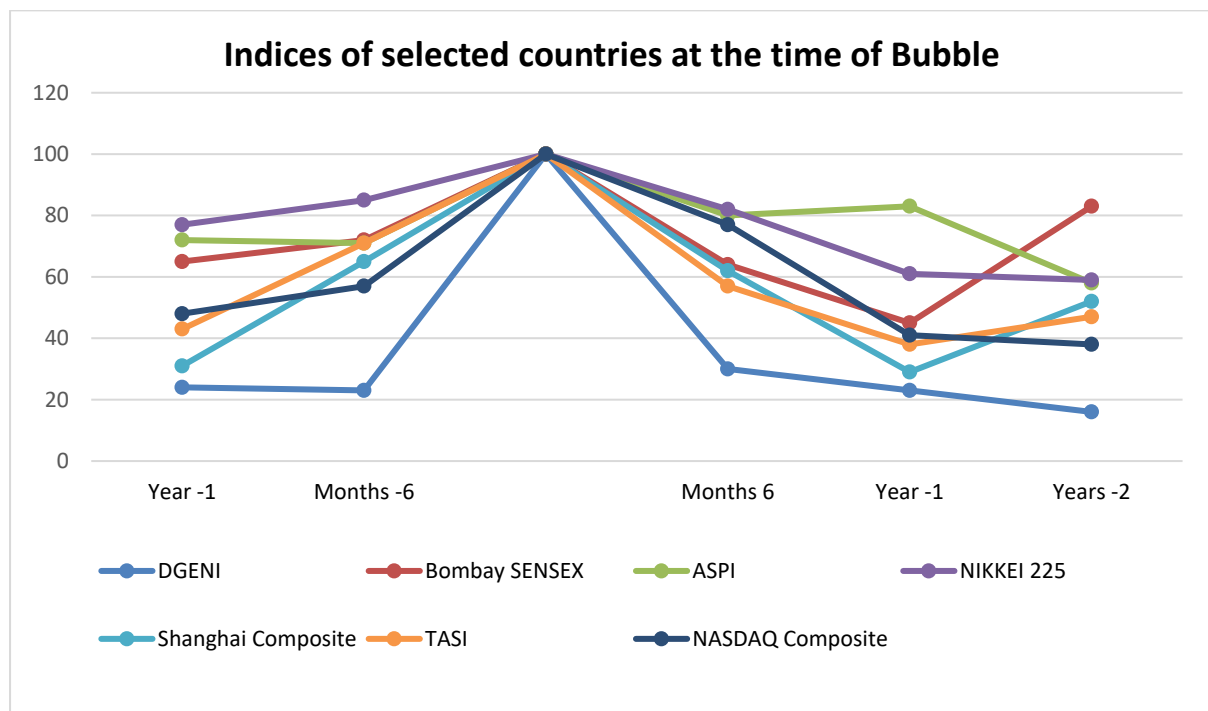
**Table 5.1: Bubble episodes of selected stock markets**

Country	Name of Stock Market	Date of Bubble Peak
China	Shanghai Stock Exchange	June 11, 2015
USA	S&P 500	August 7, 2011
Bangladesh	Dhaka Stock Exchange	December,5,2010
India	Bombay Stock Exchange	January 8, 2008
Sri Lanka	Colombo Stock Exchange	February 14, 2007
China	Shanghai Stock Exchange	October 30, 2007
KSA	Tadawul	February 25, 2006
USA	NASDAQ	March 10. 2000
Bangladesh	Dhaka Stock Exchange	November 5, 1996
Japan	Tokeyo Stock Exchange	December 29, 1989

Sources: Data collected from respective stock exchanges

Bubble and burst have been a common phenomenon in the history of stock markets. Almost all the major stock markets went through this phase. Few of our neighboring countries also

experienced this stock market turmoil. Following are few names which may fall under either of the categories: NASDAQ (USA), Tokyo Stock Exchange (Japan), Shanghai Stock Exchange (China), Tadawul (Saudi Arabia), Bombay Stock Exchange (India) and Colombo Stock Exchange (Sri Lanka). Just like other countries, Bangladesh stock market went through bubble and burst period twice, one back in 1996 and the other in 2010.



**Figure 5.1: Indices of Selected Countries during the time of Bubble**

Sources: Research Department, Bangladesh Bank, WP1203

In all cases, a steady increase in stock price, leading to an unprecedented rise in stock index was evidenced, which was then followed by a rapid fall in index. The table 5.1 shows that in all the markets, there was a gradual increase in indices up to 12 months prior to the peak. This was followed by a sharp increase in price indices near the peak. The post bubble scenario was similar for all stock markets. Price indices took a nose dive in the same pace as it took off before the bubble.

However, a steady rise in stock price may not necessarily end up in stock market bubble. A fundamental change in the economy may also cause such rise, which is sustainable in the long run. The developments of the Spanish stock market and Irish stock market are good examples of such fundamental and sustainable stock price rise. In both cases, there were sustainable rise in stock indices when these countries joined European Union (EU).



## **5.2 Stock Market Bubbles of Selected Countries**

### **5.2.1 Stock Market Bubble in India, January 2008**

Stock market of India experienced a bubble and burst period in 2008. On January, 2008, the Indian Stock Exchange was at its peak. Sensex - Bombay Stock Index (BSI), was rising at an amazing speed. The investors were optimistic and were speculating on further rise in stock price. But, on January, 21, BSI fell by 1408 points to 17,605 leading to one of the largest commotions in investor wealth. From then onwards, Sensex continued to fall till November, 2008. Like many other stock market bubbles and bursts around the globe, a single factor could not be traced out as the cause of such a bubble. The burst of the bubble was prompted by a combination of factors.

One of the primary causes that could be identified was the massive fear that United States' economy was heading towards recession and that there will be a cut in the US interest rate. Moreover, there was a market rumour that the foreign investors and the hedge funds, that dominated Indian stock market, would reallocate their funds to sophisticated developed market. The reason being emerging stock markets were more risky than what was perceived before. In addition to foreign factors, a number of local factors contributed to this. First, there was a huge build-up in derivatives positions leading to margin calls. Second, the liquidity of primary market was being diminished by large number of IPOs in the market. Third, a huge amount of investments was withdrawn by the insurance sector during that time.

### **5.2.2 Stock Market Bubble in Sri Lanka, September 2007**

The stock market of Sri Lanka had been performing at a moderate level throughout 1990s. However, during that time there was an ongoing Civil War in the country. Consequently, right after the signing of ceasefire agreement in 2001, both the indices of Colombo Stock Exchange (CSE) shoot up. The market went into a new phase of growth, with an annual average rate of 30 percent for three consecutive years till 2005. The CSE was declared as one of the best performing markets in the world by Bloomberg. The story did not end here, in 2006, CSE surpassed its previous records, with its two major indices namely All Share Price Index (ASPI)

and Milanka Price Index (MPI) growing at 41.6 percent and 51.4 percent respectively. The development of Sri-Lankan stock market was not a case of artificial inflammation of bubble. It was based on solid ground which made it sustainable. The growth was the reflection of improved investor confidence, which was due to positive political developments and strong corporate performance by listed companies. In 2007, the index passed 3,000 marks for the first time in its history and was at a record high for the seven consecutive days.

### **5.2.3 Stock Market Bubble in Japan, December 1989**

In Japan there was an emergence of an economic bubble between 1986–1991. In the late 1980s, irregularities within the Japanese economic system had caused a speculative asset price bubble on a massive scale. As a result, the Japanese stock market crashed in January, 1990. The Nikkei 225 slide from 38,921 on January 4, 1990 to 21,902 on December 5, 1990, which resulted in a loss of more than 43 percent within a year. The root cause of the bubble was lenient credit policy by Japanese banks, which impacted both the stock market and the real estate sector of the country. During that time, the central bank of Japan imposed an excessive loan growth target on Japanese banks. To attain the target the banks started to offer lenient credit to general people without much screening of the credibility of the borrowers. This caused a massive liquidity in the market and triggered inflation. As investors were getting easy credit, they heavily invested in stock market and real estate. As a result, both the stock price and the price of real estate properties shoot up. To tame down the speculative bubble and keep inflation in check, in late 1989, the Central Bank of Japan abruptly raised inter-bank lending rates. Due to this sharp policy which came all on a sudden, caused the burst of the bubble. Consequently, the Japanese stock market crashed.

### **5.2.4 Stock Market Bubble in China, October 2007**

During 2007, Chinese stock market was on a bull run. Within less than a year the two major exchanges of China, the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange had grown at a rate of 135 percent and 150 percent respectively. The price-earnings ratios for Chinese stocks averaged 70:1, against a worldwide average of 18.5:1. However, the bull ride could not sustain for long. In November, 2007, the SSE Composite Index of the Shanghai Stock Exchange dropped 9 percent, which was the largest drop in 10 years. The Chinese correction

had a ripple effect on global financial market, which prompted drops and major unease in nearly all financial markets around the world.

There was a combination of factors that caused this artificial bubble to pop up. During that time there was a huge surge of new unsophisticated private investors in the Chinese stock market. These investors had no knowledge about investment and randomly invested their money into the market. This pushed the demand for stocks and helped newly listed companies to reap unrealistic profit within months of initial public offering. Moreover, there was a disparity between the price of same company's stocks inside China (A- Share) and in Hong Kong Exchange (H- Share). The value of the A-shares inside China was nearly double compared to that of H-Shares on the Hong Kong exchange. There was a major misconception among the small investors that the government had an invisible hand behind the bull market which would help the boom to persist. Even the Government of China utilized the market boom to sell shares of state enterprises which were utterly debt-burdened. During this phase, no one paid heed to the caution that was coming from the World Bank, the International Monetary Fund (IMF) and other international agencies, not even the Government. However, the market reacted to the rumours that the Government would raise interest rates in an attempt to check inflation and that the Government would impose restriction on speculative trading with borrowed money. Finally, the bull run of Chinese stock market came to an end in November, 2007.

### **5.2.5 Stock Market Bubble in Saudi Arabia, February 2006**

Beginning in 2003, the capital market of Saudi Arabia suddenly expanded significantly and the Tadawul All Share Index (TASI) was gradually growing at a very high rate. TASI registered a growth of 84 percent and 103.7 percent respectively by the end of 2004 and 2005. Eventually, the TASI reached the highest point of 20,634.86 in its history, during February, 2006. However, TASI started to fall dramatically by the end of February 2006 and quickly lost about 13000 points, within less than a month. The down-ward trend continued for almost two and a half months, during this time TASI dropped 50 percent from its peak.

A number of reasons were identified causing this market bubble and consequent burst. Firstly, there was an influx of new investors who were rather unsophisticated and inexperienced and invested their life saving into the stock market. This caused both the liquidity of the market and the demand for stocks to increase dramatically. Secondly, the situation was further aggravated

by easy credit facilities provided to investors by the banks. Thirdly, after 9/11, due to fear of overseas market instability, a huge amount of money was repatriated to the United Kingdom, which were channeled to the stock market. Fourthly, during that time there were major loopholes in the system, trading in shares was largely unsupervised, there were issues regarding illegal speculation, insider information, lack of transparency and lack of financial disclosure by listed companies, which were intentionally ignored by the authority. Finally, prices rose artificially, because certain wealthy investors essentially bought and sold stocks among themselves with an intention of upholding the ongoing hype of optimism in the market. However, for some unknown reason, the government was reluctant to take necessary actions against such irregularities in the stock market which caused the market to crash at the end.

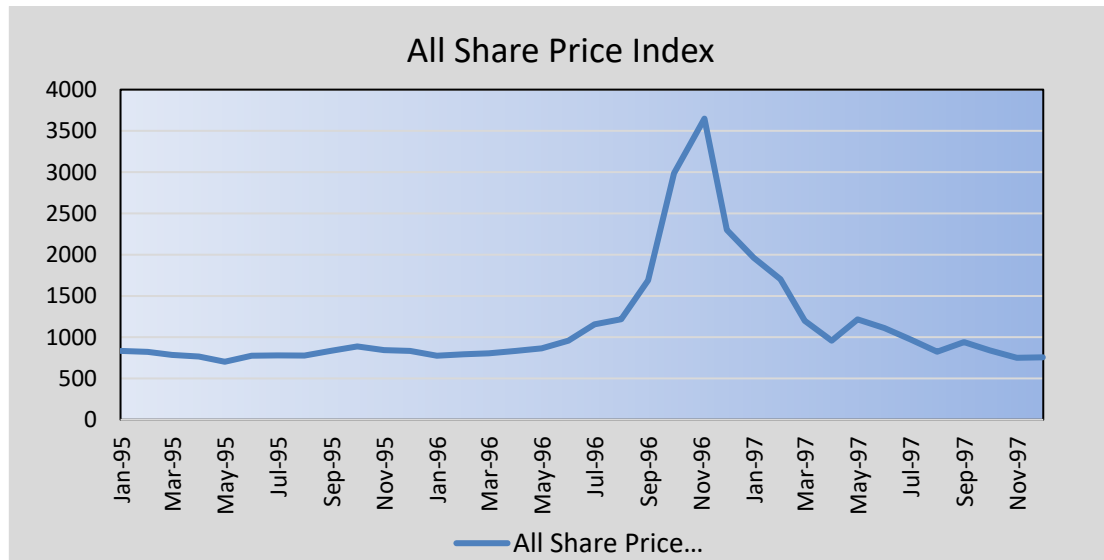
### **5.2.6 Stock Market Bubble in the USA, March 2000**

The dotcom bubble was initiated in the late 1990s, as the computer as well as the internet became a part and parcel of people's daily lives. During 1990s, many of the start-up software companies were the focus of venture capitalists who saw potentials in those companies to reap massive profits from the stock market. From 1996 to 2000, the NASDAQ stock index inflated massively from 600 to 5,000 points. However, by early 2000, investors were struck hand by reality. Investors soon realized that the dot-com hype was nothing but a classic case of speculative bubble. Within months, the NASDAQ stock index took a nose dive from 5,000 to 2,000. Investors were devastated and panic selling came into play, this caused NASDAQ to plunge further to 800 by 2002.

There was a number of factors causing the bubble. Firstly, the media played a vital role in forming exuberant confidence of investors during the early part of the bubble and later made them overly pessimistic about the market. Secondly, the low interest rate during 1998-99 also helped the start-up companies to have easy access to initial venture capital which contributed to the building-up of the bubble. Moreover, the irrational business approach of "Get Big Fast", played a major role too. By and large, all the start-up corporations were inspired by companies like Amazon, eBay, and Kozmo. However, hundreds of them failed. To sum-up, the main factor responsible for the bubble and its subsequent burst, was investor's over optimism that overshadowed the basic fundamental rules of investment, which made the investors overlook the obvious signs that the bubble was about to burst.

### 5.2.7 Stock Market Bubble in Bangladesh, November 1996

A steady rise in stock price index was observed during 1991 to 1995. At the end of 1995 DSE All Share Price Index rose by 139.3 percent and reached to 834 points. The growth was even higher in 1996, the market experienced a drastic upward movement artificially created by exuberant investors. This pushed the price index up by 337 percent.



**Figure 5.2: All Share Price Index during Stock Market Bubble 1996**

Source: DSE Data

In the mid of 1990s, capital market started to show positive signs which created a hype among the general people. The index was rising sharply which encouraged many people to invest their money in the capital market. Many new retail investors with no prior knowledge of investment, entered into the market. During that time, heavy trading in the speculative stocks were observed. Most of this trade went unrecorded. All Share Price Index stood at 3648.7 points on 5th November 1996. From mid of November, as the speculative investors started selling off their shares after reaping a huge amount of profit from the market, there was a sudden panic among the general investors which went beyond the reach of the regulatory authorities. As a result, the benchmark index dropped 80 percent within a year (3600 points in November, 1996) and was at 700 points in November 1997. The aftermath of the market crash was devastating, general investors were shattered, they lost everything and withdrew themselves from the capital market.

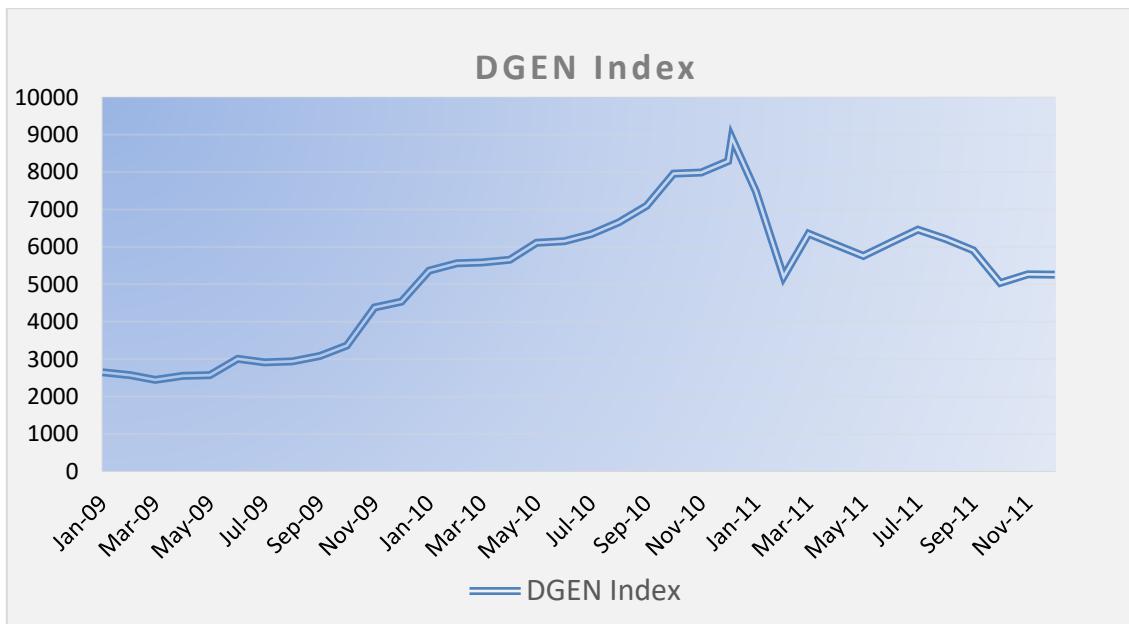
During the period of market boom, the DSE made record breaking performances and reached a new height almost every day. To calm down this overly heated market several steps were

taken by different regulatory authorities. However, none of them could have any substantial impact to cool down the market (Hossain, 2011). As an obvious consequence, the first ever stock market crash in the history of Bangladesh took place. In April, 1997, All Share Price index was at its lowest and stood at 957 points. The glorious days of DSE became a history. For the next 7 years the index was on a decreasing trend, with the benchmark index seldom crossing 1000-point mark. (Mansur, 2010)

A few factors can be highlighted as the cause of the bull run and the ultimate crash of the stock market in Bangladesh. First, the mismatch of demand and supply. During that time a huge number of new investors entered into the stock market, which caused excess liquidity, however there were not enough listed securities to meet the demand. This caused the stock price to go up. Second, it was also reported that stock prices were being distorted by certain foreign portfolio managers, brokers and sponsors who had access to inside information. Thirdly, due to the market hype, a large number of companies were going for IPOs, with the hope that they will get better price of their IPOs. There were records of high initial returns as high as 1000 percent on their first trading day. Fourthly, weak regulations and surveillances on the part of BSEC was another factor that caused the bubble to inflate. During that time there were cases of faulty financial statement, lack of disclosure of important investment information, unauthorized trading which did not draw the attention of the regulators.

### **5.2.8 Stock Market Bubble in Bangladesh, December 2010**

After the horrifying experience of 1997, the Government, the Bangladesh Bank, the Bangladesh Securities and Exchange Commission and the Dhaka Stock Exchange had given their all-out effort to stabilize the market. The Dhaka Stock Exchange had gone through many legal, infrastructural and operational reforms. For example, Central depository, circuit breaker, online trading, etc. were introduced in the market to attract investors. Emphasis was given on corporate governance and financial disclosure practices by the Bangladesh Securities and Exchange Commission to make the listed companies more transparent to the investors. During this time, the progress of DSE with respect to size, depth and maturity was phenomenal. This was the result of various legal and institutional reforms undertaken by different regulatory authorities over the years. As a result of all the positive changes, a good number of well-established companies with sound financial indicators got listed with the DSE which helped the exchange to get greater breadth and become more attractive to investors.



**Figure 5.3: DGEN Index during Stock Market Bubble 2010**

Source: DSE Data

The increased level of investors' participation in the market created an optimistic hype which was reflected on all market indicators. The index started to rise at a rocketing speed and reached its highest on December 5, 2010, which was termed as “the last glorious day of the year” by many authors in previous studies (Saha, 2012). On this day the DSE General Index (DGEN) was at its historical high and stood at 8,918.51 points. Moreover, DSE turnover broke all records and reached Taka 32.50 billion on the same day. The regulators could foresee the consequence of such heated market. The Bangladesh Securities and Exchange Commissions and Bangladesh Bank applied a lot of directives to keep the market under control. However, the market was on the falling trend from then onwards. There were panic among the investor, they started to sell-off their shares. On December 19, 2010, the DSE experienced its largest one-day fall, the DGEN index lost 551.76 points in one day and dropped to 7654 points. From then onward the Bangladesh stock market was on a decreasing trend. On January 9, 2011 and January 10, 2011, DGEN Index declined by 600 points and 660 points on two consecutive days and came down to 6499.44 points from 7,735.22 points just two days before the fall. The government, the Bangladesh Bank and Bangladesh Securities and Exchange Commission took immediate steps to tame the market. However, it took quite some time to improve the market conditions and bring back the investors' confidence.

After the burst of the bubble a number of probe reports were published by different agencies and committees. In all these reports a combination of factors were highlighted as the cause of the bubble. Firstly, there was a huge inflow of investment, the number of beneficiary owners (BO) account reached 3.21 million in December, 2010 which was only 1.25 million in December, 2009. This increased number of BO account was possible due to the introduction of internet-based trading operations, opening up of many new branches of brokerage houses across the country, countrywide road show of 'Share Mela', stock fair etc. Secondly, the amount of investment by both banks and other financial institutions also increased during this period, as they had excess liquidity due to less business opportunities during the recession period of 2009-2010. This caused a huge demand-supply mismatch as the number of listed securities were too little to cope with the huge growth of demand.

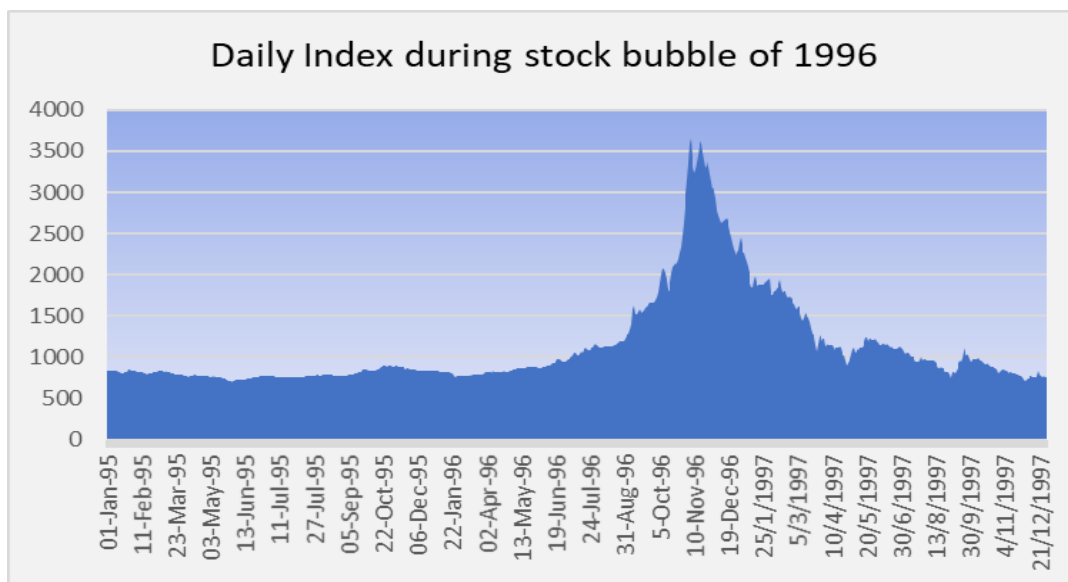
Irregularities in Pre-IPO and IPO process were considered the main reason for the stock market crash. In case of book building method of IPO, share price was unrealistically inflated during the price discovery stage. However, this inflated price was preserved only for the lock-in period when the privileged investors could not sell their shares. This helped them to pull out a huge profit within a short period. Some experts argue that share price was also distorted by direct listing. Moreover, there were also irregularities regarding revaluation of assets. By taking advantages of weak asset revaluation method, many listed companies abruptly increased their share price beyond any reasonable limit. To some extent, Government was also responsible for fuelling the market bubble through its accommodative monetary policy and lenient investment policy which permitted whitening of black money through tax breaks. In some cases, poor monitoring and market surveillance, frequent change in directives by BSEC were also highlighted as major contributor to 2010 market bubble. There were even questions about the credibility of BSEC and the suspicious activities of few of its employees. However, the burst of the bubble was initiated by Bangladesh Bank through its directive to withdraw illegal industrial loans and another directive to increase statutory liquidity ratio (SLR) and cash reserve ratio (CRR) of banks in December, 2010.



## 5.3 Market Indicators during stock market bubbles in Bangladesh

### 5.3.1 Stock Market Index

During the stock market bubble of 1996, the stock price index started to gear up from the early part of January 1996. Throughout the year the index was spiraling at around an average rate of 2 percent per month. However, the growth rate reached double digit from June, 1996, with around 35 percent and 77 percent rise in September and October, 1996, respectively. By the end of October 1996, the All Share Price Index (ASPI) reached 2986 points, which was only 1890 points at the beginning of the month, this was the highest growth rate in one-month span in the history of Dhaka Stock Exchange.



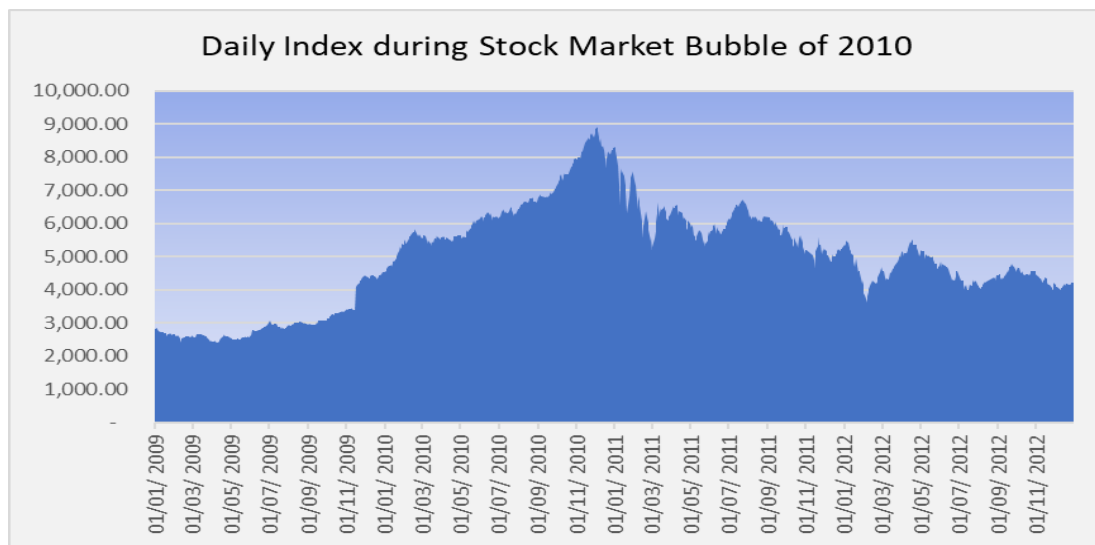
**Figure 5.4: Daily Index during Stock Market Bubble of 1996**

Source: DSE Data

However, the story did not end here. All share price index of DSE reached its highest point at 3649 on November 5, 1996. Surprisingly the index was only 770 points on February 5, 1996, which was only nine months ago. This was an obvious sign of stock market bubble. At this point many measures were initiated by both the DSE and the BSEC to stabilize the market. However, it was then already too late, the market was totally out of control. From the next day, the share price index slumped down and this downward trend continued for quite some time, despite several efforts by different regulatory authorities. This was the first stock market crash in the history of Bangladesh. The index dropped to 761 points in September, 1997, which was

almost the same level as it was nine months ago. To be precise, the index lost around 2888 points or dropped 79 percent from its peak. From then onwards, the All Share Price Index maintained an average range of 650-550 points till 2000.

Bangladesh Stock Market experienced a second bubble within a time span of 14 years. During this time the DSE General Index (DGENI) started accelerating from November 2009 right after the launching of Grameen Phone (GP) to the public. On November 16, 2009, which was the first trading day of GP, the DGENI jumped to 4148 points which was an increase of 23 percent in a single day. Even though, inappropriate calculation of the index was responsible for this sudden rise in index, the pace continued during the next three months, from November, 2009 to February, 2010. The DGEN index rose by 71 percent and reached 5828 points. Nevertheless, from February to May, 2010, the pace of increase of DGENI had been a little defused. However, it remained at a level above 5500 points.



**Figure 5.5: Daily Index during Stock Market Bubble of 2010**

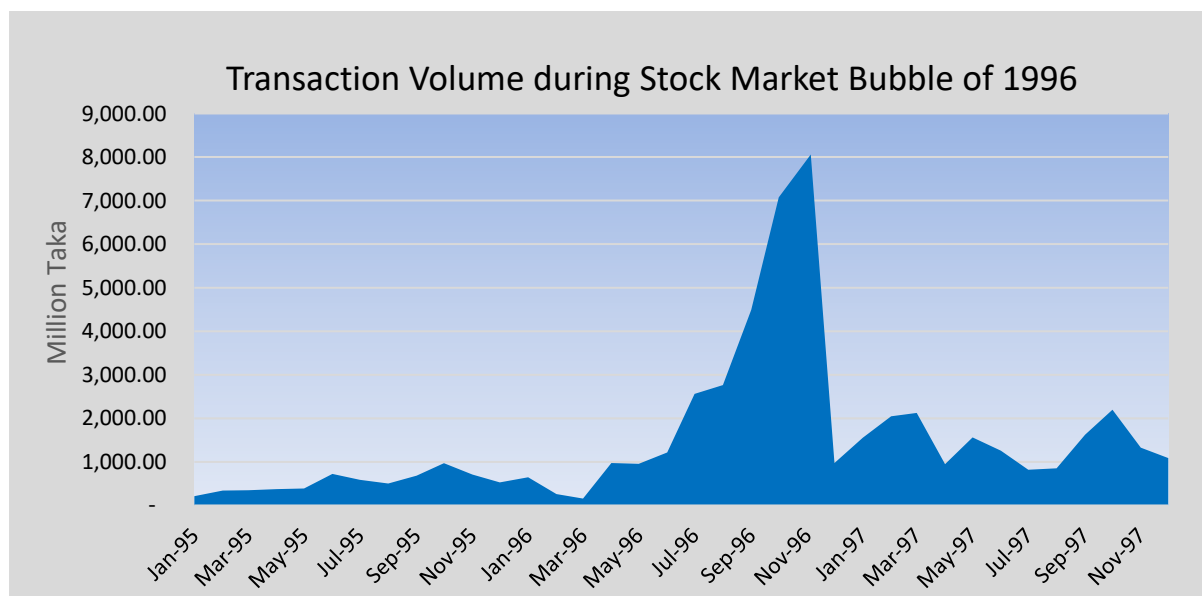
Source: DSE Data

But, from then onwards the market accelerated at a very rapid pace. On December 5, 2010 the DSE General Index (DGEN) was at its highest and stood to 8,918.51 points by breaking all old records of DSE. However, the story reversed completely from the next day. The index was on a decreasing trend for quite some time. On February 28, 2011 the DGENI stood at 5203 points which was the lowest point during that time. For the next couple of months, the market was quite slow, the index was mainly on a downward trend with some sudden hiccups. The DGENI maintained an average range of 4500-4000 points till 2013.

### 5.3.2 Transaction Volume

Prior to market bubble of 1996, the transaction volume of the DSE remained at an average level of Taka 550 million. However, due to the optimistic hype that was prevalent during that time, investors started to pour their money in, which was reflected in the upward trend of transaction volume from May, 1996 to November, 1996, within these seven months the transaction volume rose by 743 percent.

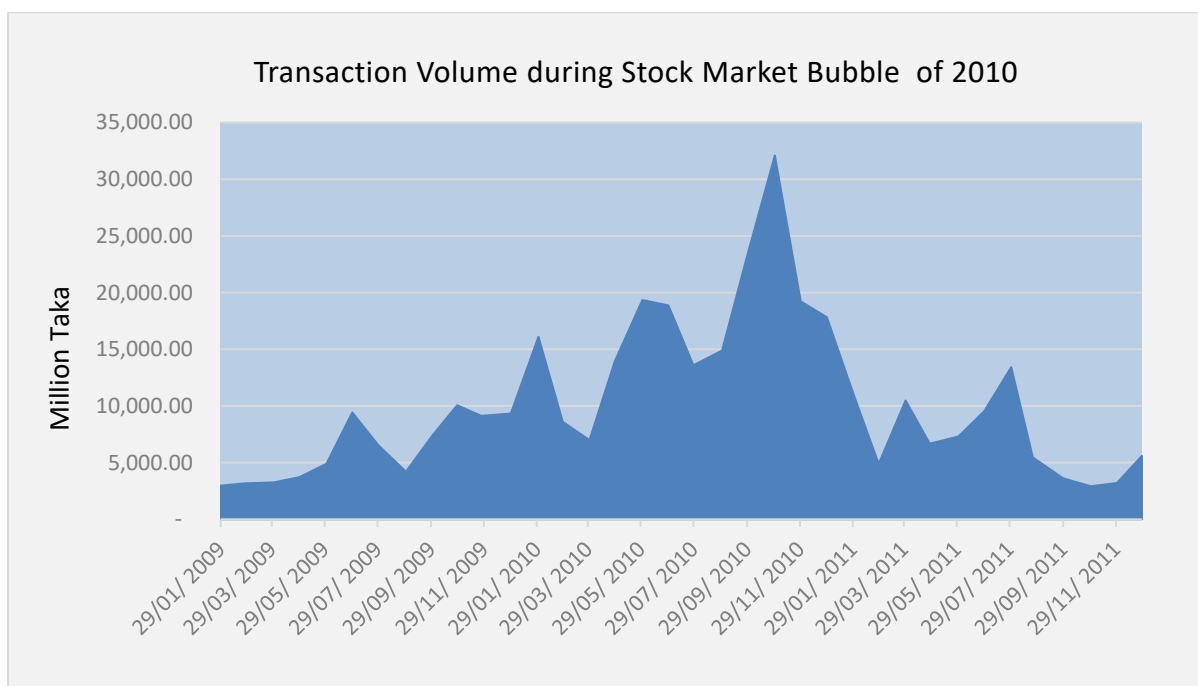
The volume was at its peak in November, 1996 to Taka 8058.84 million. Within a month transaction volume dropped to Taka 974.28 million in December, 1996, which was an 88 percent drop from its peak. However, transaction volume was more or less stable at an average level of Taka 1450 million for the entire year of 1997.



**Figure 5.6: Transaction Volume during Stock Market Bubble of 1996**

Source: DSE Data

Before the market bubble of 2010, the transaction volume remained at an average level of Taka 4,952.35 million during the period January to September, 2009. However the market started to heat up from October, 2009. During that time average transaction volume was Taka 10,024.1 million. The scenario was a little different this time than that of 1996. Rather than a steep rise and fall of transaction volume, during this episode of market bubble, after every jump of transaction volume, it remained at around that level for some time.



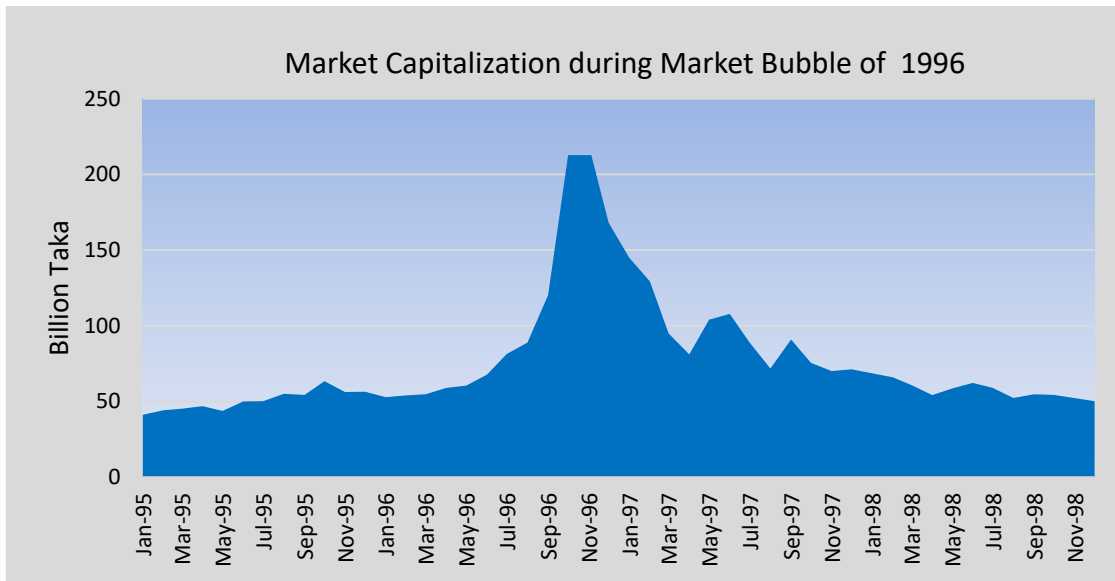
**Figure 5.7: Transaction Volume during Stock Market Bubble of 2010**

Source: Estimated from DSE Data

In 2010, from January to May the volume was at an average of Taka 12297.18 million. However, from June to October it rose to an average of Taka 18678.04 million and again jumped to an average of Taka 25852.77 million from November-December, 2010. Transaction volume was at its peak on December 5, 2010 which was the peak of market bubble. Subsequently the volume dropped to an average of Taka 8657.26 million from January to April, 2011. It slumped further during May to June, 2011 with an average of Taka 5284.11 million. The volume again rose a little in July with an average of Taka 14908.65 million. It finally dropped to an average level of Taka 3834.51 million and remained at this level till December, 2011.

### 5.3.3 Market Capitalization

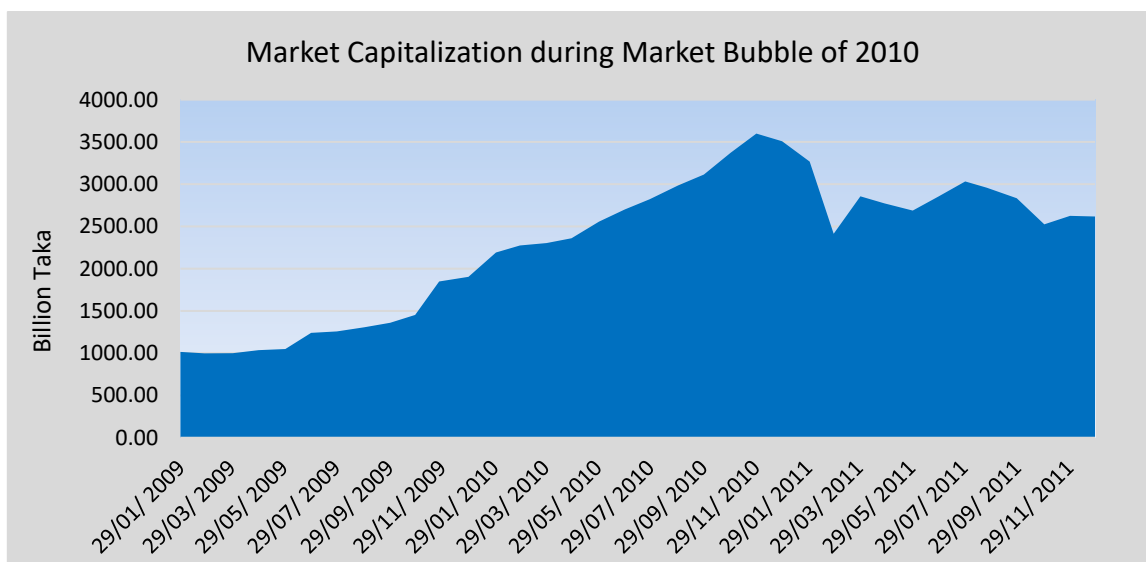
Prior to 1996, market capitalization was quite stable. From January, 1995 to June, 1996, market capitalization was within an average range of Taka 53,136.10 million. As the market started to gear up, market capitalization took off at a turbo power and within six months time, at the end of November, 1996, it reached Taka 212,784 million, an increase of 214.17 percent from June, 1996.



**Figure 5.8: Market Capitalization during Stock Market Bubble of 1996**

Source: DSE Data

However as soon as the market crashed, market capitalization slid down to Taka 81,093 million in April, 1997, which was a 61.89 percent decrease from its peak in November, 1996. Market Capitalization went through some rough time at this level for the next few months, but it was quite stable from November, 1997 and remained at an average level of Taka 59,643 million till December, 1998.



**Figure 5.9: Market Capitalization during Stock Market Bubble of 2010**

Source: DSE Data

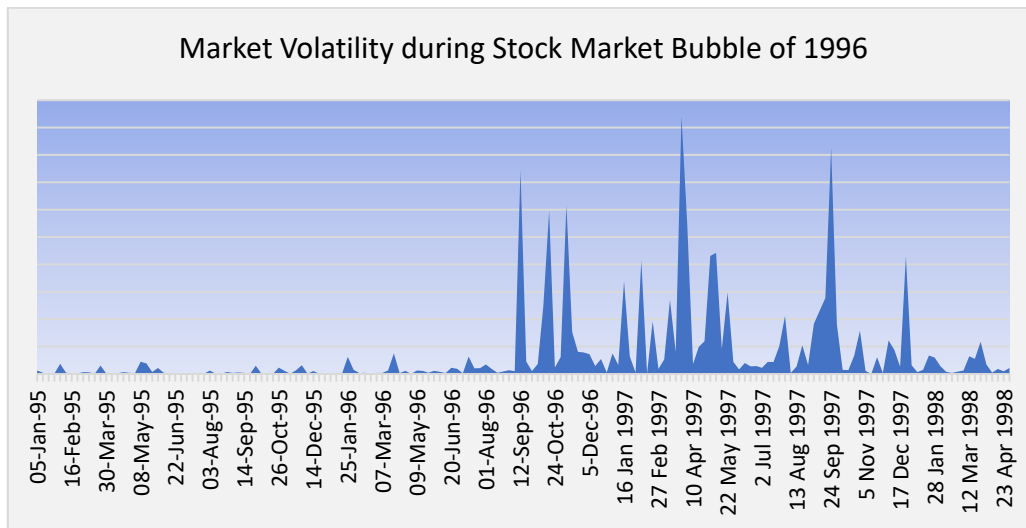
Prior to the stock market bubble episode of 2010, during the first half of 2009 (January- June, 2009) market capitalization was stable with an average level of Taka 1,041.30 billion.

However, like all other indicators, the launching of Grameen Phone, disrupted the market capitalization as well. Within a single day it increased by 17 percent from Taka 1503.37 billion on November 15, 2009 to Taka 1763.85 billion on November 16, 2009.

From then onwards, a gradual upward trend in market capitalization had been observed till it reached its peak in December 5, 2010, at Taka 3680.71 billion, an increase of 98.18 percent from December, 2009. But as the market crashed the figure dropped to Taka 2413.07 billion at the end of February, 2011, a drop of 52.53 percent from its peak. Afterwards, there were frequent fluctuations in market capitalization till August, 2011. However, during the period September to December 2011, market capitalization was quite stable at an average level of Taka 2667.25 billion.

### 5.3.4 Market Volatility

Generally, volatility is measured by standard deviation of stock return. For this study, market volatility has been measured by weekly variance of daily return of adjusted stock price index.



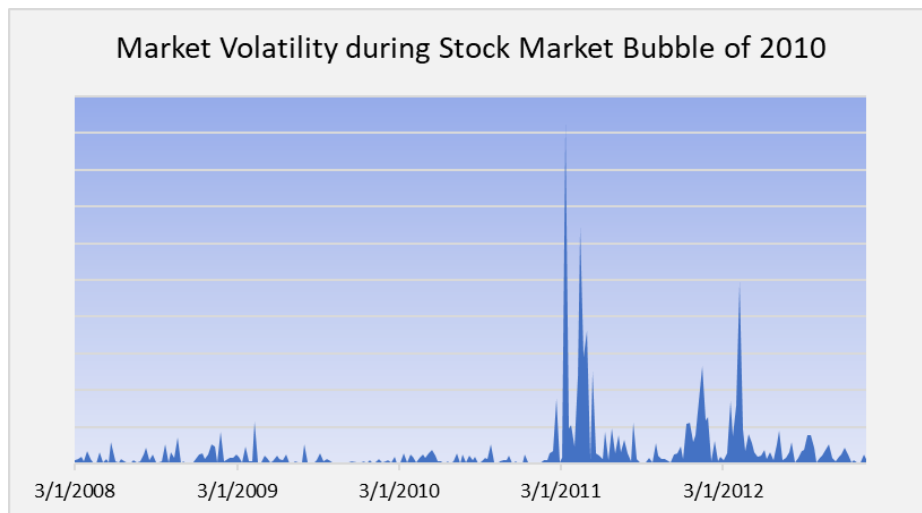
**Figure 5.10: Market Volatility during Stock Market Bubble of 1996**

Source: Estimated from DSE Data

During the stock price bubble period of 1996, market volatility increased significantly. A high level of volatility was observed from September, 1996 to September, 1997. This was the time when the bubble was getting bigger and stronger and as an inevitable consequence the market crashed. However, like many other indicators, volatility did not die out immediately after the

market crashed, it took quite a while for the market index to stabilize and the volatility to drop down to a negligible level. From January, 1998, market volatility of the DSE was back to its original minimal level.

In particular, the increase in standard deviation of stock return was severe prior and immediately following the peak on November 5th, 1996. On that day the value of standard deviation of stock return (based on DGEN) increased from 87 (end of September) to 574. This was well beyond the 376 standard deviation registered at the NASDAQ price index at the peak of the US market bubble in March 2000 and it was approximately one fourth of ASI of Saudi Arabian market's bubble in February 2006.



**Figure 5.11: Market Volatility during Stock Market Bubble of 2010**

Source: Estimated from DSE Data

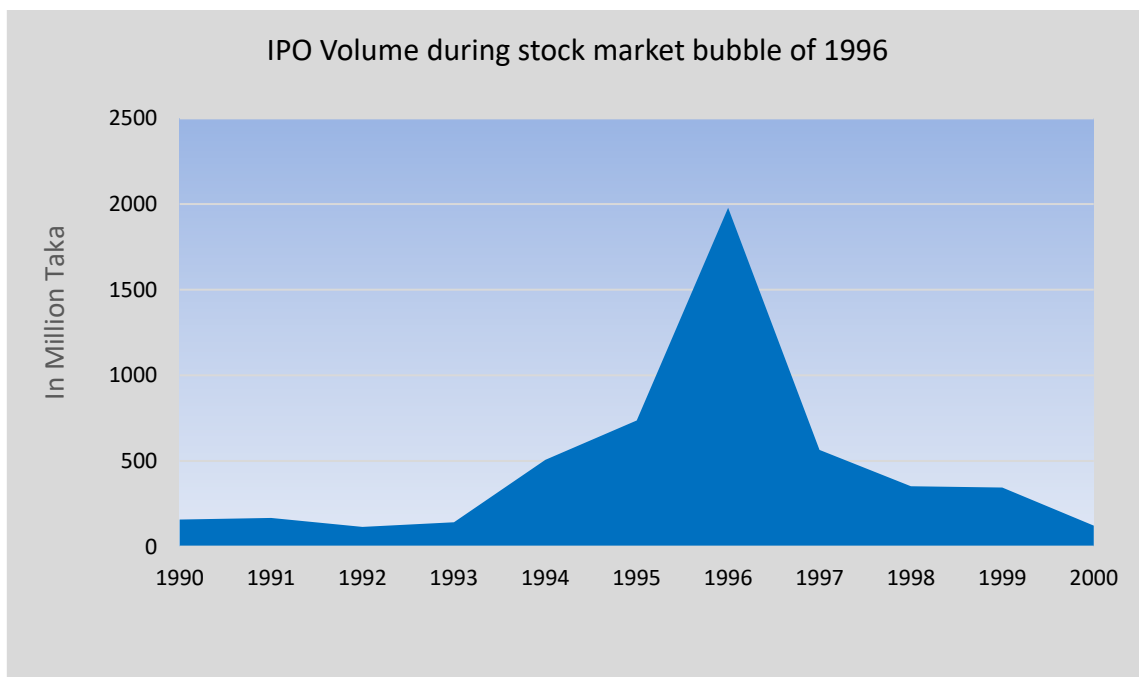
Prior to stock market bubble of 2010, market volatility was at its minimal for quite a long period of time, from January, 2008 till October, 2010. Volatility was at its highest around the peak bubble period and remained unstable till the early part of 2012. However, there was a brief period of minimal volatility in between.

### **5.3.5 Capital Raised through IPOs**

For a long period of time, prior to stock market bubble of 1996, the capital raised through IPO (IPO volume) was at a minimal level averaging Taka 145.79 million. IPO volume started to rise gradually from the beginning of 1994, there was a 45.34 percent increase in IPO volume

from 1994 to 1995. During 1996, IPO volume soared steeply at a rate of 168.51 percent and stood at Taka 1978.08 million by the end of 1996.

This was the reflection of the optimistic sentiment that was prevailing in the market at that time. The companies were inclined to go public with the expectation of getting higher issue price. However, as the bubble was burst the volume dropped sharply to Taka 564.79 million at the end of 1997, a decrease of 71.45 percent within a year. For the next two years the IPO volume was within an average range of Taka 348.55 million with a little decline in 2000.



**Figure 5.12: IPO Volume during Stock Market Bubble of 1996**

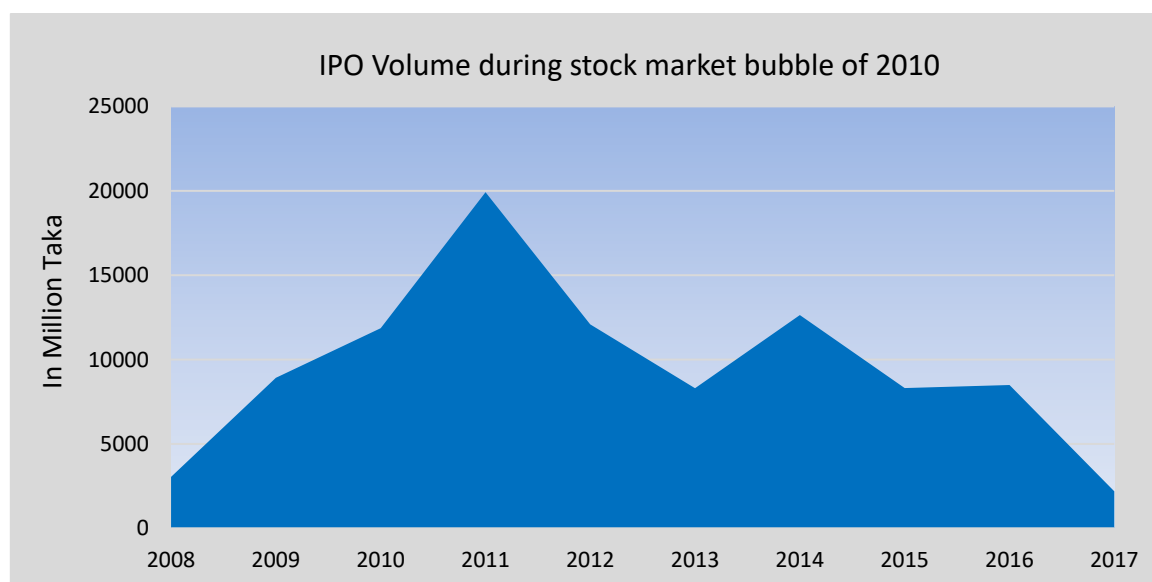
Source: DSE Data

During the stock market bubble of 2010, there was a gradual rise of IPO volume which started from early 2008. The IPO volume rose at an average rate of 33 percent on a yearly basis. The volume was at its peak at Taka 19914.15 million in 2011, an increase of 67.9 percent within a year. However, the market experienced a drastic fall of IPO volume from 2011 to 2013, a drop of 58.3 percent. For the next few years, the IPO volume was relatively stable averaging at Taka 9812.14 million. During 2017, the IPO volume dropped further and stood at Taka 3043.41 million.



### 5.3.6 Number of IPOs and Average First-day Return on IPOs

During 1994 to 1998, 75 companies got listed with the DSE, which was an indicator of market boom. The total share capital of these companies was Taka 11.5 billion, where Taka 24.9 billion was oversubscribed against public offering of Taka 4.4 billion.



**Figure: 5.13 IPO Volume during Stock Market Bubble of 2010**

Source: DSE Data

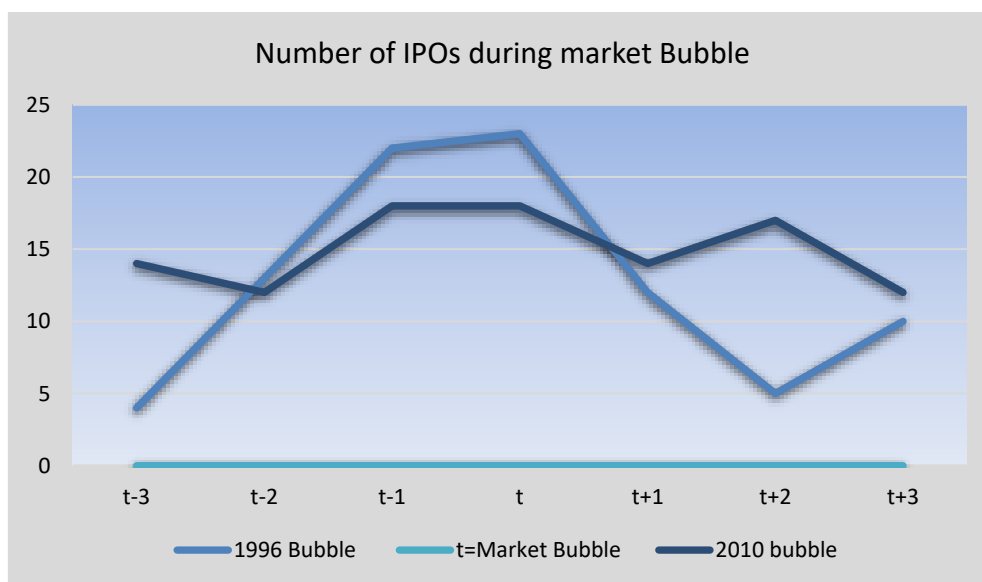
This oversubscription is a reflection of the exuberant demand of stocks by the investors as they were speculating on rising price of these shares. In 1996, 23 new companies offloaded their shares against only 4 companies in 1993. The gradual increase in IPO over the years indicates the forming of bubble. After the market crashed the number again came down to an average of 5 in 1998.

**Table 5.2: IPO scenario during Stock Market Bubbles**

Year	No. of IPOs	Avg. First-Day Return on IPO (%)	Year	No. of IPOs	Avg. First-Day Return on IPO (%)
1993	4	5.95	2007	14	138.26
1994	13	78.12	2008	12	160.84
1995	22	48.85	2009	18	343.53
1996	23	257.27	2010	18	174.05
1997	12	20.84	2011	14	87.54
1998	5	2.56	2012	17	85.13

Source: Estimated from DSE Data

During the second bubble episode, within the time span of 2007 to 2010, 62 companies got listed with DSE with a total share capital amounting to Taka 68.01 billion. During this time, Taka 202.4 billion was oversubscribed (about eleven times higher than the public offer) against public offering of Taka 28.76 billion.



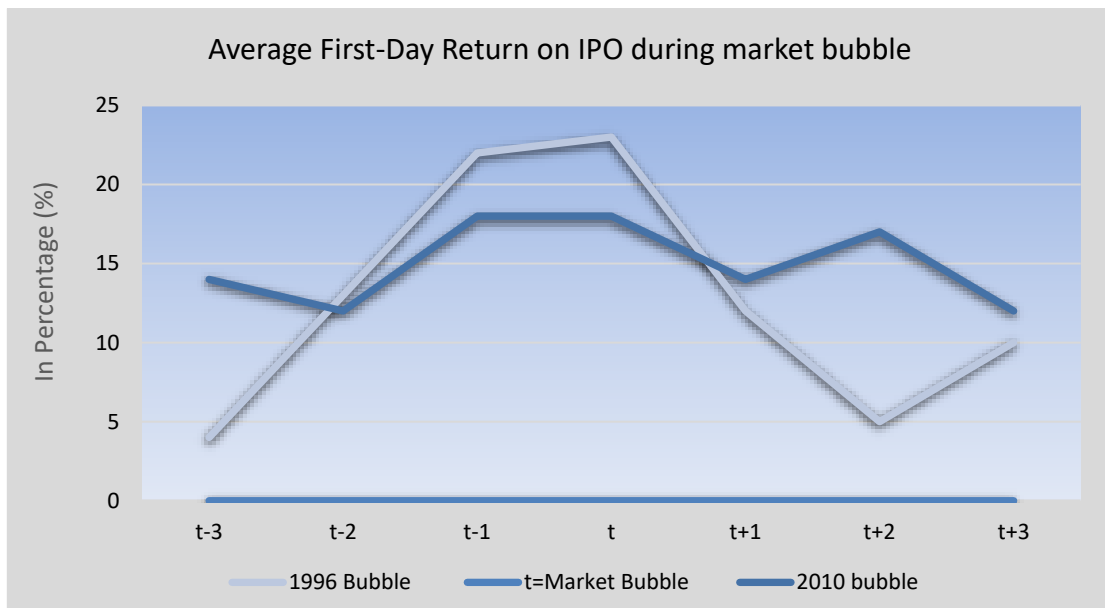
**Figure 5.14: Number of IPOs during Stock Market Bubbles of Bangladesh**

Source: DSE Data

After the first market crash, several steps had been taken by the regulatory authorities to stabilize the market. Of which, the main emphasis was given on strengthening the supply side of the Bangladesh stock market. A number of legal, operational and structural reform had been undertaken by both BSEC and DSE. As a result of these positive changes, from early 2005, many public limited companies and Government enterprises, with strong financial records raised their capital through IPOs. From then onwards, a reasonable number of IPOs were seen every year. In both 2009 and 2010, 18 new companies went public with shares capital amounting to Taka 23.15 billion and 26.53 billion respectively.

During the market bubble of 1996, the first-day return on IPO went up drastically to 257.27 percent against 48.85 percent in 1995. During that time, there was an extreme demand for stocks in the market. Due to the ongoing optimistic hype, many new investors wanted to pour their money into the stock market, which caused the price of any new share to shoot up as soon as it hit the secondary market. There was excess liquidity which drove up the prices of stocks.

However, after the burst of the market bubble, the first-day return went down to 20.84 percent in 2011 and was further down to 2.56 percent during 2012.



**Figure: 5.15 Average First-day Return on IPO during Stock Market Bubbles of Bangladesh**

Source: Estimated from DSE Data

During the second episode of market bubble, the first-day return went up sharply before the bubble and was at its peak in 2009. During this year the first-day return was 343.53 percent against 160.84 percent in 2008. This time the market started to heat up from early 2007 and a three-digit figure of first-day return was observed from then onwards. After the burst of the bubble the first-day return came down to 87.54 percent in 2011 and was around the same level in 2012.

# **Chapter # 6**

## **Empirical Results and Discussion**

The main objective of this study is to identify the impact of investor sentiment on the excess stock market return and market volatility in the Bangladesh stock market. In this study both GARCH-M model and GJR-TGARCH model are used. To facilitate the research, the models are applied to the period between 1990 and 2018. Moreover, to identify the unique impact of investor sentiment during the stock market bubbles, the models are repeated separately on two bubble and burst periods. To check the robustness of the empirical results, the entire study period is divided into two sub-periods of equal length. In this chapter, the empirical results of all the models are discussed. The chapter starts with summary statistics of all the variable considered in this study for the entire study period along with the results of both GRACH-M and GJR-TGARCH models. In the next section, the summary statistics of the variables and the results of the mean and the variance models during the two bubble and burst periods are presented. This is followed by the robustness check carried out in this study. The chapter ends with a discussion on the overall findings of the study.

## **6.1 Summary Statistics and Empirical findings for the entire study period**

This section presents the results of generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model and Glosten, Jagannathan and Runkle's threshold generalized autoregressive conditional heteroskedasticity (GJR-TGARCH) model along with the summary statistics of the variables concern for the entire study period.

### **6.1.1 Summary Statistics for the entire study period**

Table 6.1 presents the summary statistics of all the variables relating to the market along with the sentiment proxies for the period between 1990 and 2018. As the study is based on weekly data, the summary statistics of the weekly variables are discussed in this section. From the table it can be seen that, during the period of investigation, the average weekly market return (WMR) is 0.15 percent with a maximum of 30.84 percent and a minimum of -18.02 percent and the average of weekly excess market return (WEMR) is -0.0046 percent with a maximum of 30.69 percent, and a minimum of -18.18 percent. If compared with other empirical studies, the average weekly excess market return of Bangladesh is lower than that of US market (Lee et al., 2002) and Taiwanese market (Chuang, 2010). However, the average weekly market return is higher in Bangladesh than that of US market (Lee et al., 2002).

The weekly estimated market variance (MVAR) has an average of 0.00017 with a maximum of 0.0092 and a minimum of 0.000. The low value indicates that on an average, the volatility in the market was minimal during the entire study period. However, the averages shoot up to 0.00028 and 0.00034 during the first and the second bubble period respectively. Of the three sentiment proxies, the change in trading volume per security ( $\Delta TVOL$ ) has an average of 0.00 with a maximum of 0.1436 and a minimum of -0.087. For the change in modified relative strength index ( $\Delta MRSI$ ) and the change in closed-end-fund discount ( $\Delta CEFD$ ), the averages are 0.019 and -0.012 respectively. The signs of sentiment proxies are consistent with the expectation. Both the change in trading volume per security and the change in modified relative strength index have positive average values indicating that the market is in positive trend as a whole. Similarly, the negative sign of the change in closed-end fund discount indicates positive sentiment since the CEFD is expected to have an inverse relationship with the investor sentiment.

Table 6.1 also includes the summary statistics of sentiment proxies that could not be considered in the current study. From the table it can be observed that dividend premium (DP) has a negative median value of -0.0012. This means that non-dividend paying firms have relatively higher values than the dividend paying firms in majority of cases. Therefore, it had to be dropped from the current study as negative value of dividend premium is irrational and misleading. Moreover, the average weekly number of IPOs is 0.23 with a minimum of 0.00 and a maximum of 4.0. This proxy could not be taken either due to its insufficient number. As mentioned earlier, on an average there are around 11 IPOs floated per year in the Bangladesh stock market, which is too small a number to be considered on a weekly basis.

The standard deviation of the excess market return and the estimated market volatility are 0.032 and 0.0005 respectively, indicating that there is minimal variation in return and volatility during the entire study period. The standard deviation of modified relative strength index and closed-end fund discount are significantly high. However, both of the proxies have low weekly average which may be due to the fact that negative and positive change in investor sentiment are nullifying.

**Table 6.1: Summary Statistics for the period 1990-2018**

Summary Statistics for the period 1990-2018								
Variables	Obs.	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Quarterly Market Return (QMR)	116	0.019524	-0.002845	0.150186	-0.651660	0.655553	0.408752	8.801918
Monthly Market Return (MMR)	348	0.006508	0.003936	0.084980	-0.363546	0.583850	0.786130	12.154270
Weekly Market Return (WMR)	1494	0.001493	0.000296	0.032064	-0.180248	0.308396	0.800506	15.541260
Daily Market Return (DMR)	7432	0.000038	0.000028	0.000452	-0.011987	0.010704	-8.61890	298.128600
Risk Free Rate (RF)	1495	0.001539	0.001539	0.000000	0.001539	0.001539	1.000000	1.000000
Quarterly Excess Market Return (QEMR)	116	-0.063812	-0.091908	0.154301	-0.709165	0.570553	0.506012	7.823412
Monthly Excess Market Return (MEMR)	348	0.001266	-0.001205	0.085097	-0.368210	0.578058	0.778393	12.101280
Weekly Excess Market Return (WEMR)	1494	-0.000046	-0.001242	0.032064	-0.181786	0.306858	0.800506	15.541260
Daily Excess Market Return (DEMUR)	7432	0.000127	-0.000077	0.013332	-0.121651	0.144646	0.193016	15.935310
Quarterly Estimated Market Variance (QMVAR)	116	0.000268	0.000085	0.000846	0.000003	0.008618	8.549929	83.512020
Monthly Estimated Market Variance (MMVAR)	348	0.000172	0.000062	0.000335	0.000001	0.003123	4.581951	29.484880
Weekly Estimated Market Variance (WMVAR)	1494	0.000174	0.000040	0.000521	0.000000	0.009222	8.523980	103.681500
Daily Estimated Market Variance (DMVAR)	7432	0.000165	0.000040	0.000489	0.000000	0.009317	9.029615	118.652800
Trading Volume per security (TVOL)	1494	0.015979	0.010020	0.019775	0.000000	0.233628	3.644860	27.027620
Change in Trading Volume per security ( $\Delta$ TVOL)	1493	0.000004	-0.000009	0.010384	-0.086651	0.143588	1.655577	47.038070
Modified Relative Strength Index (MRSI)	1495	30.575490	33.579050	15.734390	0.000000	50.000000	-0.56341	2.173656
Change in Modified Relative Strength Index ( $\Delta$ MRSI)	1494	0.018878	0.000000	19.442070	-50.000000	50.000000	-0.01624	2.887887
Closed-end Fund Discount (CEFD)	1495	19.675490	8.991250	168.0120	-1453.3440	1382.2760	-2.89062	37.469320
Change in Closed-end Fund Discount ( $\Delta$ CEFD)	1494	-0.011649	0.000000	106.6231	-974.8114	1380.4170	0.392537	42.586670
Dividend Premium (DP)	348	0.001095	-0.001229	0.085108	-0.370430	0.576803	0.760511	12.079360
No. of IPOs (NIPO)	1494	0.232107	0.000000	0.491193	0.000000	4.000000	2.369043	10.112120
First-day Return on IPOs (RIPO)	1494	169.7000	61.800000	185.845600	-40.000000	1284.000000	2.596019	11.561200

Source: Estimated from DSE Data

The overall market return is positively skewed indicating a distribution with an asymmetric tail extending to positive values. This indicates that during this period frequent past small losses and a few past extreme gains were observed. High kurtosis is observed during the period in the market returns which indicate extreme losses or gains. In this case the high value of kurtosis is due to few extreme gains observed from the skewness result.

### 6.1.2 Correlation among the key variables for the entire study period

Table 6.2 contains the contemporaneous correlations among the sentiment measures and the other key variables, namely, the excess market returns and the estimated market variance. Overall, it is observed that the sentiment proxies are more correlated with returns and are statistically significant compared to estimated market volatility.

**Table 6.2: Correlation among the key variables for the period 1990-2018**

Correlation					
	EMR	MVAR	$\Delta$ TVOL	$\Delta$ MRSI	$\Delta$ CEFD
EMR	1.000				
MVAR	-0.040	1.000			
$\Delta$ TVOL	0.061**	0.010	1.000		
$\Delta$ MRSI	0.375***	0.050*	-0.0311	1.000	
$\Delta$ CEFD	-0.052**	-0.020	-0.0012	0.0146	1.000

Note: \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Source: Estimated from DSE Data

Among the sentiment proxies,  $\Delta$ MRSI has substantial positive correlation with return at 1 percent significance level, which is 0.37 and a small positive (0.05) correlation (at 10 percent significance level) with estimated market volatility. It is worth mentioning here that the three sentiment proxies have very low and statistically insignificant correlation among themselves which made it unreasonable to use Principal Component Analysis (PCA) and extract common variation for developing a composite sentiment index.

### 6.1.3 Results of Base-line model with three sentiment proxies

The estimated results of five different GARCH-M and GJR-TARCH models comprising of the entire study period are shown in Table 6.3. All the 5 models consider 29th lag of the excess market return in the mean model and different combinations of ARCH, TARCH and GARCH



lags in the variance model. Model 1 considers ARCH (2), TARARCH (18) and GARCH (12) lags, model 2 considers ARCH (2), TARARCH (18) and GARCH (11) lags, model 3 considers ARCH (2), TARARCH (18) and GARCH (8) lags, model 4 considers ARCH (2), TARARCH (18) and GARCH (18) lags and model 5 considers ARCH (2), TARARCH (14) and GARCH (12) lags. In all the 5 models ARIMA (3,5,0) is used. Where, the first term stands for autoregressive order, the second term stands for integrated (difference) order and the third term stands for moving average order. In these models three sentiment proxies are considered namely the change in trading volume per security ( $\Delta TVOL$ ), the change in modified relative strength index ( $\Delta MRSI$ ) and the change in closed-end fund discount ( $\Delta CEFD$ ). It is worth mentioning that almost similar results are found in all the five models.

$$R_{it} - R_{ft} = \alpha_0 + \alpha_1 h_{it} + \alpha_2 EMR_{t-1} + \alpha_3 \Delta TVOL_t + \alpha_4 \Delta MRSI_t + \alpha_5 \Delta CEFD_t + \varepsilon_{it} \dots\dots\dots(1)$$

In this section the overall empirical results of all the five base-line models (GARCH-M and GJR-TGARCH model) are presented. At first the overall results of GARCH-M models based on Equation (1) is discussed. The coefficient of three sentiment proxies namely, the change in trading volume per security ( $\Delta TVOL$ ), the change in modified relative strength index ( $\Delta MRSI$ ) and the change in closed-end fund discount ( $\Delta CEFD$ ) have the expected signs, but only the coefficient of the change in modified relative strength index ( $\Delta MRSI$ ) is statistically significant.

As it can be observed from Table 6.3, the estimated coefficient  $\alpha_4$  is found positive and significant in all the models at 1 percent significance level. This indicates that there is positive impact of  $\Delta MRSI$  on the excess market return. As discussed previously, an increase in MRSI indicates that the market is bullish and a decrease in MRSI indicates that the market is bearish. The estimated results, therefore indicates that when investors are optimistic about the market, they gain higher returns; when investors are pessimistic about the market, they earn lower returns.

**Table 6.3: Base-line models with three sentiment proxies for the period 1990-2018**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
<b>Variables</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>
$\alpha_0$	0.0001116	0.0001829	0.0001029	0.0001753	0.0000776
$\alpha_1 h_{it}$	-8.1718060***	-8.6143560***	-9.4194680***	-9.5345650***	-8.8380810***
$\alpha_2 EMR_{t-n}$	-0.0068770	-0.0192127	-0.0187758	-0.0224211*	-0.0152255***
$\alpha_3 \Delta vol_t$	0.0240000	0.0277339	0.0167258	0.0162606	0.0204760
$\alpha_4 \Delta MRSI_t$	0.0004799***	0.0004848***	0.0004904***	0.0004907***	0.0004851***
$\alpha_5 \Delta CEFD_t$	-0.0000011	-0.0000014***	-0.0000015	-0.0000001	0.0000022
$\beta_0$	-6.2641360***	-6.0897030***	-6.1329430***	0.0001753	-6.1822610***
$\beta_1 \varepsilon_{it-1}^2$	0.6151406***	0.5778660***	0.6142826***	0.6294517***	0.6464940***
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	0.1443471***	0.2018481***	0.1612156***	0.1450800***	0.0585007*
$\beta_3 h_{it-1}$	0.1234912***	0.0805997***	0.0870923***	0.0037006	0.1212575***
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0003108**	0.0003049**	0.0003330**	0.0003441***	0.0002488*
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	0.0006190***	0.0006273***	0.0006344***	0.0006037***	0.0007475***
Log-likelihood	1562.547	1554.930	1558.171	1552.525	1555.247
EMR Lags	29	29	29	29	29
ARCH Lags	2	2	2	2	2
TARCH Lags	18	18	18	18	14
GARCH Lags	12	11	8	18	12
ARIMA (p,d,q)	(3,5,0)	(3,5,0)	(3,5,0)	(3,5,0)	(3,5,0)
Number of observations (n)	1459	1459	1459	1459	1459
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.9373	0.7869	0.6983	0.7094	0.7076
Kurtosis	0	0	0	0	0
DW d-statistics	2.2822	2.3087	2.2644	2.3021	2.2661
P-value2	0	0	0	0	0

This table reports the GARCH-M model and GJR-TGARCH model described in Equation (1) and (2). The models are based on the entire study period (1990-2018). All the 5 models consider lag 29 of excess market return in the mean model and different combinations of ARCH, TARCH and GARCH lags in the variance model. In all the 5 models ARIMA (3,5,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

The estimated coefficient of the change in trading volume per security ( $\Delta TVOL$ )  $\alpha_3$  is positive in all the five models. This indicates that there is a positive impact of the change in trading volume per security on the excess market return. However, the result is insignificant in all the models. The sign of the coefficient is consistent with the expectation that a positive change in the trading volume per security would trigger a bullish shift in the investor sentiment and a negative change in volume would cause a bearish sentiment. This means, when investors are optimistic about the market, they gain higher returns; when investors are pessimistic about the market, they earn lower returns. However, since all the results are found insignificant, it can be depicted that the change in trading volume per security does not have much influence on excess market return in Bangladesh Stock Market.

The coefficient  $\alpha_5$  is expected to have a negative sign as the change in closed-end fund discount ( $\Delta CEFD$ ) is presumed to be negatively correlated with the excess market return. This means that there is an inverse relationship between the excess market return and  $\Delta CEFD$ . As mentioned earlier, an increase in CEFD indicates that the market is bearish and a decrease in CEFD indicates that the market is bullish. The estimated coefficient for time-varying portion of the excess market return  $\alpha_5$  is negative in all five models. However, the coefficient  $\alpha_5$  is found statistically insignificant in all the four models except model 2. The estimated results, therefore indicates that the impact of the change in closed-end fund discount on the excess market return is nominal in the Bangladesh securities market for the entire study period. This is possibly due to the fact that there is low demand for mutual funds in Bangladesh and such these securities are often underpriced in the market. Mutual funds are less risky securities and are highly demanded by the investors, particularly by the institutional investors in other countries. Because of this very idiosyncratic characteristic of the Bangladesh stock market, the closed-end fund discount is probably less appropriate in Bangladesh.

The estimated coefficient for the constant,  $\alpha_0$  is found positive but insignificant in all the models. This term refers to the portion of average excess return that does not vary with time. In all five models, the estimated coefficient  $\alpha_1$  indicates that there is a negative and significant relationship between the conditional volatility and the excess market returns. This result is consistent with the findings of Glosten et al. (1993), Lee et al. (2002) and Chuang (2010). A negative coefficient of  $\alpha_1$  is not consistent with the CAPM model. According to CAPM model, investors can earn higher return up to a certain risk level which is termed as the systematic risk,

any additional risk, which is termed as idiosyncratic risk, may not result in additional gain. From this point of view, noise traders' risk must be the unsystematic risk as the result shows that investors cannot receive rewards for taking up such risks. Therefore, the results indicate that the instability resulting from the investor sentiment should be considered as an unsystematic or an idiosyncratic risk and not systematic or market risk. In the GARCH-M model an additional lag term of excess market return is added to avoid the problem of auto-correlation. However, the estimated coefficient  $\alpha_2$  is found insignificant in majority of the models.

$$h_{it} = \beta_0 + \beta_1 \varepsilon_{it-1}^2 + \beta_2 \varepsilon_{it-1}^2 I_{t-1} + \beta_3 h_{it-1} + \beta_4 (\Delta S_{t-1})^2 D_{t-1} + \beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1}) \dots\dots\dots (2)$$

Next the overall results of the variance (GJR-TGARCH) models based on Equation (2) is discussed. Here coefficient  $\beta_1$  and coefficient  $\beta_3$  represent the ARCH and GARCH terms respectively. The results show that coefficient  $\beta_1$  is positive and significant at 1 percent level for all the models presented. This result suggests that the past returns play a significant role in determining the future market volatility. The estimated coefficients  $\beta_3$  is positive and significant as well which indicates that past conditional variance of returns is capable enough to forecast the volatility persistence. Therefore, both the findings suggest that the GJR-TGARCH model is able to capture the volatility persistence and volatility clustering efficiently. Moreover, the coefficient  $\beta_2$  is positive and significant in all the five models, which shows that there is leverage effect between positive and negative shock for all these five models. The estimated coefficient reveals that a negative shock causes higher conditional volatility. It implies that stock market volatility is more aggravated through the negative risk factors that exist in the markets than that of positive shocks of same magnitude. The result is consistent with the findings of similar studies in other countries (Glosten et al., 1993; Uger and Tas, 2014; Kumari and Mahakud, 2015).

The next coefficient,  $\beta_4$  measures the magnitude of bullish sentiment and the coefficient  $\beta_5$  measures the magnitude of bearish sentiment. Here, the change in lagged investor sentiment,  $\Delta S_{t-1}$ , has been considered. The results identify a positive and significant effect of both bullish and bearish sentiment in all the models. This implies that volatility is influenced by the magnitude of both the lagged bullish and the lagged bearish sentiment. For both cases, the

coefficient is positive, which indicates that, when the magnitude of the lagged bullish and bearish sentiment increases, the market's conditional volatility also increases.

It is worth mentioning here that the asymmetric impact of sentiment on the conditional volatility is based on the premise that investors purchase stocks when they are positive about the stock market. Consequently, the trade related sentiment proxies of the stock market rise along with a growing volatility which causes the stock prices to rise as well. On the other hand, when investors are pessimistic, they delay their investment decisions to avoid loss and wait until the price correction takes place. Thus, the trade related sentiment proxies of stock market falls with a declining volatility which in turn causes the stock prices to decrease. The empirical results are consistent with the research findings of Chuang et al. (2010) in the Taiwanese market. Overall, the empirical results postulate that the investor sentiment has significant impact on the excess market return and the conditional volatility in the Bangladesh stock market.

There are a number of prerequisites to use GARCH-M and GJR-TGARCH models. First of all, the data needs to have ARCH effect (Autoregressive Conditional Heteroskedasticity). Secondly, the data requires to be heteroskedastic. Finally, in order for the model to have forecasting power, the standardized residuals of the models need to be normally distributed and free from auto-correlation. For this study, Lagrange Multiplier (LM) test for autoregressive conditional heteroskedasticity (ARCH) is applied to the raw data and it is found that there is ARCH effect in the data set. In order to check whether the data fulfils the second pre-requisite, that is, heteroskedasticity, Cameron and Trivedi's decomposition of IM-test (Heteroskedasticity Test) is conducted and the data is found heteroskedastic. To test the predictive power of the model both Durbin-Watson (DW) d-statistic (Serial correlation test) test and Skewness and Kurtosis normality test are performed. The results of DW test indicate that the models presented are capable of forecasting future volatility. That is to say, the residual of the model is found to be free from serial correlation. However, the residuals of the models are too Leptokurtic to fit in the normal distribution.

#### **6.1.4 Results of Base-line model with one sentiment proxy**

In the next section the same models are repeated with Modified Relative Strength Index as the only sentiment proxy in GARCH-M model based on equation (1.a). All the 5 models consider

29th lag of the excess market return in the mean model and different combinations of ARCH, TARARCH and GARCH lags in the variance model. Model 1 considers ARCH (2), TARARCH (18) and GARCH (7) lags, model 2 considers ARCH (2), TARARCH (18) and GARCH (15) lags, model 3 considers ARCH (2), TARARCH (18) and GARCH (12) lags, model 4 considers ARCH (2), TARARCH (18) and GARCH (9) lags and model 5 considers ARCH (2), TARARCH (18) and GARCH (17) lags. In all the 5 models ARIMA (3,5,0) are used. Where, the first term stands for autoregressive order, the second term stands for integrated (difference) order and the third term stands for moving average order. In these models only one sentiment proxy is considered namely, the change in modified relative strength index ( $\Delta\text{MRSI}$ ). Almost similar results are found in all the five models.

$$R_{it} - R_{ft} = \alpha_0 + \alpha_1 h_{it} + \alpha_2 \text{EMR}_{t-n} + \alpha_3 \Delta\text{MRSI}_t + \varepsilon_{it} \dots\dots\dots(1.a)$$

From the Table 6.4, it is can be observed that, the estimated coefficient of change in modified relative strength index ( $\Delta\text{MRSI}$ )  $\alpha_3$  is found positive and significant at 1 percent level for all the five models. This indicates that there is a strong positive impact of  $\Delta\text{MRSI}$  on the excess market return. This implies that when investors are optimistic, the market moves in the positive direction; when investors are pessimistic, the market moves downward.

The estimated coefficient for the constant,  $\alpha_0$  is found positive but insignificant in all the models. The estimated coefficient  $\alpha_1$  indicates that there is a negative and significant relationship between the conditional volatility and the excess returns in all five models presented. Similar results were found in the studies conducted by Glosten et al. (1993) and Lee et al. (2002). However, a negative coefficient of  $\alpha_1$  is not consistent with the CAPM model. To avoid the problem of auto-correlation an additional lag term of excess market return has also been incorporated here. However, estimated coefficient  $\alpha_2$  is found insignificant in all the models with an exception of model 4.

Next the results of the variance models based on Equation (2) is discussed. For all the five models, the results show that  $\beta_1$  is positive and significant at 1 percent significance level which suggests that the past returns play a significant role in determining the future market volatility. The estimated coefficients  $\beta_3$  is also positive and significant at 1 percent significance level which indicates that past conditional variance of returns has strong impact on future stock market volatility.

**Table 6.4: Base-line models with one sentiment proxy (MRSI) for the period 1990-2018**

	Model 1	Model 2	Model 3	Model 4	Model 5
Variables	Co-efficient	Co-efficient	Co-efficient	Co-efficient	Co-efficient
$\alpha_0$	0.000194	0.0001575	0.0001138	0.000164	0.0001781
$\alpha_1 h_{it}$	-9.002959***	-8.847847***	-8.200939***	-9.518832***	-7.745698***
$\alpha_2 EMR_{t-n}$	-0.0142322	-0.0074621	-0.0063109	-0.0228336*	-0.0071316
$\alpha_3 \Delta MRSI_t$	0.0004842***	0.0004809***	0.0004776***	0.0004881***	0.0004808***
$\beta_0$	-6.045484***	-6.379349***	-6.257537***	-5.987411***	-6.26723***
$\beta_1 \varepsilon_{it-1}^2$	0.5929389***	0.6440837***	0.6220242***	0.617556***	0.6121805***
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	0.174455***	0.1805731***	0.140117***	0.1415131***	0.1509642***
$\beta_3 h_{it-1}$	0.0649971***	0.1348526***	0.1202592***	0.0454908*	0.1279521***
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0003404***	0.0002512	0.0003054**	0.0003716***	0.0002492
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	0.000643***	0.0005575***	0.0006215***	0.0006201***	0.0006225***
Log-likelihood	1556.011	1562.645	1563.572	1554.967	1564.742
EMR Lags	29	29	29	29	29
ARCH Lags	2	2	2	2	2
TARCH Lags	18	18	18	18	18
GARCH Lags	7	15	12	9	17
ARIMA (p,d,q)	(3,5,0)	(3,5,0)	(3,5,0)	(3,5,0)	(3,5,0)
Number of observations (n)	1460	1460	1460	1460	1460
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.9166	0.8992	0.8787	0.8541	0.82
Kurtosis	0	0	0	0	0
DW d-statistics	2.305056	2.266393	2.281889	2.310641	2.286167
P-value	0	0	0	0	0

This table reports the GARCH-M model and GJR-TGARCH model with one sentiment proxy modified relative strength index (MRSI). The models are based on the entire study period (1990-2018). All the 5 models consider lag 29 of excess market return (EMR) in the mean model and different combinations of ARCH, TARCH and GARCH lags in the variance model. In all the 5 models ARIMA (3,5,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Therefore, both the findings suggest evidence of the volatility persistence and volatility clustering in the Bangladesh stock market. Moreover, the coefficient  $\beta_2$  is positive and significant which indicates that there is leverage effect between positive and negative shock. The estimated coefficient indicates that a negative shock causes higher conditional volatility. The result is consistent with the previous findings of Glosten et al. (1993), Uger and Tas (2014), Kumari and Mahakud (2015) in other markets.

Furthermore, the coefficient  $\beta_4$  measures the magnitude of bullish sentiment and coefficient  $\beta_5$  measures the magnitude of bearish sentiment. The results identify a positive and significant effect of both bullish and bearish sentiment in majority of the models, which implies that volatility is influenced by the magnitude of both the lagged bullish and the lagged bearish sentiment. For both cases, the coefficient is positive, which indicates that, when the magnitude of the lagged bullish and bearish sentiment increases, the market's conditional volatility also increases. The empirical results are consistent with the research findings of Chuang et al. (2010) in the Taiwanese market. Overall, the empirical results indicate that investor sentiment has significant impact on the excess returns and on the formation of conditional volatility in the Bangladesh stock market.

To summarize the study finding for the entire study period, a significant negative relation between the market variance and the excess market return is evident. Moreover, there exists a strong positive correlation between  $\Delta\text{MRSI}$  and the excess market return. However, the other two proxies, namely, the change in trading volume per security ( $\Delta\text{TVOL}$ ) and the change in closed end fund discount ( $\Delta\text{CEFD}$ ) are found insignificant. The study further identifies significant ARCH and GARCH effect which indicates presence of volatility clustering and volatility persistence effect. Moreover, the findings reveal negative leverage effect in the Bangladesh stock market during the entire study period. The sentiment asymmetric impact on market volatility is also present in this market.

## **6.2 Summary Statistics and Empirical Findings for the bubble periods**

This section presents the results of generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) model and Glosten Jagannathan and Runkle's threshold generalized autoregressive conditional heteroskedasticity (GJR-TGARCH) models along with the



summary statistics of the key market variables for the two bubble and burst periods in Bangladesh. To examine the unique impact of investor sentiment during stock market bubble, the models are repeated separately on two bubble and burst periods. To facilitate the objective five years around the peak bubble period have been taken as sub-period. Here, the period 1993-1998 has been considered for the first bubble period and the period 2008-2013 has been considered for the second bubble.

### **6.2.1 Summary Statistics for the first bubble period**

Table 6.5 presents the summary statistics of all the variables considered for this study during the first bubble period. As the current study is based on weekly data, the summary statistics of the weekly variables are discussed in this section. From the table 6.5 it is evident that during the first bubble and burst period, the average of weekly market returns is 0.20 percent with a maximum return of 30.84 percent, and a minimum of -17.91 percent. The average of weekly excess returns is 0.043 percent with a maximum return of 30.69 percent, and a minimum of -18.06 percent. The average weekly market return is higher than that of both the entire study period (0.17 percent) and the second bubble period (0.05 percent). This indicates that on an average investor could earn relatively higher return during the first bubble compared to the overall average return for the entire study period and the second bubble period. The estimated market volatility has an average of 0.00027 with a maximum of 0.0057 and a minimum of 0.00 per week. This indicates that the market became more volatile around the bubble period as compared to the overall market volatility (0.00017).

Of the three sentiment proxies, the change in trading volume per security ( $\Delta TVOL$ ) has an average of 0.0002 with a maximum of 0.143 and a minimum of -0.087, the change in modified relative strength index ( $\Delta MRSI$ ) has an average of 0.117 and the change in closed-end-fund discount ( $\Delta CEFD$ ) has an average of -0.0197. As seen in the previous case, the signs of sentiment proxies are consistent with the expectations. Both the change in the trading volume per security and the change in modified relative strength index have positive average values indicating that overall, the market is bullish during this period. The negative sign of the change in closed-end fund discount also indicates a bullish sentiment since the CEFD is expected to have an inverse relationship with the investor sentiment.

**Table 6.5: Summary Statistics during the first bubble period**

Summary Statistics for the period 1993-1998								
Variables	Obs.	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Quarterly Excess Return (QMR)	24	0.01582	-0.00713	0.25564	-0.65166	0.65555	0.34501	5.02039
Monthly Market Return (MMR)	72	0.00840	-0.00110	0.13712	-0.35078	0.58385	0.00840	7.22548
Weekly Market Return (WMR)	307	0.00197	0.00064	0.04685	-0.17908	0.30840	1.28187	11.41984
Daily Market Return (DMR)	1586	0.00004	0.00003	0.00003	0.00003	0.00068	9.92795	170.14290
Risk Free Rate (RF)	307	0.00154	0.00154	0.00000	0.00154	0.00154	.	.
Quarterly Excess Market Return (QEMR)	24	-0.06537	-0.09862	0.25659	-0.70916	0.57055	0.49107	4.83121
Monthly Excess Market Return (MEMR)	72	0.00342	-0.00506	0.13744	-0.35658	0.57806	1.10796	7.16464
Weekly Excess Market Return (WEMR)	307	0.00043	-0.00089	0.04685	-0.18062	0.30686	1.28187	11.41984
Daily Excess Market Return (DEMR)	1586	0.00022	-0.00001	0.01744	-0.12165	0.12388	0.24373	11.38405
Quarterly Estimated Market Variance (QMVAR)	24	0.00030	0.00017	0.00046	0.00003	0.00224	3.33292	14.09712
Monthly Estimated Market Variance (MMVAR)	72	0.00027	0.00008	0.00042	0.00000	0.00200	2.23981	7.64800
Weekly Estimated Market Variance (WMVAR)	307	0.00028	0.00005	0.00067	0.00000	0.00574	4.71512	29.39307
Daily Estimated Market Variance (DMVAR)	1586	0.00026	0.00005	0.00066	0.00000	0.00837	6.47518	61.27809
Trading Volume per security (TVOL)	307	0.00873	0.00227	0.02775	0.00008	0.23324	5.33678	33.80092
Change in Trading Volume per security ( $\Delta$ TVOL)	307	0.00017	-0.00002	0.01258	-0.08651	0.14335	3.43622	70.18037
Modified Relative Strength Index (MRSI)	307	29.88294	34.02209	17.03596	0.00000	50.00000	-0.50163	1.91471
Change in Modified Relative Strength Index ( $\Delta$ MRSI)	307	0.11666	0.00000	20.05143	-50.00000	50.00000	-0.02719	2.99316
Closed-end Fund Discount (CEFD)	307	65.02414	23.67833	154.50220	-181.58710	1382.27600	5.01385	36.57212
Change in Closed-end Fund Discount ( $\Delta$ CEFD)	307	-0.01967	-0.36833	175.86270	-974.81140	1380.41700	0.86338	23.07352
Dividend Premium (DP)	72	0.00315	-0.00506	0.13737	-0.35808	0.57680	1.09849	7.15296
No. of IPOs (NIPO)	307	0.25733	0.00000	0.57925	0.00000	3.00000	2.43383	8.85694
First-day Return on IPOs (RIPO)	307	132.64	25.61875	168.35810	-32.40000	1028.14000	3.01229	11.96489

Source: Estimated from DSE Data

In this section it is worth mentioning that there is a significant improvement in the average number of IPOs during the first bubble period. The average weekly number of IPOs is 0.26 which is 0.23 during the entire study period. The number increased even further during the second bubble period (0.29). The average first-day return on IPO is 132.63 percent during the first bubble period. However, the average return is much higher in the second bubble period (226.86 percent). This indicates that in Bangladesh the IPO returns may be a good indicator of investor sentiment. Unfortunately, due to its insufficient observations during the entire study period this proxy had to be dropped. Moreover, the median value of dividend premium is negative (-0.00506) during the first bubble. This means that non-dividend paying firms have relatively higher values than the dividend paying firms. Therefore, it had to be dropped as it may lead to misleading results.

The standard deviation of excess market return and market volatility are 0.047 and 0.0007 respectively during the first bubble period. Both the figures are higher than the entire study period, indicating that the variation in market return and fluctuation in market volatility is higher during this period. This is natural for any bubble period. However, the standard deviation of market volatility was much higher in the second bubble period. This indicates that the market was comparatively more volatile during the second bubble period.

The market return during the first bubble period is positively skewed which indicates that there were frequent past small losses and a few past extreme gains. High kurtosis is observed during the period which indicates the existence of extreme losses or gains, a natural phenomenon for every bubble and burst episode.

### **6.2.2 Correlation among the key variables for the first bubble period**

Table 6.6 contains the contemporaneous correlations among the sentiment measures and the excess market returns and the realized volatility during the first bubble and burst period. The results indicate that the sentiment proxies are more correlated with returns than volatility. Among the sentiment proxies, only  $\Delta$ MRSI has substantial positive correlation (0.29) with the return at 1 percent significance level. The correlation between  $\Delta$ MRSI and estimated market volatility is 0.013, however it is statistically insignificant. The three sentiment proxies have a very low and statistically insignificant correlation among themselves.

**Table 6.6: Correlation among the key variables during the first bubble period**

Correlation					
	EMR	MVAR	$\Delta$ TVOL	$\Delta$ MRSI	$\Delta$ CEFD
EMR	1.000				
MVAR	0.077	1.000			
$\Delta$ TVOL	0.016	0.004	1.000		
$\Delta$ MRSI	0.287***	0.013	0.0595	1.000	
$\Delta$ CEFD	-0.086	-0.080	-0.0131	0.0632	1.000

Note: \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Source: Estimated from DSE Data

### 6.2.3 Results of the first bubble period

In this section the empirical results of GARCH-M and GJR-TGARCH models for the first bubble and burst period are discussed. To get a closer look at the nature of sentiment during the bubble and burst episodes, the period is shortened to five years around the pick bubble period (1993-1998). Table 6.7 presents the empirical results of five GARCH-M and GJR-TGARCH models. All the 5 models consider different combinations of EMR lags and lag 2 of ARCHM in the mean model and same combinations of ARCH, TARCH and GARCH lags in the variance model. All the five models consider ARCH (2), TARCH (14) and GARCH (25) lags. In all the 5 models ARIMA (1,1,0) is used. Where, the first term stands for autoregressive order, the second term stands for integrated (difference) order and the third term stands for moving average order. In these models only one sentiment proxy is considered namely, the change in modified relative strength index ( $\Delta$ MRSI).

It is observed from Table 6.7 that the estimated coefficient of change in modified relative strength index ( $\Delta$ MRSI)  $\alpha_3$  is found positive and significant at 1 percent level in all five models. This indicates that there is a positive impact of  $\Delta$ MRSI on the excess market return. As discussed previously, a positive change in MRSI indicates that the market is bullish and a negative change indicates that the market is bearish. The estimated results, therefore indicates that when investors are optimistic about the market, they gain higher returns; when investors are pessimistic about the market, they earn lower returns. Similar result is also found during the second bubble.

For all five models the estimated constant term,  $\alpha_0$  is positive but insignificant. The estimated coefficient  $\alpha_1$  is found negative and significant at 1 percent significance level. This result is

consistent with previous findings of Glosten et al. (1993), Lee et al. (2002) and Chuang (2010) in other markets. However, the result is not consistent with the basic capital asset pricing model (CAPM). The estimated coefficient ( $\alpha_2$ ) of the lagged excess market return is found significant in majority of the models.

Next the results of the variance model are discussed. For all the five models, the results show that  $\beta_1$  is positive but insignificant which suggests that the past returns do not play a vital role in determining the future market volatility. The estimated coefficients  $\beta_3$  is negative and significant for all models. This indicates that the future market volatility can be forecasted by past conditional variance of returns. Moreover, the coefficient  $\beta_2$  is negative and insignificant in all the five models, which indicates that there is no trace of leverage effect during the first bubble period in the Bangladesh stock market.

Furthermore, the coefficient  $\beta_4$  measures the magnitude of bullish sentiment and the coefficient  $\beta_5$  measures the magnitude of bearish sentiment. As discussed previously the bull and the bear market are identified by the positive and negative change in lagged sentiment respectively. Here, the period till the highest peak is found to be the bull market and the period after the peak point is considered as the bear market. Both the coefficients are found insignificant. This means that during the first bubble period there are no asymmetric impact of investor sentiment on stock market volatility.

To summarize the results of first bubble and burst period during 1993-1998, a strong impact of the change in modified relative strength index ( $\Delta\text{MRSI}$ ) is identified on the excess market return of the Bangladesh stock market. During this period a negative relationship between the market variance and the excess market return is found. The GARCH term is found significant which suggests that during the bubble episode, volatility takes a longer time to diminish. However, there are no traces of ARCH effect, negative leverage effect or asymmetric impact of investor sentiment during the first bubble period of the Bangladesh stock market.

**Table 6.7: Models for the first bubble and burst period (1993-1998)**

	Model 1	Model 2	Model 3	Model 4	Model 5
Variables	Co-efficient	Co-efficient	Co-efficient	Co-efficient	Co-efficient
$\alpha_0$	0.0984192	0.1153159	0.1107214	0.1634007	0.1066283
$\alpha_1 h_{it}$	-7.241806***	-7.321151***	-7.078595***	-12.41896***	-7.449467***
$\alpha_2 EMR_{t-n}$	-0.0677139*	-0.0290922	-0.0722952*	0.2054583***	-0.0712001**
$\alpha_2 EMR_{t-n}$	-0.015332	-0.0661255*	-0.0227356	-0.073054**	0.0325687
$\alpha_3 \Delta MRSI_t$	0.0005329***	0.000527***	0.0005253***	0.0006966***	0.0005277***
$\beta_0$	-6.460521***	-6.470495***	-6.456811***	-6.519167***	-6.472749***
$\beta_1 \varepsilon_{it-1}^2$	0.0348557	0.0299347	0.0313723	0.0128032	0.0367784
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	-0.0198952	-0.016774	-0.0189592	-0.0078907	-0.0198557
$\beta_3 h_{it-1}$	-0.6578698***	-0.648843***	-0.665225***	-0.686554***	-0.640594***
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0000384	0.00003	0.000032	0.0000279	0.0000371
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	-0.0000419	-0.0000332	-0.0000345	-0.0000279	-0.0000391
Log-likelihood	632.4489	632.7241	632.5066	643.3745	632.8008
EMR Lags	18, 26	11, 18	18, 20	1, 18	18, 24
ARCH Lags	2	2	2	2	2
TARCH Lags	14	14	14	14	14
GARCH Lags	25	25	25	25	25
ARIMA (p,d,q)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)
ARCHM Lags	18	18	18	18	18
Number of observations (n)	306	306	306	306	306
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.4367	0.4448	0.3849	0.5969	0.4127
Kurtosis	0.0148	0.0148	0.0165	0.0161	0.0236
DW d-statistics	2.044805	2.056231	2.050117	2.139602	2.025344
P-value	0.0412	0.0415	0.0418	0.0499	0.056

This table reports the GARCH-M model and GJR-TGARCH model described in Equation (1) and (2). The models are based on the first bubble period (1993-1998). Each of the five models consider two lags of excess market return (EMR) and lag 18 of ARCHM in the mean model and lag 2 of ARCH, lag 14 of TARCH and lag 25 of GARCH in the variance model. In all the 5 models ARIMA (1,1,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

#### 6.2.4 Summary Statistics for the second bubble period

Table 6.8 presents the summary statistics of all the variables considered for this study during the second bubble period. From the table it is evident that, during the second bubble and burst period, the average of weekly market returns is 0.05 percent with a maximum return of 20.13 percent, and a minimum of -18.02 percent. This average return is relatively lower than that of the first bubble which is 0.19 percent. The return is even lower than that of the entire study period (0.15 percent). This indicates that during the second bubble period the return earned by investors were marginal on an average. Moreover, the average of weekly excess market returns is -0.10 percent with a maximum return of 19.98 percent, and a minimum of -18.18 percent. Although, a negative figure in the average excess market return is observed during the second bubble, the figure is positive (0.043 percent) during the first bubble period. This indicates that the decline in return during the bubble and burst was more pervasive than the increase in return during the formation of second bubble. The estimated market volatility has an average of 0.00034 with a maximum of 0.0092 and a minimum of zero per week. The volatility in the market during the second bubble is relatively higher compared to the first bubble period (0.00028) and the entire study period (0.00017).

Of the three sentiment proxies the change in trading volume per security has an average of 0.00 with a maximum of 0.036 and a minimum of -0.039, the modified relative strength index has an average of 0.043 and the closed-end-fund discount has an average of -0.143. As evident in previous cases the signs of sentiment proxies are consistent with the expectations. The standard deviation of excess market return and estimated market volatility is 0.036 and 0.0008 respectively. Both the figures are higher than those during the entire study period, indicating that the variation in market return and fluctuation in market volatility is higher during this period. This is expected during any bubble period. However, the standard deviation of market volatility was relatively lower during the first bubble period. This indicates that the market was comparatively less volatile during the first bubble period.

The market return during the second bubble period is negatively skewed indicating a distribution with an asymmetric tail extending to negative values meaning frequent past small gains and a few past extreme losses. High kurtosis is observed during the period in the markets returns which is obvious for a bubble and burst period.

**Table 6.8: Summary Statistics during the second bubble period**

Summary Statistics for the period 2008-2013								
Variables	Obs.	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Quarterly Excess Return (QMR)	24	0.00688	-0.00877	0.12204	-0.26631	0.20767	0.00436	2.48847
Monthly Market Return (MMR)	72	0.00234	0.00836	0.08631	-0.36355	0.19953	-1.06540	6.79377
Weekly Market Return (WMR)	306	0.00051	0.00027	0.03634	-0.18025	0.20134	-0.00298	8.76452
Daily Market Return (DMR)	1436	0.00004	0.00002	0.00003	0.00002	0.00029	3.38269	22.31433
Risk Free Rate (RF)	306	0.00154	0.00154	0.00000	0.00154	-0.00298	.	.
Quarterly Excess Market Return (QEMR)	24	-0.09082	-0.11738	0.12734	-0.34885	0.12940	0.15492	2.25636
Monthly Excess Market Return (MEMR)	72	-0.00341	0.00228	0.08628	-0.36821	0.19487	-1.04983	6.73837
Weekly Excess Market Return (WEMR)	306	-0.00102	-0.00127	0.03634	-0.18179	0.19980	-0.00298	8.76452
Daily Excess Market Return (DEMUR)	1436	-0.00007	0.00020	0.01789	-0.09345	0.14465	0.07817	9.51148
Quarterly Estimated Market Variance (QMVAR)	24	0.00029	0.00009	0.00036	0.00002	0.00114	1.27323	3.08778
Monthly Estimated Market Variance (MMVAR)	72	0.00032	0.00017	0.00049	0.00004	0.00312	3.78490	18.88156
Weekly Estimated Market Variance (WMVAR)	306	0.00034	0.00012	0.00081	0.00000	0.00922	6.99081	64.46950
Daily Estimated Market Variance (DMVAR)	1436	0.00032	0.00013	0.00073	0.00000	0.00932	6.81680	65.41636
Trading Volume per security (TVOL)	306	0.02744	0.02464	0.01869	0.00202	0.10192	0.82398	3.37047
Change in Trading Volume per security ( $\Delta$ TVOL)	306	0.00002	-0.00012	0.00993	-0.03851	0.03567	0.10499	5.06395
Modified Relative Strength Index (MRSI)	306	31.92522	33.44811	14.07341	0.00000	50.00000	-0.60618	2.53401
Change in Modified Relative Strength Index ( $\Delta$ MRSI)	306	0.04311	0.41140	18.48367	-47.91351	50.00000	-0.04695	2.86279
Closed-end Fund Discount (CEFD)	306	-9.50875	3.17832	324.15000	-1453.3440	602.88920	-2.35265	10.11975
Change in Closed-end Fund Discount ( $\Delta$ CEFD)	306	-0.14324	0.08112	126.93120	-868.13790	584.94310	-1.08897	15.58077
Dividend Premium (DP)	72	-0.00373	0.00215	0.08646	-0.37043	0.19361	-1.06649	6.78423
No. of IPOs (NIPO)	306	0.29085	0.00000	0.48961	0.00000	3.00000	1.50187	5.33808
First-day Return on IPOs (RIPO)	306	226.86	160.91180	200.16730	-6.56626	915.75000	1.36867	5.11984

Source: Estimated from DSE Data



It is worth mentioning that there is a marginal increase in the average number of IPOs during the second bubble period. The average weekly number of IPOs is 0.29 compared to 0.25 during the first bubble period. However, the average first-day return on IPO is 226.86 percent during the second bubble period which is significantly higher than the first bubble period (132.63 percent). This indicates that in Bangladesh IPO figures may be a good indicator of investor sentiment. Unfortunately, due to its insufficient number of observations during the entire study period this proxy had to be dropped. Moreover, the median value of dividend premium is negative (-0.00373) during the second bubble. This means that non-dividend paying firms have relatively higher values than the dividend paying firms. Therefore, it had to be dropped as it may lead to misleading results.

### 6.2.5 Correlation among the key variables for the second bubble period

Table 6.9 contains the contemporaneous correlations among the sentiment measures, the excess market returns and the realized volatility during the second bubble and burst period. The excess market return has significant (at 1 percent level) correlation with most of the sentiment proxies, but the volatility has relatively weaker correlation with the proxies. Among the sentiment proxies, both  $\Delta TVOL$  and  $\Delta MRSI$  has positive correlation with return at 1 percent level, which are 0.282 and 0.499 respectively. Moreover, there is a small positive correlation (0.119) between  $\Delta MRSI$  and the estimated market volatility at 5 percent significance level. Moreover, the sentiment proxies have minimal correlation among themselves.

**Table 6.9: Correlation among the key variables during the second bubble period**

Correlation					
	EMR	MVAR	$\Delta TVOL$	$\Delta MRSI$	$\Delta CEFD$
EMR	1.000				
MVAR	-0.216***	1.000			
$\Delta TVOL$	0.282***	-0.06	1.000		
$\Delta MRSI$	0.499***	0.119**	0.1459**	1.000	
$\Delta CEFD$	-0.027	0.046	-0.029	-0.027	1.000

Note: \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Source: Estimated from DSE Data

A comparative analysis between the first and second bubble period indicates that, from the point of view of market returns, investors were able to earn relatively higher return during the first bubble period. Moreover, the market variance in general is higher in the second bubble

period, indicating a more turbulent period for the securities market of Bangladesh. Moreover, during both the bubble periods the signs of sentiment proxies indicate that there was positive vibe in the market.

### **6.2.6 Results of the second bubble period**

In this section the empirical results of GARCH-M and GJR-TGARCH models for the second bubble and burst period (2008-2013) are discussed. The purpose of this section is to get a closer look at the impact of sentiment during the bubble and burst episode and to identify whether there exists any difference in the impact of sentiment between 1996 bubble period and 2010 bubble period. Table 6.10 presents the empirical results of four GARCH-M and GJR-TGARCH models.

All the 5 models consider 18th lag of the excess market returns and lag 2 of ARCHM in the mean model. Different combinations of ARCH, TARCH and GARCH lags is also used in the variance model. Model 1 considers ARCH (12), TARCH (19) and GARCH (19) lags, model 2 considers ARCH (11), TARCH (19) and GARCH (19) lags, model 3 considers ARCH (10), TARCH (18) and GARCH (19) lags, model 4 considers ARCH (11), TARCH (18) and GARCH (19) lags and model 5 considers ARCH (12), TARCH (18) and GARCH (19) lags. In all the 5 models ARIMA (1,1,0) is used. Where, the first term stands for autoregressive order, the second term stands for integrated (difference) order and the third term stands for moving average order. In these models only one sentiment proxy is considered namely, the change in modified relative strength index ( $\Delta\text{MRSI}$ ). It is worth mentioning that almost similar results are found in all the five models.

From Table 6.10, it is observed that, the estimated coefficient of change in modified relative strength index ( $\Delta\text{MRSI}$ )  $\alpha_3$  is found positive and significant at 1 percent significance level in all the five models. This indicates that there is a positive impact of  $\Delta\text{MRSI}$  on the excess market return. This implies that when investors are optimistic about the market, they gain higher returns; when investors are pessimistic about the market, they earn lower returns. This is consistent with the previous findings during the entire study period and during the first bubble period. Therefore, it can be said that there is a strong positive relationship between investor sentiment and excess market return in the Bangladesh stock market.

**Table 6.10: Models for the second bubble and burst period (2008-2013)**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
<b>Variables</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>
$\alpha_0$	-0.0052255*	-0.003572	-0.0061247	-0.0056281	-0.0087439
$\alpha_1 h_{it}$	-7.55497***	-8.130742***	-7.932494***	-7.828587***	-6.913858***
$\alpha_2 EMR_{t-n}$	0.0762479***	0.078665***	0.0627861**	0.0653736**	0.0605297**
$\alpha_3 \Delta MRS_{it}$	0.0009372***	0.0009344***	0.0009573***	0.0009458***	0.0009317***
$\beta_0$	-7.449665***	-7.563956***	-7.415475***	-7.578309***	-7.396784***
$\beta_1 \varepsilon_{it-1}^2$	0.0394711	0.0803269	0.0020291	0.0968723*	0.0765039
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	-0.1239056**	-0.121714**	-0.003458**	-0.0061447	-0.0376026
$\beta_3 h_{it-1}$	-0.1264583*	-0.0935717*	-0.1446529	-0.1241421*	-0.2095286**
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0009067***	0.0010456***	0.0008511***	0.0009263***	0.0007344***
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	0.000613***	0.0006896***	0.0005312***	0.0006366***	0.000531***
Log-likelihood	690.7841	692.4141	687.1651	690.4271	688.6084
EMR Lags	18	18	18	18	18
ARCH Lags	12	11	10	11	12
TARCH Lags	19	19	18	18	18
GARCH Lags	19	19	19	19	19
ARIMA (p,d,q)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)
ARCHM Lags	2	2	2	2	2
Number of observations (n)	305	305	305	305	305
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.2163	0.2651	0.3161	0.46	0.4086
Kurtosis	0.1555	0.1961	0.2215	0.2697	0.3128
DW d-statistics	2.113024	2.103318	2.09652	2.085382	2.119833
P-value	0.1683	0.1574	0.2845	0.4116	0.4247

This table reports the GARCH-M model and GJR-TGARCH model described in Eqs. (1) and (2). The models are based on the second bubble period (2008-2013). All the 5 models consider lag 18 of excess market return (EMR) and lag 2 of ARCHM in the mean model and different combinations of ARCH, TARCH and GARCH lags in the variance model. In all the 5 variance models ARIMA (1,1,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

The estimated constant term,  $\alpha_0$  is negative and insignificant in all models except in model 1. The estimated coefficient  $\alpha_1$  is found negative and significant at 1 percent significance level in all the models. Although the result is similar to the previous findings of Glosten et al. (1993), Lee et al. (2002) and Chuang (2010) but it is not consistent with the CAPM model. It is worth mentioning that this strong negative relationship between estimated market variance and excess market return is evident during the first bubble period as well.

Next the results of the variance models are discussed. For the majority of the models, the results show that  $\beta_1$  is insignificant which suggests that the past returns do not play a significant role in determining the future market volatility. The estimated coefficients  $\beta_3$  is negative and significant for most of the models which indicates that there is evidence of volatility persistence during the second bubble period. Moreover, the coefficient  $\beta_2$  is negative and significant in majority of the models, which indicates that there is a negative leverage effect during the second bubble period. However, the negative leverage effect was insignificant during the first bubble period.

Furthermore, the coefficient  $\beta_4$  measures the magnitude of bullish sentiment and the coefficient  $\beta_5$  measures the magnitude of bearish sentiment. In all five models both  $\beta_4$  and  $\beta_5$  are found significant with both having positive signs. This indicates that volatility is positively influenced by both bullish and bearish sentiment. This result was also insignificant during the first bubble period.

To sum up the results of second bubble and burst episode of 2008-2013, the investor sentiment is found to have enormous influence on the excess market return. During this period a negative relationship between the market variance and excess market return is found. Both the TARCH and GARCH term is found significant which indicates the existence of negative leverage effect and volatility persistence effect. The results further indicate the asymmetric effect of sentiment on market volatility during both bull and bear market.

If the results of the two bubble periods are compared it is evident that in both the bubble periods there are strong influence of investor sentiment on excess market return. Moreover, a strong negative relationship exists between the market variance and the excess market return in both the periods. The GARCH term is found significant in both the periods which suggests that during the bubble episodes, volatility takes a longer time to parish. However, even though the

negative leverage effect and the asymmetric impact of sentiment is found significant during the second bubble period, these results are insignificant during the first bubble period. During both the bubble periods there are no traces of ARCH effect which indicates that the past returns do not play a significant role in determining the future market volatility in Bangladesh during the stock market boom.

### **6.3 Robustness Check**

In this section the robustness of the results is examined by splitting the entire data into two sub-periods. Each sub-period has almost equal number of observations. First sub-period comprises of the period between January 4, 1990 and June 10, 2004, and second sub-period comprise of the period between June 17, 2004 and December 27, 2018. For each sub-period, the basic GARCH-M and GJR-TGARCH models are applied. However, the lags are adjusted according to the fitness of models.

#### **6.3.1 Summary Statistics for the first sub-period**

Table 6.11 presents the summary statistics of all the variables considered for this study during the first sub-period for robustness check. As can be seen from the Table 6.11, during the first sub-period, the average of weekly market returns is 0.13 percent with a maximum and minimum of 30.84 percent, and -17.91 percent respectively. This return is lower than that of both the entire study period (0.15 percent) and the second sub-period (0.17 percent). Moreover, during first sub-period, the average of weekly excess market returns is -0.025 percent which is lower that of second sub-period (0.16 percent). This indicates that during the first half of the study period the return was comparatively lower. The average weekly realized volatility is 0.00016 with a maximum and minimum value of 0.0057 and 0.00 per week respectively. This figure is also lower than the second sub-period which is 0.00019. This indicates that the market was less volatile during the early part of the study period.

Of the three sentiment proxies, the change in trading volume per security has an average of 0.000. The change in modified relative strength index and the change in closed-end-fund discount have an average of 0.038 and -0.008 respectively. The signs of sentiment proxies are consistent with the expectation.

**Table 6.11: Summary Statistics during the first sub-period**

Summary Statistics for the period 1990-2003								
Variables	Obs.	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Quarterly Excess Return (QMR)	58	0.01792	-0.00459	0.18485	-0.65166	0.65555	0.45348	7.53474
Monthly Market Return (MMR)	174	0.00595	0.00028	0.09729	-0.35078	0.58385	1.43203	12.13663
Weekly Market Return (WMR)	747	0.00131	0.00004	0.03547	-0.17908	0.30840	1.19996	16.53291
Daily Market Return (DMR)	3717	0.00004	0.00003	0.00004	-0.00074	0.00096	5.08880	303.82260
Risk Free Rate (RF)	748	0.00154	0.00154	0.00000	0.00154	0.00154	.	.
Quarterly Excess Market Return (QEMR)	58	-0.06516	-0.09862	0.18916	-0.70916	0.57055	0.57099	6.77587
Monthly Excess Market Return (MEMR)	174	0.00056	-0.00544	0.09753	-0.35658	0.57806	1.42073	12.04925
Weekly Excess Market Return (WEMR)	746	-0.00025	-0.00152	0.03549	-0.18062	0.30686	1.20136	16.52282
Daily Excess Market Return (DEMUR)	3717	-0.00005	-0.00024	-0.00024	-0.12165	0.12388	0.38434	19.05915
Quarterly Estimated Market Variance (QMVAR)	58	0.00019	0.00012	0.00032	0.00001	0.00224	5.09214	32.19098
Monthly Estimated Market Variance (MMVAR)	174	0.00016	0.00005	0.00032	0.00000	0.00200	3.41371	15.10499
Weekly Estimated Market Variance (WMVAR)	747	0.00016	0.00002	0.00049	0.00000	0.00574	6.54610	55.04475
Daily Estimated Market Variance (DMVAR)	3714	0.00015	0.00002	0.00049	0.00000	0.00837	8.31232	100.03280
Trading Volume per security (TVOL)	747	0.01209	0.00337	0.02242	0.00000	0.23324	4.67315	33.62397
Change in Trading Volume per security ( $\Delta$ TVOL)	746	0.00002	0.00000	0.01177	-0.08651	0.14335	2.40783	49.25828
Modified Relative Strength Index (MRSI)	747	29.31434	33.35668	16.83301	0.00000	50.00000	-0.45227	1.88566
Change in Modified Relative Strength Index ( $\Delta$ MRSI)	746	0.03781	0.00000	20.25867	-50.00000	50.00000	-0.02034	2.88363
Closed-end Fund Discount (CEFD)	747	40.02595	15.95800	107.18660	-338.81550	1382.27600	6.73718	71.02959
Change in Closed-end Fund Discount ( $\Delta$ CEFD)	746	-0.00805	0.00000	119.72050	-974.81140	1380.41700	1.09853	44.39371
Dividend Premium (DP)	174	0.00040	-0.00544	0.09749	-0.35808	0.57680	1.40705	12.02462
No. of IPOs (NIPO)	747	0.2078	0.0000	0.5140	0.00000	4.0000	2.9843	13.8293
First-day Return on IPOs (RIPO)	748	83.31	15.8750	117.1416	-40.000000	1028.1400	4.5902	26.6798

Source: Estimated from DSE Data

Both the change in trading volume per security and the change in modified relative strength index have positive average values indicating a positive trend in market. Likewise, the negative sign of closed-end fund discount indicates bullish sentiment since the CEFD is expected to have an inverse relationship with investor sentiment.

The standard deviation of the excess market return is 0.036 during the first sub-period which is the highest compared to both the entire study period (0.032) and the second sub-period (0.028). This indicates that the market during the early period experienced high fluctuations in the excess market returns. The standard deviation of the estimated market volatility is 0.00049 during the first sub-period. This is slightly lower than that of both the entire study period (0.00052) and the second sub-period (0.00055). This indicates that the market remained relatively less volatile during the early part of the study period.

The market return during the first sub-period is positively skewed indicating a distribution with an asymmetric tail extending to positive values. High kurtosis is observed during the period which indicates extreme losses or gains. It is worth mentioning that the average weekly number of IPOs is 0.207 during the first sub-period compared to 0.256 during the second sub-period. This indicates the poor supply of new issues in the Bangladesh stock market during that period. Moreover, the average first-day return on IPO is 83.31 percent during the first sub-period which is significantly lower than the second sub-period (222.06 percent). As mentioned earlier, the proxies related to IPOs could not be taken due to its insufficient number. The median value of dividend premium during the first sub-period is negative which indicates that non-dividend paying firms have relatively higher values than the dividend paying firms. Therefore, this proxy could not be taken either.

### **6.3.2 Correlation among the key variables for the first sub-period**

Table 6.12 contains the contemporaneous correlations among the sentiment measures, the excess market returns and realized volatility. Overall, it is observed that the sentiment proxies are more correlated with returns than with volatility. Among the sentiment proxies,  $\Delta TVOL$  and  $\Delta MRSI$  has substantial positive correlation with return at 1 percent significance level, which are 0.137 and 0.31 respectively. However, only the correlation between  $\Delta TVOL$  and estimated market volatility is (0.111) significant at 1 percent level. The three sentiment proxies have a very low and statistically insignificant correlation among themselves.

**Table 6.12: Correlation among the key variables during the first sub-period**

Correlation					
	EMR	MVAR	$\Delta$ TVOL	$\Delta$ MRSI	$\Delta$ CEFD
EMR	1.000				
MVAR	0.089**	1.000			
$\Delta$ TVOL	0.137***	0.111***	1.000		
$\Delta$ MRSI	0.309***	0.005	0.0382	1.000	
$\Delta$ CEFD	-0.066*	-0.070*	-0.0134	0.0354	1.000

Note: \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Source: Estimated from the DSE Data

### 6.3.3 Results of the first sub-period

The estimated results of five different models comprising of the first sub-period is shown in table 6.13. All the 5 models consider 1st lag of the excess market return in the mean model. However, only model 1 uses lag 26 of ARCHM in the mean model. Different combinations of ARCH, TARARCH and GARCH lags are considered in the variance model. For example, model 1 considers ARCH (2), TARARCH (6) and GARCH (15) lags, model 2 considers ARCH (2), TARARCH (2) and GARCH (7) lags, model 3 considers ARCH (2), TARARCH (6) and GARCH (24) lags, model 4 considers ARCH (2), TARARCH (8) and GARCH (24) lags and model 5 considers ARCH (2), TARARCH (3) and GARCH (18) lags. In all the 5 models ARIMA (1,1,0) is used. Where, the first term stands for autoregressive order, the second term stands for integrated (difference) order and the third term stands for moving average order. In these models only one sentiment proxy is considered namely, the change in modified relative strength index ( $\Delta$ MRSI). It is worth mentioning that almost similar results are found in all the five models.

From the Table 6.13 it is observed that the estimated coefficient of change in modified relative strength index ( $\Delta$ MRSI)  $\alpha_3$ , is found positive and significant, for all five models. This indicates that there is a strong positive impact of  $\Delta$ MRSI on excess market return. This matches with the result for the entire study period. Moreover, the estimated coefficient  $\alpha_1$  show that there exists a negative and significant relationship between the excess market return and the market variance in all the models. The result is consistent with the baseline model run for the entire study period.



**Table 6.13: Models for robustness check during the first sub-period (1990-2004)**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
<b>Variables</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>
$\alpha_0$	0.0003842	-0.0001033	0.0000295	-0.0000663	-0.0001817
$\alpha_1 h_{it}$	-8.939249***	-4.848675***	-10.58052***	11.0521***	12.47992***
$\alpha_2 EMR_{t-n}$	0.1449955***	0.1707006***	0.1494926***	0.1401438***	0.1271651***
$\alpha_3 \Delta MRSI_t$	0.0004288***	0.0004284***	0.0004668***	0.0004552***	0.0004152***
$\beta_0$	-8.985257***	-8.041492***	-9.079408***	-9.065199***	-8.821161***
$\beta_1 \varepsilon_{it-1}^2$	0.47133***	0.1935802***	0.5942821***	0.6375081***	0.6683151***
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	0.2042833***	0.2261226***	0.2112969***	0.0940401*	0.0478594
$\beta_3 h_{it-1}$	0.3513831***	0.6069909***	0.2024121***	0.2173843***	0.1980844***
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0003225**	-0.4236646	0.0005597**	0.0005237*	0.000334
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	-0.0068821	-0.0261565***	0.0006017***	0.0006975***	0.0002149
Log-likelihood	1780.728	1792.832	1769.388	1765.178	1764.125
EMR Lags	1	1	1	1	1
ARCH Lags	2	2	2	2	2
TARCH Lags	6	2	6	8	3
GARCH Lags	15	7	24	24	18
ARIMA (p,d,q)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)
ARCHM Lags	26				
Number of observations (n)	744	744	744	744	744
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.9939	0.971	0.9749	0.9701	0.9643
Kurtosis	0	0	0	0	0
DW d-statistics	2.106146	2.099961	2.12547	2.121354	2.128012
P-value	0	0	0	0	0

This table reports the GARCH-M model and GJR-TGARCH model described in Eqs. (1) and (2). The models are based on sub-sample one (1990-2003). All the five models consider lag 1 of excess market return (EMR) in the mean and different combinations of ARCH, TARCH and GARCH lags in the variance model. However, only model 1 uses lag 26 of ARCHM in the mean model. In all the 5 variance models ARIMA (1,1,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

For all the five models, the results show that the coefficient  $\beta_1$  is significant which suggests that the past returns play a significant role in determining the future market volatility. The estimated coefficients  $\beta_3$  is significant for all models which indicates that past conditional variance of returns is capable to forecast future market volatility. Moreover, the coefficient  $\beta_2$  is positive and significant in all models, which indicates that a negative shock cause higher conditional volatility. Overall, the empirical findings of ARCH, TARARCH and GARCH effect are similar to the previous findings of baseline models for the entire period.

Furthermore, the coefficient  $\beta_4$  measures the magnitude of bullish sentiment and the coefficient  $\beta_5$  measures the magnitude of bearish sentiment. In majority of the models both coefficient  $\beta_4$  and coefficient  $\beta_5$  are found significant. This indicates that asymmetric impact of investor sentiment exists in the Bangladesh stock market. This finding is also consistent with the results of the models run on the entire study period.

#### **6.3.4 Summary Statistics for the second sub-period**

Table 6.14 presents the summary statistics of all the variables considered for this study during the second sub-period for robustness check. During the second sub-period the average of weekly market returns is 0.17 percent with a maximum return of 20.13 percent, and a minimum of -18.02 percent. This is relatively higher than that of the first sub-period indicating that the stock market return is higher during the second half of the study period. The average weekly excess market return is 0.016 percent with a maximum return of 19.98 percent, and a minimum of -18.18 percent. This is again much higher compared to that of the first sub-period (-0.024 percent).

On the other hand, the estimated market volatility has an average of 0.00019 with a maximum of 0.0092 and a minimum of 0.00. This is again higher than the first sub-period, indicating that the market remained relatively more volatile during the second part of the sample period. The weekly average of three sentiment proxies, namely, the change in weekly trading volume per security, the change in weekly modified relative strength index and the change in weekly closed-end fund discount are 0.00002, 0.0000 and -0.0152 respectively. The signs of sentiment proxies are consistent with the expectation and indicate positive trend in the market as a whole. Overall, during both the sub-periods the signs of sentiment proxies indicate that there was positive vibe in the market.

**Table 6.14: Summary Statistics during the second sub-period**

Summary Statistics for the period 2004-2018								
Variables	Obs.	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Quarterly Excess Return (QMR)	58	2.11323	0.00112	0.10646	-0.26631	0.21362	0.04370	2.60422
Monthly Market Return (MMR)	174	0.00706	0.00836	0.07085	-0.36355	0.19953	-0.96209	7.60055
Weekly Market Return (WMR)	747	0.00167	0.00109	0.02828	-0.18025	0.20134	-0.02041	10.59517
Daily Market Return (DMR)	3718	0.00004	0.00003	0.00064	-0.01199	0.01070	-6.12382	150.06030
Risk Free Rate (RF)	747	0.00154	0.00154	0.00000	0.00154	0.00154	.	.
Quarterly Excess Market Return (QEMR)	58	-0.06246	-0.07100	0.11069	-0.34885	0.13862	-0.00109	2.47702
Monthly Excess Market Return (MEMR)	174	0.00197	0.00308	0.07079	-0.36821	0.19487	-0.97287	7.59863
Weekly Excess Market Return (WEMR)	748	0.00016	-0.00043	0.02826	-0.18179	0.19980	-0.02242	10.60071
Daily Excess Market Return (DEMUR)	3718	0.00030	0.00027	0.01341	-0.09345	0.14465	0.00726	12.97255
Quarterly Estimated Market Variance (QMVAR)	58	0.00035	0.00006	0.00115	0.00000	0.00862	6.53630	47.17398
Monthly Estimated Market Variance (MMVAR)	174	0.00018	0.00009	0.00035	0.00000	0.00312	5.54339	40.21911
Weekly Estimated Market Variance (WMVAR)	748	0.00019	0.00006	0.00055	0.00000	0.00922	9.84843	131.58660
Daily Estimated Market Variance (DMVAR)	3718	0.00018	0.00006	0.00049	0.00000	0.00932	9.77589	137.83140
Trading Volume per security (TVOL)	748	0.01980	0.01375	0.01573	0.00183	0.10192	1.64908	6.06755
Change in Trading Volume per security ( $\Delta$ TVOL)	748	0.00002	0.00004	0.04723	-0.81928	0.82597	0.16011	255.64510
Modified Relative Strength Index (MRSI)	748	31.83496	34.06897	14.45656	0.00000	50.00000	-0.64722	2.51208
Change in Modified Relative Strength Index ( $\Delta$ MRSI)	748	0.00000	0.00000	18.60555	-50.00000	50.00000	-0.01144	2.84424
Closed-end Fund Discount (CEFD)	748	-0.64777	3.48649	210.13030	-1453.34400	602.88920	-3.63432	24.02144
Change in Closed-end Fund Discount ( $\Delta$ CEFD)	748	-0.01524	0.00000	91.79929	-868.13790	584.94310	-1.20053	26.92869
Dividend Premium (DP)	174	0.00179	0.00301	0.07088	-0.37043	0.19361	-0.98976	7.66226
No. of IPOs (NIPO)	747	0.25668	0.00000	0.46958	0.00000	3.00000	1.61082	5.12235
First-day Return on IPOs (RIPO)	747	222.05600	164.77780	209.802	-6.56626	1284.00000	2.07103	8.78190

Source: Estimated from DSE Data

The standard deviation of the excess market return during the second sub-period is 0.028. This is relatively lower compared to the first sub-period. This implies that the excess market return was on an average relatively stable during this time compared to the earlier sub-period. However, the standard deviation of the estimated market volatility is 0.0006 which is higher than the first sub-period (.00049) indicating that the market remained relatively more volatile during the second sub-period.

It is worth mentioning that the average weekly number of IPOs is 0.256 during the second sub-period compared to 0.207 during the first sub-period. This is the reflection of the legal and the institutional reforms undertaken by both the BSEC and the DSE to strengthen the supply side of Bangladesh stock market after the first market crash back in 1996. Moreover, the average first-day return on IPO is 222.06 percent during the second sub-period. This is substantially higher than that of the first sub-period (83.31 percent). As mentioned earlier, the proxies related to IPOs could not be taken due to its insufficient number of observations. Although, dividend premium during the second sub-period has a positive mean (0.0018) and median (0.0030) value. The median value remained negative for the other sub-periods as well as the entire study period. Therefore, this proxy could not be taken either.

The market return during the second sub-period is positively skewed indicating a distribution with an asymmetric tail extending to positive values. High kurtosis is observed during the second sub-period as well indicating extreme losses or gains. It is worth mentioning here that kurtosis was high in both sub-periods, however it was higher during the first sub-period.

### **6.3.5 Correlation among the key variables for the second sub-period**

Table 6.15 contains the contemporaneous correlations among the change in trading volume per security, the change in modified relative strength index, the change in closed-end fund discount and the excess market returns and realized volatility during the second sub-period. Overall, it is observed that the sentiment proxies are more correlated with returns than volatility. Among the sentiment proxies,  $\Delta$ MRSI has substantial positive correlation with return, which is 0.469 at 1 percent level of significance. Moreover, the correlation between estimated market volatility and excess return is -0.186, which is significant at 1 percent level. However, the three sentiment proxies have a very low and statistically insignificant correlation among themselves.

**Table 6.15: Correlation among the key variables during the second sub-period**

Correlation					
	EMR	MVAR	$\Delta$ TVOL	$\Delta$ MRSI	$\Delta$ CEFD
EMR	1				
MVAR	-0.186***	1			
$\Delta$ TVOL	0.058	-0.01	1		
$\Delta$ MRSI	0.469***	0.093	-0.0578	1	
$\Delta$ CEFD	-0.029	0.041	0.0022	-0.015	1

Note: \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

Source: Estimated from DSE Data

A comparative analysis between the two sub-periods indicates that from the point of view of market returns, stocks performed poorly in the first sub-period relative to that of the second. The market variance in general is higher in the second sub-period, indicating a more turbulent period for the securities market. Moreover, during both the sub-periods the signs of sentiment proxies indicate that there was positive vibe in the market.

### 6.3.6 Results of the second sub-period

In table 6.16, the estimated results of five different models comprising of second sub-period is presented. All the 5 models consider 18th lag of the excess market return and different combinations of ARCHM lags in the mean model. For example, model 1 considers ARCHM (2), model 2 considers ARCHM (2,29,30), model 3 considers ARCHM (2,19), model 4 considers ARCHM (2,18) and model 5 considers ARCHM (2) lags. Different combinations of ARCH, TARARCH and GARCH lags are considered in the variance model. For example, Model 1 considers ARCH (14), TARARCH (19) and GARCH (19) lags, model 2 considers ARCH (31), TARARCH (19) and GARCH (19) lags, model 3 considers ARCH (14), TARARCH (19) and GARCH (19) lags, model 4 considers ARCH (27), TARARCH (19) and GARCH (19) lags and model 5 considers ARCH (5), TARARCH (19) and GARCH (19) lags. In all the 5 models ARIMA (1,1,0) is used. In these models only one sentiment proxy is considered namely, the change in modified relative strength index ( $\Delta$ MRSI). It is worth mentioning that almost similar results are found in all the five models.

**Table 6.16: Models for robustness check during the second Sub-period (2004-2018)**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
<b>Variables</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>	<b>Co-efficient</b>
$\alpha_0$	-0.0074841***	-0.00419	-0.0089338***	-0.0068789***	-0.004411***
$\alpha_1 h_{it}$	-7.065929***	-7.510102***	-6.678588***	-7.640935***	-7.011079***
$\alpha_2 EMR_{t-n}$	0.0384982**	0.0350734*	0.0454189***	0.0477384***	0.0454009***
$\alpha_3 \Delta MRSI_t$	0.0007259***	0.0007453***	0.0007471***	0.000755***	0.0007323***
$\beta_0$	-7.734011***	-7.649947***	-7.654823***	-7.677699***	-7.830629***
$\beta_1 \varepsilon_{it-1}^2$	0.0656021**	0.0285507	0.0500136*	0.0369595*	0.1076373***
$\beta_2 \varepsilon_{it-1}^2 I_{t-1}$	-0.0464515*	-0.042874	-0.0488723*	-0.0465561	-0.0567692**
$\beta_3 h_{it-1}$	-0.12202	-0.1633088**	-0.1811624***	-0.1529478**	-0.0902786
$\beta_4 (\Delta S_{t-1})^2 D_{t-1}$	0.0006583***	0.0006684***	0.0006848***	0.0007215***	0.0007964***
$\beta_5 (\Delta S_{t-1})^2 (1 - D_{t-1})$	0.0005353***	0.0004627***	0.000484***	0.0004893***	0.0005579***
Log-likelihood	1790.907	1789.493	1792.84	1790.598	1793.41
EMR Lags	18	18	18	18	18
ARCH Lags	14	31	14	27	5
TARCH Lags	19	19	19	19	19
GARCH Lags	19	19	19	19	19
ARIMA (p,d,q)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)	(1,1,0)
ARCHM Lags	2	2, 29, 31	2, 19	2, 18	2
Number of observations (n)	747	747	747	747	747
<b>Diagnostic Tests</b>					
LM test statistics	0	0	0	0	0
IM test statistics	0	0	0	0	0
Skewness	0.3912	0.4154	0.4487	0.5046	0.5401
Kurtosis	0.0013	0.0011	0.0023	0.0007	0.0008
DW d-statistics	2.175182	2.177814	2.163115	2.166447	2.188972
P-value	0.0055	0.0053	0.0092	0.0042	0.0044

This table reports the GARCH-M model and GJR-TGARCH model described in Eqs. (1) and (2). The models are based on sub-sample two (2004-2018). All the 5 models consider lag 18 of excess market return (EMR) in the mean model and different combinations of ARCH, TARCH and GARCH lags in the variance model. Each model uses different combinations of ARCHM lags in the mean model. In all the 5 variance models ARIMA (1,1,0) has been used. ARIMA (p,d,q) stands for autoregressive order, integrated (difference) order and moving average order respectively.. \*, \*\*, \*\*\* denotes coefficients significant at 10%, 5% and 1% level, respectively.

It can be observed from table 6.16, that the estimated coefficient of the change in modified relative strength index ( $\Delta\text{MRSI}$ )  $\alpha_3$ , is found positive and significant, in all the five models. This indicates that there is a positive impact of  $\Delta\text{MRSI}$  on the excess market return. This is consistent with the previous findings for the entire period of the study. Moreover, the empirical results show that there exists a negative and significant relationship between the excess market return and the market variance at 1 percent significance level, in all the models. The result is consistent with the baseline model run for the entire study period.

For majority of the models, coefficient  $\beta_1$  is found positive and significant which suggests that the past returns play a significant role in determining the future market volatility. The estimated coefficients  $\beta_3$  is significant for majority of the models which indicates that the past conditional variance of returns is capable enough to forecast the volatility persistence. Moreover, the coefficient  $\beta_2$  is significant in model 1, 3 and 5, which indicates the existence of leverage effect of investor sentiment on market volatility. Overall, the empirical findings of ARCH, TARCH and GARCH effect are consistent with the previous findings of baseline models for the entire period. Furthermore, in all five models both coefficient  $\beta_4$  and coefficient  $\beta_5$  which indicates the magnitude of bullish and bearish sentiment respectively are found significant at 1 percent level. This indicates that the volatility is influenced by both bullish and bearish sentiment.

## 6.4 Discussion

To summarize the study finding for the entire study period, a significant negative relation between the market variance and the excess market return is identified. Moreover, there exists a strong positive correlation between  $\Delta\text{MRSI}$  and the excess market return. However, the other two proxies, namely, the change in trading volume per security ( $\Delta\text{TVOL}$ ) and the change in closed end fund discount ( $\Delta\text{CEFD}$ ) are found insignificant. The study further identifies a significant ARCH and GARCH effect which indicates the presence of volatility clustering and volatility persistence effect. Moreover, the findings reveal a negative leverage effect in the Bangladesh stock market during the entire study period. The sentiment asymmetric impact on market volatility is also present in this market.

In both the bubble period there is strong influence of investor sentiment on the excess market return. Moreover, a strong negative relationship exists between the market variance and excess market return in both the periods. The GARCH term is found significant in both the periods which suggests that during the bubble episodes, volatility takes a longer time to perish. However, even though the negative leverage effect and the asymmetric impact of sentiment is found significant during the second bubble period, these results are insignificant during the first bubble period.

The results of robustness check indicate that the findings of the sub-periods are consistent with that of the entire study period. During both the sub-periods, a significant negative relationship between the market variance and the excess market return is identified. Moreover, the change in modified relative strength index ( $\Delta\text{MRSI}$ ) is found to have a significant positive relationship with the excess market return. The study on both the sub-periods found significant ARCH, TARCH and GARCH effect on the estimated market volatility. The asymmetric impact of sentiment is also found in both the periods.

Considering the entire study findings a few points can be reiterated. Firstly, the investor sentiment has a significant impact on the excess market return in the Bangladesh stock market. Secondly, there is an inverse relationship between the market variance and the excess market return. Thirdly, there is a strong evidence of volatility persistence, volatility clustering effect and negative leverage effect in Bangladesh stock market. Lastly, the asymmetric impact of sentiment is found significant in both the bull and the bear market.



# **Chapter # 7**

## **Conclusions**

This study attempts to identify the impact of investor sentiment on both market return and conditional volatility, to identify the negative leverage effect of earning shocks on conditional volatility and to examine the asymmetric property of investor sentiment on market volatility. This study finds that investor sentiment has significant impact on the excess market return in the Bangladesh stock market. First, the change in modified relative strength index is found to have significant impact on both the excess market return and market volatility. However, the other two sentiment proxies namely, change in trading volume per security and change in closed-end fund discount have insignificant impact on excess market return. An inverse relationship between market variance and excess market return is found. This indicates that risk arising from market volatility is an unsystematic risk that may not result in higher return. The study also identified strong evidence of volatility persistence effect (GARCH effect) in the Bangladesh stock market. This means that the volatility takes a long time to perish following a certain incident that triggers market volatility. The study further reveals that there is volatility clustering effect in the Bangladesh stock market. Moreover, a negative leverage effect is also found in this market. That is, the negative earning shock is more likely to push volatility upward as opposed to positive earning shock of similar magnitude. Lastly, the asymmetric impact of sentiment is found significant in both the bull and the bear market.

While earlier studies examined the impact of investor sentiment on excess market return and volatility in mostly developed stock markets, this study contributes to identify the impact of investor sentiment in an emerging market like Bangladesh. Furthermore, this research contributes to identify proxies for investor sentiment that are appropriate for the Bangladesh stock market to predict the excess market return and volatility. This study documents that investors and other stakeholders can predict the formation of market bubbles using a modified relative strength index constructed specifically for the Bangladesh market. So far very limited work has been done in the field of behavioral finance, more specifically, on investor sentiment in Bangladesh. Therefore, this research is expected to contribute to the knowledge and help predict the market return and volatility in Bangladesh.

The predictability of volatility, particularly the formation of bubble has far reaching implications for different stakeholders including regulators, policy makers, stock exchanges, researchers and

investors. First, the predictability of the market behavior and the formation of a bubbles in particular implies that market is inefficient. In essence, any investor can adopt strategies to predict the market return and earn abnormal returns. Second, if it is possible to predict market bubble, it becomes easier for the regulators and policy makers to take preventive measures and formulate effective policies to protect the market from formation of bubble and eventual burst.

Despite the finding that the market return and volatility are predictable in Bangladesh, there is scope for further research. It is yet to examine whether the inclusion of macroeconomic variables can improve the predictability of market return and volatility in Bangladesh. In addition, there is scope for researchers to develop and use new sentiment proxies that can predict the stock market return and volatility. Moreover, researchers can examine whether the use of daily data improve the predictive power of the model.

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# **APPENDIX**

## APPENDIX A

Table A.1: Year-wise Stock Market Indicators

Year	Adjusted	Mkt. Cap.	No of IPOs	IPO Volume in	Yearly Avg. First-
1990	435.07	1.12	6	158.39	32.20
1991	370.96	0.83	6	167.27	13.75
1992	462.72	1.03	4	115.00	23.48
1993	629.62	1.45	4	142.50	17.84
1994	1359.05	3.08	13	506.88	139.89
1995	1341.51	3.71	22	736.70	62.86
1996	3606.23	10.11	23	1978.08	271.90
1997	1186.50	3.95	12	564.79	38.38
1998	846.97	2.51	5	352.10	10.50
1999	764.74	2.04	10	345.00	51.50
2000	1010.88	2.65	7	122.50	36.08
2001	991.25	2.52	11	220.00	42.98
2002	1013.71	5.26	8	198.00	29.64
2003	1156.45	6.27	14	1351.17	24.16
2004	2355.39	5.96	3	13512.00	105.63
2005	2004.15	5.18	19	12657.00	159.74
2006	1923.10	10.18	7	1433.95	59.64
2007	3605.07	17.18	13	4933.96	200.93
2008	3339.96	20.19	12	3043.41	277.34
2009	4419.95	43.92	18	8917.26	426.57
2010	8079.14	52.11	16	11860.82	240.24
2011	5123.62	37.08	13	19914.15	114.61
2012	4111.79	26.14	17	12081.09	136.85
2013	4266.55	25.39	11	8305.00	189.66
2014	4864.96	23.44	19	12636.20	257.16
2015	4629.64	20.92	12	8307.22	141.92
2016	5036.05	31.80	9	8493.00	166.37
2017	6244.52	34.51	9	2192.50	440.34
2018	5300.09	28.24	14	6010.00	244.97

Source: Estimated from DSE Data

**Table A.2: Monthly Stock Market Indicators during Market Bubble of 1996**

Month	All Share Price Index	Market Volatility	Transaction Volume (Tk.million)	Market Capitalization (Tk.million)	No of IPO	Avg. First-Day Return on IPO
Jan-95	834.4811	0.00007	213.78	41276	1	0.00000
Feb-95	823.0212	0.00003	342.42	44217	1	0.31512
Mar-95	784.6574	0.00006	350.52	45301	1	0.73683
Apr-95	765.8838	0.00002	373.71	46998	3	0.00000
May-95	702.9553	0.00009	391.07	43809	5	0.54530
Jun-95	776.8755	0.00001	724.94	49998	0	0.35454
Jul-95	780.2575	0.00002	589.34	50211	4	0.08579
Aug-95	778.2208	0.00002	504.62	55112	1	1.81800
Sep-95	836.7836	0.00005	684.31	54367	3	0.56790
Oct-95	887.9891	0.00007	970.15	63422	1	0.34373
Nov-95	844.1376	0.00006	708.18	56288	1	1.20050
Dec-95	834.7331	0.00001	527.88	56518	1	-0.10560
Jan-96	775.6542	0.00012	646.20	52921	5	0.00000
Feb-96	792.5954	0.00002	261.95	53996	0	0.00000
Mar-96	804.8065	0.00003	159.40	54788	0	0.00000
Apr-96	834.9382	0.00012	975.67	59032	0	0.41424
May-96	864.8678	0.00006	956.16	60467	3	0.00000
Jun-96	959.0502	0.00009	1,215.25	67728	1	0.00000
Jul-96	1156.179	0.00014	2,560.18	81406	3	0.43005
Aug-96	1217.741	0.00007	2,762.75	88944	3	1.04325
Sep-96	1690.249	0.00091	4,490.68	120313	1	11.89905
Oct-96	2986.291	0.00126	7,075.77	212731	2	8.66375
Nov-96	3648.748	0.00119	8,058.84	212784	4	4.27220
Dec-96	2300.147	0.00030	974.28	168106	1	4.15000
Jan-97	1962.731	0.00070	1,553.70	144921	1	0.00000
Feb-97	1702.491	0.00084	2,046.39	129275	0	0.80674
Mar-97	1198.785	0.00150	2,122.77	94954	0	0.02963
Apr-97	957.481	0.00089	949.02	81093	2	0.00000
May-97	1216.681	0.00093	1,561.27	104082	0	0.00000
Jun-97	1111.552	0.00015	1,257.90	107827	1	0.25300
Jul-97	973.132	0.00044	820.69	88794	4	0.00000
Aug-97	823.815	0.00023	853.98	71796	1	0.98300
Sep-97	939.9052	0.00200	1,624.94	90933	0	0.44970
Oct-97	839.6112	0.00032	2,198.25	75503	1	0.00000
Nov-97	749.8548	0.00012	1,327.32	70156	2	-0.07070
Dec-97	756.784	0.00074	1,088.24	71302	0	0.05000

Source: Estimated from DSE Data

**Table A.3: Monthly Stock Market Indicators during Market Bubble of 2010**

Months	DGEN Index	Market Volatility	Market Capitalization (Tk. Billion)	Transaction Volume (Tk. Million)	No of IPOs	Avg. First-Day Return on IPO
Jan-09	2649.494	0.000153	1016.14	2975.88	3	4.150
Feb-09	2570.964	0.000290	999.34	3175.6	0	0
Mar-09	2446.922	0.000163	1000.64	3255.29	0	6.16
Apr-09	2554.355	0.000136	1035.95	3725.11	1	2.139
May-09	2572.18	0.000042	1049.83	4887.27	1	0
Jun-09	3010.264	0.000175	1241.34	9421.98	0	3.04
Jul-09	2914.534	0.000153	1257.28	6545.22	0	15.275
Aug-09	2941.284	0.000036	1307.52	4202.86	4	2.49
Sep-09	3083.886	0.000046	1359.4	7352.11	0	2.905
Oct-09	3364.262	0.000050	1452.47	10064.09	1	3.53
Nov-09	4380.948	0.000077	1848.76	9126.32	4	1.532
Dec-09	4535.532	0.000077	1903.23	9327.15	4	0
Jan-10	5367.107	0.000129	2191.83	16097.75	0	2.409
Feb-10	5560.561	0.000169	2275.3	8611.23	1	3.280
Mar-10	5582.334	0.000189	2302.58	6983.95	2	0
Apr-10	5654.877	0.000038	2360.45	13894.21	1	0.65
May-10	6107.814	0.000124	2557.47	19336.68	1	0.28
Jun-10	6153.677	0.000109	2700.74	18873.76	2	3.329
Jul-10	6342.758	0.000187	2821.7	13593.52	0	1.3575
Aug-10	6657.975	0.000051	2984.51	14884.43	3	5.314
Sep-10	7097.382	0.000058	3113.23	23498.97	2	0.002
Oct-10	7957.121	0.000081	3371	32089.08	2	0.09
Nov-10	7986.919	0.000068	35.98.33	19225.81	0	4.1733
Dec-10	8918.513	0.000523	3508.01	17831.04	2	0
Jan-11	7484.228	0.003123	3267.39	10776.39	3	3.17
Feb-11	5203.085	0.002220	2413.07	4894.19	0	0.09
Mar-11	6352.102	0.001256	2855.3	10489.7	3	0
Apr-11	6050.846	0.000442	2772.19	6664.59	0	5.87
May-11	5758.264	0.000514	2688.1	7307.51	1	0.1645
Jun-11	6117.234	0.000317	2853.89	9548.44	0	0.0026
Jul-11	6459.623	0.000096	3032.65	13412.63	1	0.27
Aug-11	6211.997	0.000255	2957.86	5452.19	0	0
Sep-11	5910.203	0.000272	2833.21	3618.78	3	-0.02
Oct-11	5036.498	0.000661	2525.35	2908.6	1	0
Nov-11	5268.554	0.001356	2624.09	3193.45	0	0.958
Dec-11	5257.606	0.000271	2616.73	5598.52	1	0

Source: Estimated from DSE Data

**Table A.4: Market Capitalization to GDP Ratio of Selected Countries (1990-2003)**

Country Name	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bangladesh		4.75	5.36	10.97	12.79	20.42	36.10	37.08					31.80	34.51	28.24
China	22.90	17.58	41.62	126.15	38.72	70.04	66.17	45.18	43.33	41.26	57.53	74.33	65.73	71.74	46.48
United Kingdom	117.15	121.12	140.20	124.72	64.33										
Hong Kong SAR, China	509.44	581.04	886.11	1254.47	605.97	1076.94	1185.86	908.62	1078.30	1124.71	1109.26	1029.43	995.21	1273.39	1052.15
Indonesia	28.52	28.48	38.10	48.98	19.36	39.83	47.73	43.69	46.65	37.99	47.39	41.04	45.69	51.28	46.71
India	54.69	67.42	87.09	149.51	53.98	97.36	97.39	55.25	69.12	61.34	76.42	72.08	68.40	87.90	76.42
Japan	73.89	96.16	101.85	95.92	61.85	63.20	67.15	54.01	56.08	88.12	90.26	111.51	100.58	128.04	106.56
Sri Lanka	17.70	23.44	27.47	23.35	10.53	22.69	35.12	29.77	24.80	25.31	29.82	25.81	22.67	21.54	17.52
Malaysia	145.59	125.77	144.80	168.07	81.99	143.00	160.26	132.78	148.39	154.79	135.78	129.11	121.24	144.82	112.32
Pakistan	46.54	41.38	32.72	45.75	13.73	18.96	21.42	15.25	19.46	24.79	30.07	24.42	32.97		
Philippines	31.30	38.61	55.52	68.86	29.87	51.30	78.82	73.64	91.69	79.95	92.01	81.57	78.63	92.60	78.01
Singapore	189.07	201.35	258.55	297.98	136.86	247.87	269.89	214.17	259.27	242.03	239.11	207.78	201.35	232.64	188.73
Thailand	66.74	65.44	63.20	74.97	35.39	62.81	81.42	72.40	98.04	84.31	105.67	86.92	105.00	120.54	99.16
United States	133.65	130.41	141.65	137.85	78.78	104.35	115.28	100.63	115.26	143.19	150.27	137.59	146.21	164.85	148.51

**A.5: Market Capitalization to GDP Ratio of Selected Countries (2004-2018)**

Country Name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bangladesh				1.40	3.02	5.08	15.90	5.74	4.06	3.05	4.11	1.81	27.21	
China														30.90
United Kingdom	77.74	86.62	80.95	108.38	100.25	99.56	121.41	133.12	139.96	177.12	156.35	132.21	104.69	118.69
Hong Kong SAR, China	108.39	137.01	164.94	319.93	198.44	209.95	281.26	233.05	203.43	366.87	363.14	298.74	278.36	442.79
Indonesia						32.94	40.02	13.46	23.13	45.75	16.25	14.33	15.37	23.28
India														45.93
Japan	93.48	83.85	57.69	65.25	73.20	65.06	62.47	47.24	60.50	97.66	64.60	52.62	50.29	66.43
Sri Lanka										10.12	6.58	8.45	10.16	14.36
Malaysia	108.73	115.42	150.43	320.99	247.08	240.97	303.57	93.23	132.42	176.77	120.65	128.23	124.72	145.93
Pakistan				24.58	24.91	15.60	18.42	18.91	8.71	11.13	8.96	6.78	14.06	19.98
Philippines							97.35	38.08	48.88	50.82	32.06	27.86	22.75	27.62
Singapore	94.81	104.68	93.87	218.91	181.96	168.55	155.82	104.31	110.80	223.66	159.07	128.84	109.67	152.08
Thailand	23.97	38.75	51.39	99.40	86.65	82.87	52.83	15.24	30.13	45.14	23.12	29.88	33.88	78.16
United States	51.88	67.55	69.72	76.56	70.50	91.00	105.05	125.56	142.59	153.44	147.36	132.15	101.08	124.51

Data Source for table A4 and A5: The World Bank