Micro and Macro Dynamics of the Stock Market: An investigation into the Dhaka Stock Exchange (DSE)

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Abstract

From a theoretical perspective, based on the Efficient Market Hypothesis, stock prices always should incorporate and reflect all publicly available information (see Fama, 1970). Gergoriou et al. (2009) assert that among asset prices, stock prices are typically closely monitored and are commonly regarded as being highly sensitive to economic policy news. The influence of various macro and non-macroeconomic factors including monetary and fiscal policy variables on the stock markets have been studied rigorously in earlier literature, such as Fama (1981), Pearch and Roley (1985), Chang, (2009) Belo and Yu (2013). Nevertheless, some related issues, such as the investors' behaviour after the weekend, daily transmission of information across markets, and influence of various macro and non-macroeconomic information on returns, volatility and liquidity, have been ignored or little empirical evidence is available; particularly documentations from emerging and frontier markets are rare. This study therefore selects the Dhaka Stock Exchange (DSE), an emerging equity market and the main exchange of Bangladesh for investigation. We provide firm level evidence by sorting all listed firms on the DSE into size, dividend and sector. This study is an empirical study by nature and followed quantitative approach to carry forward the research process. For the purpose of analysis, we have used secondary data and applied several time-series and panel based econometric methods.

Major findings from this study are: First, the market opens from Sunday to Thursday and the 'information content theory' works; there is a 'Sunday effect' in returns and variance. Supporting the 'information processing hypothesis' the study finds that trading patterns of individual investors create the weekend effect and the results are significantly different for size and dividend yield based portfolios. Second, the volatility of the DSE is significantly influenced by the residuals of Japan, Hong Kong, Canada and the US. Investors take regional information from markets in similar time-zones but adjust world factors from the US and Canada at the beginning and end of the week. The multivariate cointegration shows that the DSE is cointegrated with markets from similar time-zone as suggested in Bekaert et al. (2005). Third, timing of breaks in the returns and volatility coincide with the timing of monetary policy, fiscal policy, political uncertainty, government policy, national election and electoral system as suggested in Ardagna (2009) and Chau et al. (2014). The top and bottom 20 percent firms are more sensitive to any information, however smaller firms are significantly affected by monetary policy. Financial and manufacturing sectors are subject to both macro and non-macro news. Fourth, the (il)liquidity of the DSE is significantly caused by the bank rate, government borrowing and private borrowing. The results indicate that there is significant 'crowding out' and 'cost of funds' effect in the DSE. Finally, the 2008-09 financial crisis had positive impact on market liquidity.

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Author's Declaration

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Except where stated, all of the work contained within this thesis represents the original contribution of the author.

This work has not previously been presented for an award at this, or any other, University.

Chapter 1: Introduction

1.1 Research Background

The Stock Market Efficiency Hypothesis contends that stock prices fully reflect all publicly available information (Fama, 1970). So far most of the empirical research in this area has been primarily concerned with whether stock prices reflect available information on monetary policy in particular and very little attention, if any, has been devoted to assessing the possible effects of fiscal policy on stock prices (Darrat, 1988). Yet, on purely theoretical grounds (Tobin 1969, Blanchard 1981, Shah, 1984), both monetary and fiscal policy could have significant effects on the returns of assets. Among asset prices, stock prices are typically closely monitored and are commonly regarded as being highly sensitive to economic policy news (Gregoriou et al. 2009).

In multifactor asset pricing models, any variable that affects the future investment opportunity set or the level of consumption, given wealth, could be a priced factor in equilibrium (Merton, 1973; Breeden 1979). Macroeconomic variables, both monetary and fiscal policies, are excellent candidates for these price factors, because macro changes simultaneously affect many firms' balance sheet, cash flows and may influence the risk-adjusted discount rate (Bernanke and Gertler, 1995; Flannery and Protopapadakis, 2002).

Theoretically, monetary policy can affect the return from the stocks in two distinct ways. First, via changes in the firm's expected cash flows, for example, an expansionary monetary policy creates real effects by increasing a firm's profitability and thus its expected cash flows (Thorbecke, 1997). By contrast, the effects of contractionary monetary policy will be to lower a firm's expected profitability and thus its stock price or returns (Thorbecke, 1997). Second, via the means of altering the discount rate at which the firm's expected cash flows are discounted (Conover et al., 1999). For instance, an expansionary monetary policy stance will reduce market interest rates, both short and long, and, by consequence the firm's appropriate discount rate which, in turn, will increase a firm's stock price. On the other hand, contractionary monetary policy will raise the market interest rate and thus will decrease the stock returns (Peter, 2001).

In line with the monetary policy of central banks, the fiscal policy actions, such as changes in the government expenditures or taxes resulting in budget deficits or surpluses also play a significant role in the determination of asset prices (Tobin, 1969; Blinder and Solow, 1973; Fisher, 1988, Darrat, 1988, 1990). For example, increases in tax rates, with government spending unchanged, would lower the expected asset returns as they indirectly discourage investors from further investing in the stock market. Moreover, higher corporate tax will reduce the net income of companies. On the other hand, increases in government borrowing raise the short-term interest rate which, in turn, lower the discounted cash flow value from an asset and thus signals a reduction in stock market activity, aside from other adverse effects in the general economy (Laopodis, 2009). In the latter case, if higher interest rates threaten to choke off future economic activity, then the central bank might step in to reverse this undesirable situation by increasing money supply and this is how monetary policy might interact with fiscal policy (Laopodis, 2006).

It is now empirically evident that the government and the central bank can both influence the interest rate or discount rate or cost of capital through monetary policy and fiscal policy. This variation in interest rate might cause investors and companies to either go to the bank or capital market for their investment or financing (see Bernanke and Gertler, 1995; and Strulik 2008;). Thus the investment portfolio of investors and capital structure of companies will be affected because of changes in their preferences for the debt-equity mixture. Modigliani (1971) and Mishkin (1977) point out that lower interest rates increase stock prices which in turn lead to increase business investment. Bosworth (1975) agrees with this but adds that higher stock prices lower the yield on stock and reduce the cost of financing through equity issuance. Furthermore, the tax rate such as value added tax, corporate tax and personal tax can also affects firm performance through capital structure (Modigliani and Miller, 1958) and also the value of shareholders' wealth.

Other than the stock price (i.e. both returns and variance), monetary and fiscal policy variables also influence the aggregate market liquidity. Since the cost of financing and perceived risk of holding securities is influenced by those macroeconomic policies, therefore, equity market liquidity should be affected. It is asserted in the inventory paradigm that stocks are expected to be more liquid if market participants can cheaply finance their holdings and perceive a low risk of holding those assets (see Fernández-Amador et al., 2013 for details). In a similar vein, Brunnermeier and Pedersen (2009) argue there is a spiral relationship. On one hand traders' funding, i.e. their capital and margin requirements, depends on the assets' market liquidity and on the other hand traders provide market liquidity, and their ability to do so depends on their availability of funding. Expansionary or contractionary monetary and fiscal policies, therefore, restrict the traders' funding opportunities and hence, influence overall market liquidity. In their empirical study, Chordia et al. (2001) find short-term interest rates significantly affect liquidity for NYSE listed stocks. Similarly, Goyenko and Ukhov (2009), and Fernández-Amador et al.

(2013) report a very strong association between monetary policy changes and changes in market liquidity. Recently, Gagnon and Gimet (2013) find that fiscal policy such as government spending shocks can also influence equity market liquidity.

It is now often claimed that a stock market is not only influenced by its domestic macroeconomic news but also takes spillover effects of disturbances (including monetary and fiscal policy) from other equity markets (see Hamao et al., 1990; Lin et al., 1994; Gagnon and Karolyi, 2006; Kohonen, 2013). For example, Gagnon and Gimet (2013) find evidence that foreign budgetary shocks have international spillovers. In the literature, there are several possible reasons claimed about why volatility is being transferred across borders, e.g. globalization of financial markets, liberalization of capital markets regulations, free flow of capital investment, international trade, improvements in information technology, market cointegration and contagion. For example, King and Wadhwani (1990) assert price changes in one market in a real sense depend on the price changes in other countries through structural contagion coefficients and further, mistakes or idiosyncratic changes in one market may be transmitted to other markets, thus increasing volatility. Supporting this argument Koutmos and Booth (1995) explain this behaviour as being consistent with the efficient market hypothesis, provided that information generated by international stock markets is relevant for the pricing of domestic securities. Studies extensively investigate the volatility transmission between stock markets and have got empirical support for spillover effects between markets (see Singh et al., 2010; Jiang et al., 2012; Balli et al., 2013).

It is well established that investors including the market-makers have access to different sets of information and they can infer valuable information even from price changes in other markets and incorporate those into their buy and sell decisions (King and Wadhwani, 1990). However, there is a difference in the nature of gathering and evaluating information between individual investors and institutions. Their pattern of investment decision making processes is also different. For example, Abraham and Ikenberry (1994) claim that it is practically costly for the individual investors to make investment decision during weekdays when these people are usually employed in other activities; therefore, weekends provide a convenient, low-cost opportunity for them to process the gathered information and execute their decisions when markets reopen. A similar explanation is also cited in Osborne (1962). He claims individual investors devote their weekend to making investment decisions and are relatively active on Monday. However, to institutional investors Monday is a day for strategic planning.

Altogether, these behavioural differences create a pattern in investors' mode of transactions and also in returns and variances of the market. In addition, the method of information release could be another possible reason for crafting a trend in stock returns and volatility. For example, Damodaran (1989) finds that the delay of announcement of bad news toward the weekend might cause negative returns on Monday. Fortune (1991) suggests that firms and governments release good news during market trading, and store up bad news after the close on Friday, when investors cannot react until the Monday trading. Further to the negative returns, French and Roll (1986), Forster and Viswanathan (1990) and Barcley et al. (1990) offer evidence that the variance should be highest on Monday, when informed traders have their maximum information advantage. To support all these arguments, there is consistent evidence available that returns on Monday are negative (see Keim and Stambaugh, 1984; Jaffe and Westerfield, 1985; Harris, 1986; Agrawal and Tandon, 1994) and returns variance is highest (see Ho and Cheung, 1994; Choudhry, 2000; Berument and Kiymaz, 2001, 2003).

Based on all these theoretical and empirical support, we can conclude that stock prices are very sensitive to macroeconomic news. Equity returns, variance and market liquidity are not only affected by local monetary, fiscal and other macroeconomic policies but also from spillover effects of international information. In addition, there is a difference in the nature of processing information between individual and institutional investors. Their decision making and trading patterns could create certain trends in stock returns and volatility. The aim of this research is to study several micro and macro perspectives of Dhaka stock exchange (DSE), the main equity market of Bangladesh. In particular, from a micro perspective this study examines investors' roles in processing information and transmitting market disturbances. It also explores macro dynamics by linking stock prices (both returns and variance) with monetary, fiscal and other macro and non-macroeconomic variables. Finally, we combine micro and macro perspectives by investigating the influence of central bank and government policy variables on market liquidity.

1.2 Scope and Objectives of the study

The scope of this study includes several micro and macro perspectives on Bangladesh stock market. We present evidence from the Dhaka Stock Exchange (DSE), the main exchange of Bangladesh. It was recorded as Asia's best and second best performing equity market respectively in 2010 and 2008. Indeed, attention on the capital market and economic behaviour of Bangladesh have developed since Goldman Sachs coined it as one of the '*Next -11*' countries (O'Neill et al., 2005). Goldman Sachs evaluated Bangladesh on the basis of macroeconomic stability, political maturity, education, openness of trade and investment regulation. The economic importance was further augmented when JP Morgan included Bangladesh in the list of '*Frontier Five*' in 2007 (Mowat and Gordon, 2007). The '*Frontier Five'* is selected on the relative attractiveness of these markets based on macro-economic and demographic trends. Recently Elliot (2012) reported in The Guardian that Bangladesh is among a number of emerging countries [1] that could overtake the West by 2050, as they are growing fast. Overall, the contribution of Bangladesh to the world economy is growing over time and becoming attractive to the foreign investors. This research study, in a similar vein, puts forward important contributions to the management and development of equity markets of Bangladesh by helping the regulators in formulating their policies.

The impact of monetary policy, fiscal policies and other macro and non-macroeconomic information on stock markets has been widely analysed in the US, the UK, Japan, Canada, China and European markets (see Fama, 1981; Pearce and Roley, 1985; Wang and Theobald, 2008; Chang, 2009; Cenesizoglu, 2010; Belo and Yu, 2013; Croce et al., 2013). However, there are some related areas where little or no attention has been given; additionally evidence is limited from emerging and frontier markets. For example, it is difficult to find any credible documentation from emerging markets that shows how individual and institutional investors process information and create a trading pattern as a reason for the weekend anomaly. In one study, Venezia and Shapira (2007) only explore the behaviour of amateur and professional investors following the weekend for the Israeli stock market. Yet they ignore the influence on variance and impact of investors' preferences for investment. Similarly, little attention has been given to the transmission of financial disturbance to an emerging equity market from other markets located within similar time-zones and different time-zones. Moreover, findings related to daily dynamics of volatility spillover from synchronous and non-synchronous trading hours are also rarely available.

Empirical results connected to the combined influence of macro and non-macroeconomic news on an emerging stock market's returns and volatility are not very common in existing literature.

[1] The emerging market was a term coined by World Bank economist Antoine W. van Agtmael in 1981 in reference to nations undergoing rapid economic growth and industrialization. Recently Bangladesh is being classified as an emerging economy by the International Monetary Fund (World Economic Outlook, 2008 of IMF) and many others. World Bank has ranked Bangladesh as 17 for 'investors protection' ranking above India (29) and Vietnam (143). Euromonitor international also has included Bangladesh in their list of top 5 fastest growing key emerging economies in 2014. However, before being classified as an emerging economy, Bangladesh was classified as a frontier markets by different organizations, such as FTSE, MSCI, S&P, Dow Jones and Russel list. In this study we refer this country as a new emerging economy of the South East Asia.

But there is growing evidence that the standard valuation model has failed to capture stock market movements (see Shiller, 1981; Bailkowski et al., 2008; Chau et al., 2014) and hence, we need to identify and evaluate drivers of volatility other than conventional dividends and earnings, such as national election, political uncertainty, government policy etc. (see Leblang and Mukherjee, 2005; Mei and Guo, 2004; Pastro and Veronesi, 2012). This study extends its focus to this area of analysis and presents evidence from an emerging market to fill the gap. Finally, the empirical relationship between market liquidity and macroeconomic management is not conclusive, since various effects ranging from strong (see Chordia et al., 2001; Goyenko and Ukhov, 2009), mixed (see Fujimoto, 2003), modest (see Chordia et al., 2005) to no effect (see Choi and Cook, 2006) are documented in different equity markets. In addition, only one study (see Gagnon and Gimet, 2013) has focused on the influence of fiscal policy variables and little substantiation is available from emerging stock markets. This study fills those research gaps and provides evidence of both monetary and fiscal policy influence on liquidity at firm and aggregate levels from an emerging stock market.

In this thesis, therefore, we identify the following objectives for the study of Bangladesh stock market. Indeed, by studying each of the objectives, this study looks deep into several micro and macro dynamics of the Dhaka Stock Exchange:

1. The effect of individual and institutional investors on the stock market – how their information processing and trading behaviour create a pattern after the weekend.
2. Examining the daily transmission of information from other equity markets – whether the time-zone of the markets has any influence on the nature of volatility spillover effects.
3. Exploring the impact of monetary, fiscal and other macro and non-macroeconomic events on the stock market – whether the timing of market breaks coincides with the timing of those events and affects the firm level returns and volatility.
4. Investigating the association of macroeconomic management information on aggregate and firm level market liquidity.

1.3 Importance of the Study

Other than the theoretical and empirical contributions to related issues, the evidence documented in this study is important for investors, policy makers and regulatory bodies.

Besides, this market has some unique characteristics, which makes the findings from this study even more interesting to academics and researchers across the world. In section 1.3.1, we present the significance of this study for the Bangladesh stock market. In section 1.3.2 we describe those unique characteristics of this economy which augment the importance of this study for the finance literature.

1.3.1 Empirical perspective for the DSE

An efficient and stable stock market provides a unique opportunity to supply capital for future business expansion and thus plays an important driving force for economic growth. The government of Bangladesh has indeed taken initiatives to revive the stock market since the late 1990s and undertook a series of measures through changes in the legal code and development of infrastructure, notably the establishment of the Securities and Exchange Commission (SEC) in 1993, the Central Depository System in 2000 and automation of securities transactions in 1998. Nonetheless, the market experienced a series of serious falls in late 1996, late 2008 and early 2011; unfortunately the last one is still continuing.

A few studies have already attempted to explain the causes and effects of stock market collapse in relation with the national economy and politics of Bangladesh; but they have not analysed it from a macroeconomic management and non-macroeconomic perspective. Yet, in order to play a proactive role in capital market development, the central bank (i.e. which is Bangladesh Bank) and government need to analyse the reactive functions of the stock market over changes in monetary and fiscal policies. Indeed, the relationship of monetary and fiscal policies to stock prices is complex, because these policies can influence the stock markets and broadly economic performance of any country through several channels (see Bernanke and Gertler, 1985; Haan and Sterken, 2000; Strulik, 2008). So there is a need for detailed research to know the empirical connection in this area form economy like Bangladesh, which is growing and included in the list of emerging markets.

On Bangladesh stock market research, Ahmed et al. (2006) examine only a few aspects of macroeconomic management, namely the effects of monetary policy on stock prices of the DSE by using a structural VAR. Chowdhury et al. (2006) and Chowdhury and Rahman (2004) investigate how macroeconomic volatility, such as risk associated with industrial production, inflation, and exchange rate, can influence stock market volatility. In this vein, Ahmed and Imam (2007) try to link a set of macroeconomic variables such as the industrial production index, broad money supply, GDP growth, interest rate changes, and T-bill growth rate to the stock market by applying co-integration and vector error correction model. So far these are the only noteworthy pieces of research in the area linking the stock market and macroeconomic variables. However, no research has yet been made to examine the influence of macroeconomic management on the DSE, except Ahmed et al. (2006) and he only considers some aspects of monetary policy. Therefore, a gap exists for a study to discover the interrelationship and impact of both monetary and fiscal policy variables on the stock market, which will help the government and the central bank to achieve a stable stock market including other objectives of macroeconomic management. Moreover, using different methodologies this study also provides firm level evidence regarding the influence of those macroeconomic management policies. Furthermore, there is no empirical documentation available on other micro and macro aspects for DSE, which are investigated in this study – the role of individual versus institutional investors in market seasonality; the transmission of disturbances from international equity markets; and the association of monetary and fiscal policy with market liquidity.

Therefore, the research gap coupled with the recent stock market crash due to poor macroeconomic management sheds light on the importance of this study for Bangladesh. Should the central bank play some role in creating and bursting asset bubbles? This is a contentious issue that has been discussed for a long time in this market. There are different arguments for and against this view; however, the role of the Bangladesh bank is strongly criticized and is being questioned as the reason for the recent stock market bubble and crash (see Monzur, 2011; and New Age, 2011a). Monetary easing during the last couple of years increased the money supply more than 22 percent and allowed commercial and merchant banks to get heavily involved in the stock market (CPD, 2011). Unexpectedly, proper data on their exposure to the capital market remain unknown by the Bangladesh Bank (central bank of Bangladesh), which is a failure from the part of the central bank as a supervisory agency (CPD, 2011). In addition, surprisingly, almost all the policies to minimize the exposure of banks to stock markets were taken in the second half of 2010, when the stock index had reached an alarming level (Mufazzal, 2010).

The situation worsened when the Bangladesh Bank made it mandatory for all commercial banks to maintain their investment in the stock market equivalent to 10 percent of their total deposits and asked them to comply with this requirement by December, 2010; when in reality the investment ratio was much higher, almost 82% (see New Age, 2011b). Moreover, increasing the cash reserve ratio (CRR) was a double debacle for the banks. This liquidity constraint forced commercial banks to sell huge volumes of shares which caused share prices to decline from late December 2010. On the other hand, the government took several steps to stop the fall and improve the performance of DSE, such as allowing 'black money' into the market, reducing borrowing from commercial banks, giving tax benefits to investors, and promoting public enterprises to issue stocks (CPD, 2011). Unfortunately nothing worked as planned and the DSE faced a largest plunge in prices. Indeed, this poor macroeconomic management and poor coordination between the SEC, Central Bank and government were leading Bangladesh to replay what happened in Japan (Manzour, 2011). After the bubble burst in the early 1990s in Japan, a decade of crisis started. With the first failure in 1992, as many as 180 banks up to 2003 failed according to the statistics by Deposit Insurance Corporation, Japan.

Fortunately, no bank failure had happened in Bangladesh but due to the conflicting policies of the central bank and government, the DSE has been experienced significant rises and falls over the last decades. Lack of coordination between regulatory bodies and their asynchronous expansionary or contractionary policies have created inflationary pressure, a lack of liquidity, minimal investment opportunities, a crowding-out effect and excessive supply of funds (i.e. market became overheated) in the market. For example, while the government allows black (undisclosed) money into the stock market, the central bank increases the cash reserve ratio; while the central bank increases the money supply, the government follows an expansionary expenditure policy. Similarly, there is expansion (contraction) of domestic credit versus rising (decreasing) government debt from the banking sector; a reduction in savings and investment rate versus a surging cash reserve ratio and statutory liquidity reserve ratio. In this study we are going to investigate, how each of these policies are affecting the overall market and firm level stocks.

1.3.2. Market characteristics

The market that we examine in this study (i.e. The DSE of Bangladesh) has some interesting characteristics, which are distinctly different than most other developed and emerging economies, such as the US, the UK, Japan, Russia, China, India, Brazil, Latin America and Eastern European countries. Hence it would be interesting and challenging to investigate various micro and macro perspectives of this stock market. Our findings will make original contributions to existing theoretical and empirical debates. Moreover, lessons from this equity market will be useful for policy makers, academics and researchers of similar markets across the world.

First, the stock market operates from Sunday to Thursday, whereas most of the equity markets of the world open on Monday to Friday. Evidence available that when the market is operating from Monday to Friday, the stock returns are negative and returns variance is higher on Monday (see French, 1980; Gibbons and Hess, 1981; Rogalski, 1984; Cho et al., 2007). Yet, documentation is rare on whether the pattern in returns and variance happens in the equity markets that open other than the usual Monday to Friday. In addition, studies find that the financial disturbances transmit between stock markets with similar trading hours (see Hamao et al., 1990; Jiang et al., 2012; Balli et al., 2013). But little evidence is documented related to the nature of daily transmission of volatility. In particular, the dynamics of daily spillover effects between markets operating in a Monday-Friday cycle to Sunday-Thursday cycle is uncommon. Furthermore, the literature describes the importance of time-zone (see Engle and Susmel, 1993; Cai et al., 2009), nevertheless time-zone is not tested as a determinant of volatility spillover effect. This study, hence, fills the research gap and examines the DSE which has different trading hours and located in different time-zone.

Second, the market is largely dominated by individual investors. According to 2012 data, more than 99 percent of investors are individual and hold 40 percent stocks traded in the market. On the other hand, the institutional investors in this market is less than one percent but holds 17 percent traded stocks. Existing literature shows that in developed markets institutional investors generally hold more shares, sometime up to 67 percent (see Chan et al., 2004; Blume and Keim, 2012) of traded stocks. Nonetheless, the higher number of trading activities of individual investors on Monday creates the weekend effect in those developed stock markets (see Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994; Kamara, 1997). On the contrary, Sias and Starks (1997) claim that stocks with higher institutional holdings exhibit significant greater weekend effect. Therefore, since little or no evidence is available, it would be interesting to further investigate the information processing and trading behaviour of investors from an emerging market, in particular where the individuals have greater holding. Besides, this study examines the impact of investors' trading activities both on stock returns and volatility, empirical evidence is also limited in this aspect of the market.

In addition, individual investors usually have less opening to diversify their portfolios and limited access to information (see, Bialkowski et al., 2008; Giofre, 2013). This group of investors also have low scales of investment and lack knowledge about the capital market, thus faceing informational disadvantage which lead them to make investment decisions based on factors other than fundamentals (see Haque, 2011; Odean, 2013). It is asserted in literature that when investors have little opportunity for international diversification, market exhibits strong home bias (see French and Poterba, 1991; Baxter and Jermann, 1997; Bialkowski et al., 2008). Therefore, where the stock market is dominated by individual investors, market might not be influenced by international information, might not be integrated with other equity markets and even might not be received contemporaneous response to changes in domestic macro and non-macro policies. Yet, empirical evidence is rare from emerging markets and this study will provide documentation on these issues.

Third, firms listed on the DSE are very small compared to firms listed on the NYSE (New York Stock Exchange) or LSE (London Stock Exchange) or even Indian stock exchange. For example, it is calculated that the market value of the largest firm (which is Grammeen Phone, a subsidiary of Telenor Group) listed on the DSE is only 1.5 percent (as of 2012) of the market value of Wal-Mart, which is the largest firm listed on the NYSE. The Grammeen Phone is only around 14 percent by the market capitalization of the largest firm listed on the Indian stock exchange, which is Reliance Industries Ltd. (as of 2012). Therefore, where firm size is a factor to examine the investor's and market's characteristics, the findings from DSE should be new evidence. It is reported in the earlier literature that firm size can make a difference between the choice of individual and institutional investors and cause the weekend seasonal (see Abraham and Ikenberry, 1994; Kamara, 1997; Brusa et al., 2000, 2005). While institutional investors tend to invest in stocks that are larger and more liquid (Gompers and Metrick, 2001; Chan et al., 2005), individual investors are generally perceived to have greater holdings in smaller firms (Lakonishok et al., 1992; and Barber and Odean, 2005). In DSE, most of the investors are individual (also hold larger percentage of stocks than institutions) and the size of larger firms is significantly smaller compared to other developed and emerging equity markets, thus it would be interesting to investigate the possible influence of firm size and investors' preference on seasonality.

Furthermore, the results to the combined impact of changes in monetary policy, fiscal policy and other macro and non-macroeconomic variables on size sorted portfolios from the DSE will provide new evidence. This is because, earlier studies only investigate the association separately and empirical documentations from emerging markets are limited. For example, Perz-Quiros and Timmermann (2000), Ehrmann and Fratzscher (2004) and Basistha and Kurov (2008) show that monetary policy creates larger effect on the smaller firms than others (i.e. medium and larger sized firms). Similarly, Guo (2004) finds that monetary shocks are significantly stronger on small firms for the US market. For other factors, evidence is also available, e.g. on the connection of equity markets with political risk (see Bilson et al., 2002), national elections (see, Bialkowski et al., 2008), and changes in regulations (see, Bengtsson et al., 2014). However, limited or no documentation is found on the combined influence of all these variables including fiscal policy changes on aggregate and firm level data. Credible research is lacking from emerging markets and this study fills the gap.

Fourth, this market has five categories of stocks based on the frequency of holding annual general meetings (AGM) and percentage of dividends declared in any financial year. Therefore, the dividend yield makes a big difference in their nature of listing. Large and prudent firms usually maintain a good dividend rate in their fiscal years as suggested in Smith and Watts (1992). Fifth, the effective marginal tax rate for dividends in this market is higher for institutional investors. According to the National Board of Revenue (NBR) of Bangladesh, corporate shareholders are subject to a 20% tax rate, whereas individuals pay 10% tax on their dividends. Whereas, in the developed markets, such as in the US, corporate shareholders have always been allowed to deduct their taxable income on at least 70% of any dividend they receive (Barclay et al., 2008).

This study applies dividend yield as a factor for investment preference between institutions and individuals. Since the tax-based dividend clientele hypothesis assumes or predicts that high dividend-paying firms attract institutional investors (see Shleifer and Vishny, 1986; Redding, 1997; Allen et al., 2000), hence it would be interesting to examine the dynamics of trading behaviour of institutional investors for the DSE, in terms of whether they prefer high dividend paying firms over higher tax on dividends. Moreover, we investigate the time-varying reaction of portfolios based on dividend yield to various macro and non-macroeconomic events. Since, Cenesizoglu (2011) mentions that there are important asymmetries in the reaction of daily volatilities of portfolios, such as the dividend yield might provide further evidence on the relation between stock price and the aggregate economy. The dividend yield exhibits less variability and hence is more likely to represent permanent rather than transitory changes (Bekaert and Harvey, 2000). Additionally, empirical studies on the association between firm level liquidity for dividend yield, size and sector sorted portfolios with monetary and fiscal policy changes are rare. In one study, Gagnon and Gimet (2013) only examine the effect of standard monetary and budgetary policies on market liquidity for the US, Euro zone and Canadian stock markets.

Sixth, from 1990-2011, Bangladesh had a system of an interim non-political government (commonly known as Caretaker Governments) between politically elected governments. Initially, this was a consensus between major political parties but it was adopted into the constitution in 1996. The objectives of this special kind of small scale government system were to ensure a smooth transition and hold a free and fair election without any influence from the outgoing government. A similar mechanism is found only in Australia and the Netherlands (here it is known as Caretaker Cabinet). Over the sample period from January 1990 to December 2012, altogether the Caretaker Government ran this country for about three years, presented three national budgets and conducted four national elections. Hence, the type of government system in Bangladesh is limited in the world, thus the reaction of the stock market to macroeconomic news from this country will be a new evidence for the existing literature. This is because, we examine the influence of fiscal policy changes on returns, volatility and liquidity and it is reported that the application of fiscal policy largely depends on the environment of political economy in which it is made (see, Cooray, 2011; Chatziantoniou et al., 2013).

Seventh, the political government of this country is very powerful and the performance of the stock market is considered as a barometer of the ruling party's success. Therefore, they frequently interfere in the market. Eighth, black money (undisclosed earnings) is allowed into this market. To increase market liquidity the government took this step despite strong opposition from various organizations, such as the National Board of Revenue (NBR), the Financial Action Task Force (FATF) and the Transparency International Bangladesh (TIB). In this study one of our prime objectives is to investigate the role of government on the DSE. It is suggested in the literature that government plays a central role in the capital market (see Bengtsson et al., 2014) and sets the rules of the game and also changes these rules from time to time (see Pastor and Veronesi, 2012). Similarly, Leblang and Mukherjee (2005) assert that governments attempt to influence the stock market to enhance their electoral preferences. However, empirical evidences from emerging markets are limited, hence this study will add new evidence by providing dynamic connection of the stock market with government policies.

Ninth, this characteristic is related to the political uncertainty that affects the entire economy and thus the financial market as well. In Bangladesh one form of political risk is national shutdown or strike (known as hartal) that has become commonplace in politics over the decades. From 1990 to 2012 there have been more than 1100 days (equal to about 4 working years) of hartal called by political parties. This culture is also found in other parts of South Asia but the phenomenon is more severe in Bangladesh (see UNDP, 2005). The International Chamber of Commerce of Bangladesh has estimated that the country loses around \$200 million every hartal day. It is documented in earlier research that labour strikes have significantly negative relationship with stock prices (see Dinardo and Hallock, 2002; Nelson et al., 1994). For example, Nelson et al. (1994) find a loss in stock price of about 1% for the 5-day window around the strike. Diamonte et al., (1996) and Nguyen and Bellalah (2008) report that the political risk represents a significant determinant of stock returns and volatility in emerging markets than in developed markets. Therefore, findings from the DSE will further add new evidence on this connection from emerging market, since such an action (i.e. hartal) will reduce production, sales, cash flows, and also limit the investment opportunities.

Finally, as a Muslim country, Bangladesh has stocks of different sets of industries or firms than is conventional, e.g. banks with Islamic banking norms. It is documented in earlier literature (e.g. Chau et al., 2014) that conventional and Islamic financial market indices react heterogeneously to political turmoil. In addition, Muslim investors prefer not to invest in fixed interest-earning assets because of their religious restrictions, thus the stock market is a good alternative opportunity for them (see Islam and Khaled, 2005). The results from Bangladesh capital market will further validate the findings reported in Chau et al., (2014) and Islam and Khaled (2005).

Altogether the major significance of this study is six-fold. First, it would be interesting to find out whether the stock market offers an important channel for transmitting the impact of fiscal policy and monetary policy to the financial and real side of the economy. Second, it would fill the gap in the research to discover whether the Security Exchange Commission, Central Bank, and government are playing their part properly and in a coordinated way. Third, if the stock market is not efficient with respect to fiscal and monetary policy information then private sector investor actions could profitably exploit the stock market, at least in the short run. Fourth, from the perspective of businesses, large budgetary deficits undercut investments in financial assets such as stocks and bonds and real assets such as plant and equipment by driving interest rates higher, that is a 'crowding-out effect' works which, in turn, curtails economic growth. Fifth, whether the nature of information disclosure and processing have any impact on investors' investment decision making is important to know. Finally, for foreign portfolio investors, they need to know whether the market is integrated with other equity markets and receives local, regional and international disturbances – if it does not then this market is a good opportunity for diversification.

1.4 Structure of the Study

The broader aims and objectives of this study that have been set out in this chapter are addressed through separate but interrelated analysis. The next chapter (i.e. chapter two) presents an overview of the Bangladesh stock market. Discussion includes the history of the capital market, the legal structure, management, regulatory bodies, and the trend and performance of the DSE. In trend and performance, this study explains various perspectives of DSE mostly from 1990-91 till 2011-12 – number of listed companies, size to GDP (Gross Domestic Product), turnover, volatility, market concentration, and foreign portfolio investment. This chapter also provides a description of the macroeconomic management of Bangladesh. In particular, various instruments of monetary and fiscal policy used by the central bank and government respectively are discussed. Their trends and implication on the economy and capital market are also highlighted. The nature of coordination between those regulatory bodies is also stressed in this chapter.

Chapter three brings together the relevant literature on macroeconomic management policy variables along with theories and motivations. This chapter addresses the development of theories and determinants of monetary and fiscal policy and their impact on stock markets. Briefly we discuss the relevant literature of volatility spillover effects; the influence of individual and institutional investors; the association and impact of monetary, fiscal, and other macro and non-economic variables on returns, variance and liquidity. A detailed literature review of each of these areas is presented in the respective empirical chapter (i.e. from chapter four to seven). However, the theoretical review in this chapter serves as the foundation of discussion and analysis of the subsequent chapters.

The first objective, which involves solely a micro perspective of the market, is given in chapter four. The study examines whether information content theory works for this market, i.e. how investors (both individual and institutional) process their information and become active after the weekend. Following previous arguments, individual investors generally do not process information on weekdays as it is costly for them and therefore gather and process it over the weekend and become active traders on the first trading day. This study provides firm level evidence regarding the nature of trading behaviour of individual and institutional investors. An interesting extension is to include investors' preferences regarding portfolio based on dividend yield and their influence on the weekend and feedback effects.

Chapter five discusses the second empirical objective of this study, which is another micro perspective on the DSE. Here, we examine the dynamics of volatility transmission from other international equity markets into the DSE. The markets are selected based on their time-zone and classified as local, regional and global. Since the domestic market operates from Sunday to Thursday, it would be interesting to examine the nature of daily transmission of disturbances from other markets, which are, first, located in different time-zones and second, operating from Monday to Friday.

The macro aspects of the DSE are investigated in chapter six – the impact of various macro and non-macroeconomic events on the stock market of Bangladesh. It is highlighted in previous literature that the stock market is not only affected by macroeconomic information but non-macroeconomic events are also important. Political uncertainty, national elections, government policy and regulatory changes can also influence the price and volatility of stock returns. In the first stage, the study has identified several major events related to all those areas. We then empirically examine whether the market suffers any structural shift at the time of any major macro or non-macro event. The chapter also categorizes the stocks listed on the DSE based on size, dividend yield and sector to assess in detail the relationship of firms to changes in any of those macro and non-macro events.

We combine the micro and macro aspects of DSE in chapter seven. The associations between market liquidity with the central bank and government policy variables are explored in this chapter. Theoretically, expansionary (contractionary) monetary and fiscal policy can increase (decrease) liquidity of the economy and of the equity market as well. It is highlighted in the literature that in emerging and developing countries the influence of fiscal policy is sometimes stronger than central bank policies. Moreover, cyclical movements of the market, variations in the business cycle and inflationary pressures can also affect market liquidity and it is interesting to examine all these dynamic linkages at the aggregate and firm levels.

Finally, chapter eight presents a summary of the research background, methodology of the study and the major findings on the relationship of information at the micro and macro levels in an emerging stock market. The chapter also considers the managerial implications of the major findings and suggests areas of further research.

1.5 Chapter Summary

This chapter has established the context of the study, set out the scope and objectives of the research and described the importance of the study. The basic structure of the dissertation has also been described here. This study empirically investigates for Bangladesh whether information or/and changes in macroeconomic policies have any effect on current market prices or returns and return variances of stocks. This study will be a guide for the government, central bank (i.e. Bangladesh Bank) and security exchange commission (SEC) of emerging countries regarding their management of the stock markets and how effective integration can be made between the money and capital market.

In literature we have seen that the developed stock markets are extensively examined but evidence from developing markets is limited. Thus, we can apply similar hypotheses and methodologies of this study in other stock markets from Eastern Europe, Latin America and Africa to add to the evidence. Moreover, there are several areas of equity markets which have been ignored both in developed and emerging market research, such as the investors' behaviour after the weekend, daily transmission of information across markets, and influence of various macro and non-macroeconomic information on returns, volatility and liquidity. We have investigated them in this study. Furthermore, this market has some characteristics which are not very common in other emerging markets, therefore the dynamics of macroeconomic information to stock returns and variance will draw attention of worldwide academics. In particular, findings will contribute to the on-going debates between academics and regulators regarding the role of central bank and government in stock markets, which has been further highlighted since the 2008-09 financial crisis. Finally, results will show the validity of stock market efficiency in Bangladesh and the possibility of earning better returns for a diligent investor.

The next chapter provides a detailed discussion of the economy, capital market and macroeconomic management of Bangladesh. More specifically, the trend and performance of the DSE, monetary policy and fiscal policy will be discussed followed by a discussion on the development and legal structure of the market.

Chapter 2:
The Capital Market and Macreconomic Management in Bangladesh

2.1 Introduction

Bangladesh is an independent country in South Asia. According to the International Monetary Fund (IMF) Bangladesh is one of the top fifty largest economies of the world and based on the Central Intelligence Agency (CIA Factbook) the Bangladesh stock market is the 74^{th} largest market in the world with a market capitalization of 7.07 billion US dollar in 2009. However, market capitalization had increased to $15.63 billion in December, 2010 and the market became the best performing equity market in Asia. In following years market moved to $23.55 billion and $17.48 billion respectively as of December 2011 and 2012.

This chapter introduces Bangladesh, its capital market performance and macroeconomic management. The objective of this chapter is to focus on the significance of the Bangladeshi economy and its capital market with respect to the world economy and financial markets. Also how the macreconomic management of the central bank and the governemnt is progressing over time. The chapter is devided into several sections as follows: section 2.2 starts with an brief introduction of Bangladesh and its economy. The history of Bangladesh capital market is given in section 2.3 including the legal structure (section 2.3.1), management of the stock market (section 2.3.2), different categories of securities (section 2.3.3) and indices used in the DSE (section 2.3.4). The performance of the DSE is described in section 2.4. This study uses different dimensions to measure the performance of Dhaka Stock Exchange, such as market size, liquidity, volatility, concentration, and foreign portfolio investment. We end section 2.4 by comparing the DSE to other major South Asian, Asian, European and the US stock markets and a summary. Section 2.5 discusses about various perspectives of macroeconomic management of Bangladesh. The monetary policies of the central bank and the fiscal policies of the government are explained in detail. Finally, section 2.6 draws a chapter summary.

2.2 Bangladesh and its Economy[2]

Bangladesh got its independence from West Pakistan on 16 December, 1971. Since then it is synonymously known as a country of famine, drought, flood, corruption, and political collision to rest of the world. However, besides all these bottlenecks, the country's economy is growing every year at an average rate of 6 percent. It is now the 42ed largest country in the world based on Gross Domestic Product (GDP) and the current size of GDP is $307 billion[3] (as on 2012). In 2010 Bangladesh has got BB- credit rating from Standard & Poor's (S&P) which is below India but well over Pakistan and Sri Lanka in South Asia. Gradually Bangladesh is reducing its dependency on foreign grants and loans to finance the annual development budget. It was 85% in 1988 and as on 2010 it is only 2% of the said budget. Its per capita income in 2011 was $691.95 based on Constant price GDP and using Purchasing Power Parity (PPP) it was $ 1900, which increased to $2000 in 2012.

The population size of Bangladesh is 154.7 million (July 2012 est.) and out of which two-thirds live in rural areas and involved in agriculture. The GDP contribution of the agricultural sector was 17.20% in 2012. Bangladesh grows very significant quantities of rice, tea, potato, mango, onion and mustard. According to the Food and Agricultural Organization (FAO), Bangladesh is one of the world's largest producers of: Rice (4th), Potato (11th), Mango (9th), Pineapple (16th), Tropical Fruit (5th), Onion (16th), Banana (17th), Jute (2nd), and Tea (11th). In the 2011–12 fiscal years the readymade garments industry exported around US$ 15 billion worth of products, however in 2002 the exported amount was $5 billion. Recently Bangladesh has been ranked as the 4th largest clothing exporter by the WTO (The World Trade Organization). The industry is now employing more than three million workers, 90% of whom are women. A large part of foreign currency earnings also comes from the remittances sent by expatriates living in other countries. Dhaka is the capital city of Bangladesh. The country has the longest sea beach in the world: Cox's Bazar in Chittagong, and one of the biggest mangrove forests of the world: Sundarban in Khulna. The Royal Bengal Tiger of Sundarban is also very famous in every part of this world.

2.3 History of Bangladesh Capital Market

The stock market history of Bangladesh refers back to 28 April, 1954, when the 8 promoters incorporated the formation of "East Pakistan Stock Exchange Association Ltd.". However,

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2 Sources: CIA Fact book, IMF country report, Wikipedia, Bangladesh Bank and Bangladesh Statistical Bureau.

3 The calculation is based on Purchasing Power Parity (PPP).

formal trading started in 1956 and got registration as a public company on 23 June 1962. On 14 May, 1964 the name of "East Pakistan Stock Exchange Limited" was changed to "Dhaka Stock Exchange Ltd. (DSE)", which is the current name of the exchange.

The authorized capital of the exchange was Rs 300000 at the time of incorporation. This capital was divided into 150 shares of Rs 2000 each. However, through an extra ordinary general meeting (EGM) held on 22 February, 1964 the authorised capital of the exchange was increased to Tk 500000 (the new currency Taka had been adopted by this time) divided into 250 shares of Tk 2000 each. The paid up capital of the exchange is now Tk 476000 dividend into 238 shares of Tk 2000 each. However 43 shares out of 238 shares were issued at Tk 954364996 only per share of Tk 2000 with a premium of Tk 954278996.00[4].

Prior to independence in 1971, the number of listed companies in DSE was 196 with a total paid up capital of Tk 4 billion. However, the trading activities of DSE remained suspended till 1975 and following changes in the economic policy of the government, DSE resumed its activities in 1976 with only 9 listed companies, having a total paid up capital of Tk 137.52 million. The actual growth of the stock exchange in Bangladesh (the DSE) started since 1983, when the market capitalisation was raised to Tk 812 million. The year 1987 experienced a relatively steep rise in the market with 92 listed companies. With the liberalisation of policies in the 1990's the stock market gradually started to prosper. In 1995 the Bangladesh capital market achieved another milestone by opening second burse in the port city Chittagong, "Chittagong Stock Exchange (CSE)".

To strengthen the capital market in Bangladesh, the government has taken different steps along with the Security Exchange Commission; for example, the Capital Market Development Program (CMDP) on 20 November, 1997. The Asian Development Bank (ADB) had provided technical and financial support to this program. The CMDP aimed at (i) strengthening market regulation and supervision, (ii) developing the stock market infrastructure, (iii) modernizing stock market support facilities, (iv) increasing the supply of securities in the market, (v) developing institutional sources of demand for securities in the market, (vi) improving policy coordination, etc. Altogether there were ninety five measures in the policy matrix of the CMDP. In 1998 both the DSE (on 10 August) and CSE (on 2 July) implemented the Automated Trading System.

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[4] Based on the Annual report of Dhaka Stock Exchange, 2010 and US$1 = Tk. 79.83 as of December 2012.

Central Depository Bangladesh Limited (CDBL) was incorporated as a public limited company on 20 August, 2000 in DSE and 26 January, 2004 in CSE. Among the objectives of CDBL - to operate & maintain the Central Depository System (CDS) of Electronic Book Entry, recording & maintaining securities accounts, and registering transfer of securities are noteworthy. It is also providing a platform for the secondary market trading of Treasury Bills and Government Bonds. CDBL went live with the Electronic Treasury Bills registry of Bangladesh Bank on 20 October, 2003 and thereafter started equity market operations on 24 January, 2004. Before establishment of CDBL, the delivery, settlement and transfer procedures were handled manually and were plagued by lengthy delays, risks of damage, loss, forgeries, duplication and considerable investment in time and capital. Continuous structural developments, coupled with better market performance in 2000s have increased the credibility of Bangladesh Capital Market to prospective foreign investors.

As of December 2012, the number of securities listed in the DSE was 291 (the number of listed companies 242, number of listed debentures 8, and number of listed mutual funds 41) and in the CSE was 253 (the number of listed companies 209, number of listed debentures 3, and number of listed mutual funds 41). The market capitalisation of DSE was Tk 2487051.00 millions (US$ 33379 millions) and CSE was Tk. 2427408.20 millions (US$32556.44 millions).

2.3.1 Legal Control

The Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE) are registered Public Limited Companies and activities are regulated by Articles of Association rules & regulations and bye-laws along with the Securities and Exchange Ordinance - 1969, Companies Act – 1994, Securities & Exchange Commission Act – 1993, and Security Exchange (inside trading) regulation 1994.

2.3.2 Management of Stock Exchanges

DSE and CSE comprise 24 members of whom 12 are elected through direct election from the 238 and 129 shareholders respectively. Another 12 members represent distinguished personalities from different key economic and social arenas of the country. The CEO of the Exchange is also a Director of the Board.

2.3.3 Categorization of Securities

All the shares and securities are listed under different categories in DSE and CSE. These categories are based on certain criteria set by the Security and Exchange Commission (SEC) of

Bangladesh; criterias are – frequency of holding Annual General Meetings (AGM) and percentage of dividend declared in any financial year. Following are those categories used in DSE and CSE:

A-category companies: Companies which are regular in holding the current annual general meetings and have declared dividend at the rate of ten percent or more in the last English calendar year will be categorized as A-category companies.

B-category companies: Companies which are regular in holding the annual general meetings but have failed to declare dividend at least at the rate of ten percent in the last English calendar year will be categorized as B-category companies.

G-category companies: Greenfield companies. Greenfield issues refer to securities issued by the start-up firms. These firms are called green fields because they had not commenced commercial operations before going public.

N-category companies (Dated: July 03, 2006): All newly listed companies except Greenfield companies will be placed in this category and their settlement system would be like B-category companies.

Z-category companies: Companies which have failed to hold the current annual general meetings or have failed to declare any dividend or which are not in operation continuously for more than six months or whose accumulated loss after adjustment of revenue reserve, if any, is negative and exceeded its paid up capital are known as Z-category companies.

2.3.4 Indices in the DSE

A stock market index is a number that indicates the relative level of prices or value of securities in a market on a particular day compared with a base-day figure, which is usually 100 or 1000. There are many different ways of constructing an index. Currently, the Dhaka Stock Exchange (DSE) is using three different indices to benchmark the market and applying the International Organization of Securities Exchange Commissions (IOSCO) recommended methodology to calculate them:

Sl. No.	Index Name	Base Index	Composition
1	DSI	350 (as on 01-11-1993)	It includes all categories of share (A, B, G, N and Z) listed in DSE.
2	DGEN	817.63704 (as on 24-11-2001)	SEC was given directive regarding this index on 17-11-2001. The calculation of DGEN Index excludes Z (includes A, B, G, N) category of shares and securities.
3	DS20	1000 (as on 01-01-2001)	It includes the best performing 20 companies in DSE and was introduced in 2001.

Index Calculation Algorithm:

$$\text{Current index} = \frac{\text{Yesterday closing index} \times \text{Current market capitalization}}{\text{Opening market capitalization}}$$

$$\text{Closing index} = \frac{\text{Yesterday closing index} \times \text{Closing market capitalization}}{\text{Opening market capitalization}}$$

where, Current market Capitalization= $\sum$ (Last trading price ×Total number of indexed shares)

and, Closing market Capitalization= $\sum$ (Closing price ×Total number of indexed shares)

2.4 Bangladesh Capital Market Performance

2.4.1 Highest Records

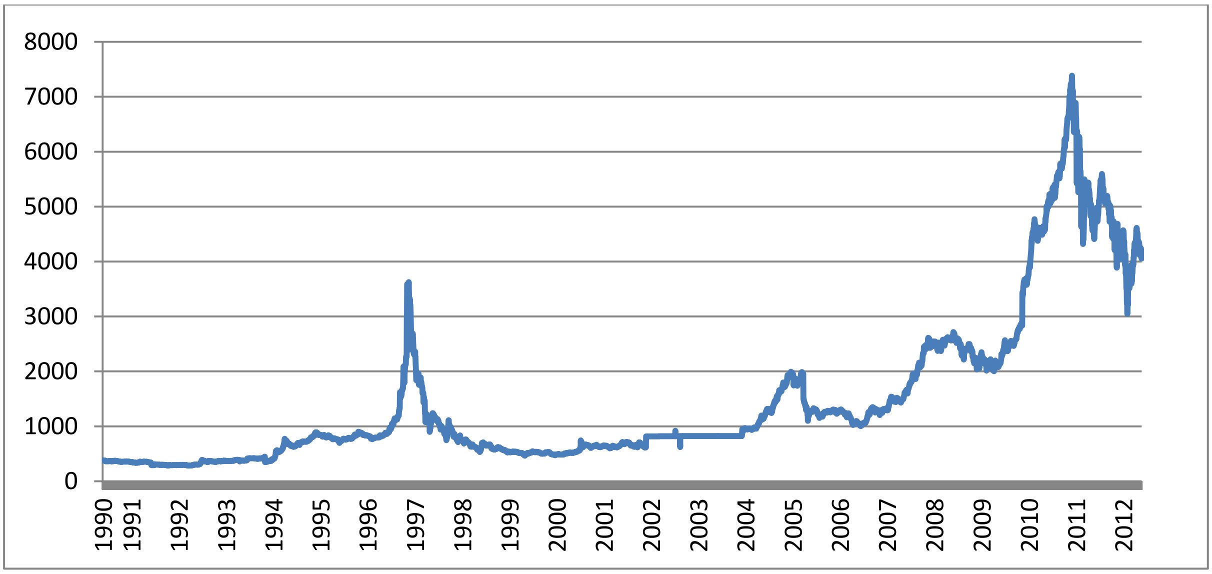
Dhaka Stock Exchange (DSE) has achieved following records (Table 2.1) at different times since the date of inception in 1954 to operating year 2011. Figure 2.1 shows the history of general index of DSE over a period from 1990 till 2012, where Y axis describe the index points and years are in X axis. This figure clearly demonstrates the two most significant rises and falls of the index during this entire period, namely 1996 and 2010-11.

Table 2.1: Highest records for DSE

Description	Values	Date
Total Number of Trades	389310	05-12-2010
Total Trade Volume	242856735	21-07-2011
Total Traded Value in Taka(million)	32495.76	05-12-2010
Total Market Capital in Taka(million)	3680714.20	05-12-2010
DSI Index	7383.94	05-12-2010
DSE General Index	8918.51	05-12-2010

Sources: Dhaka Stock Exchange

Figure 2.1: DSE General Index from 1990 - 2012



Source: Calculated Based on Data from Datastream

2.4.2 Stock market size

2.4.2.1 Market capitalization

Analysts frequently use the market capitalization to GDP ratio as a measure of stock market size. In terms of economic significance, the assumption behind market capitalization is that market size is positively correlated with the ability to mobilize capital and diversify risk on an economy wide basis. Based on this methodology the size of Bangladesh stock market (DSE) is shown in Table 2.2. Market capitalization ratio has increased from 0.869 % in 1991-92 to 21.041 % in 2011-12 with an average 33.98% increase in market capitalization every year over this period. Total market capitalization reached to US$23500 million in 2011-12 from only US$269 million in 1991-92.This shows a remarkable cumulative growth of 781.68 percentages.

Table 2.2: Stock market size of Bangladesh, 1990-91 to 2011-12

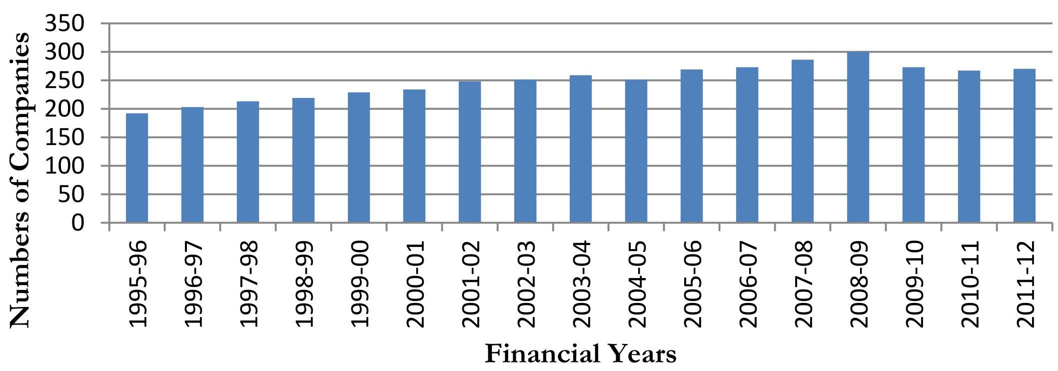
Period	Market Capitalization (Millions US$)	Ratio of Market Cap to GDP	Period	Market Capitalization (Billions US$)	Ratio of Market Cap to GDP
1990-91	321	1.065	2001-02	1140	2.436
1991-92	269	0.869	2002-03	1190	2.508
1992-93	314	0.990	2003-04	1620	3.123
1993-94	453	1.366	2004-05	3320	5.864
1994-95	1050	3.109	2005-06	3040	5.036
1995-96	1340	3.527	2006-07	3610	5.832
1996-97	4550	11.191	2007-08	6790	9.929
1997-98	1540	3.632	2008-09	6670	8.385
1998-99	1030	2.345	2009-10	7070	7.909
1999-00	865	1.894	2010-11	15700	15.627
2000-01	1190	2.517	2011-12	23500	21.041

Data source: World Development Indicator, 2013.

2.4.2.2 Number of Listed Companies

The second indicator of market size is the number of listed companies. The rationale of including this measure is that, in general as the number of listed company increases, available securities and trading volume also increases over time. However, there are other frontier markets with hundreds of listed securities yet very low trading activity, e.g. Banja Luka stock exchange of Bosnia and Herzegovina (see Kallinterakis et al., 2010). With almost thousand listed stocks this market is notably thin as evidenced by its very low turnover ratio (i.e. 42%). Figure 2.2 shows that during the period from 1995-96 to 2011-12, the number of listed companies has grown from 192 to 270 with an average annual growth rate of 2.23 % per year.

Figure 2.2 : Number of listed Companie in the DSE



The Figure 2.2 also describe that more firms have become listed since early 2000 and their number increased till 2008-09, when the market reached its highest number of listed companies, 300. Unfortunately, in the following two years growth has declined by 9 percent and 2.20 percent respectively and finally stood at 270 in 2011-12.

2.4.3 Liquidity

Liquidity of stock market refers to the ability to buy and sell securities without causing any significant movement in the price and minimum loss of value (Chordia et al., 2005). Stock markets may affect economic activity through the creation of liquidity. Liquid equity markets make investment less risky--and more attractive--because they allow savers to acquire an asset--equity--and to sell it quickly and cheaply if they need access to their savings or want to alter their portfolios. At the same time, companies enjoy permanent access to capital raised through equity issues.

A comprehensive measure of liquidity would include all the costs associated with trading, including the time costs and uncertainty of finding a counterparty and settling the trade. As the direct measure of liquidity is beset with complexity, analysts typically use proxy measures of liquidity.

2.4.3.1 Total value traded to GDP

The total value traded to GDP ratio measures the organized trading of equities as a share of national output. Basically, the total value traded to GDP ratio complements the market capitalization ratio. Together, market capitalization and total value traded to GDP inform about market size and liquidity. Table 2.3 shows the liquidity situation of Bangladesh stock market in terms of total value traded to GDP ratio. The ratio has increased from 0.01% in 1991-92 to 16.22 % at the end of 2011-12. That indicates Dhaka Stock Exchange (DSE) is becoming more liquid over the periods to investors and to companies. Particularly, the growth had started to increase from 2007-08 (it was 7.017%) and reached to double digits in 2008-09.

Table 2.3: Liquidity measure- total value traded to GDP, 1990-91 to 2011-12

Period	Total Value Traded (Millions US$)	Value Traded to GDP (%)	Period	Total Value Traded (Millions US$)	Value Traded to GDP (%)
1990-91	6	0.020	2001-02	741	1.577
1991-92	3	0.010	2002-03	666	1.399
1992-93	11	0.035	2003-04	327	0.630
1993-94	15	0.045	2004-05	890	1.574
1994-95	107	0.317	2005-06	1000	1.659
1995-96	158	0.416	2006-07	943	1.523
1996-97	722	1.775	2007-08	4800	7.017
1997-98	385	0.909	2008-09	9240	11.615
1998-99	789	1.789	2009-10	14601	16.340
1999-00	789	1.726	2010-11	14692	14.640
2000-01	767	1.629	2011-12	18158	16.226

Data source: World Development Indicator, 2013

2.4.3.2 Turnover

The second measure of liquidity is the value of traded shares as a percentage of total market capitalization (the value of stocks listed on the exchange). This turnover ratio measures trading relative to the size of the stock market. High turnover is often used as an indicator of high level of liquidity. Turnover also complements total value traded ratio. While total value traded to GDP captures trading compared with the size of the economy, turnover measures trading relative to the size of the stock market.

Table 2.4 shows the turnover ratio of the stock market of Bangladesh. During the period of 1990-91 to 2011-12 it increased from 1.87% to 77.27%. The turnover ratio peaked at 206.52% during the year 2009-10 showing a declining trend afterwards. However, since 2006-07 this ratio has started to increase again. Previously, in 1999-00 the ratio had reached to 91.21% but started to decline and hovered around 20-70 percent until 2008-09, when it crossed the 100% growth rate for the first time.

Table 2.4: Liquidity measures – turnover ratio from 1990-91 to 2011-2012

Period	Total Value Traded (Millions US$)	Market Capitalization (Millions US$)	Turnover to Market Cap (%)	Period	Total Value Traded (Millions US$)	Market Capitalization (Millions US$)	Turnover to Market Cap (%)
1990-91	6	321	1.869	2001-02	741	1140	65.000
1991-92	3	269	1.115	2002-03	666	1190	55.966
1992-93	11	314	3.503	2003-04	327	1620	20.185
1993-94	15	453	3.311	2004-05	890	3320	26.807
1994-95	107	1050	10.190	2005-06	1000	3040	32.895
1995-96	158	1340	11.791	2006-07	943	3610	26.122
1996-97	722	4550	15.868	2007-08	4800	6790	70.692
1997-98	385	1540	25.000	2008-09	9240	6670	138.531
1998-99	789	1030	76.602	2009-10	14601	7070	206.521
1999-00	789	865	91.214	2010-11	14692	15700	93.580
2000-01	767	1190	64.454	2011-12	18158	23500	77.268

Data source: Calculated from World Development Indicator, 2013

2.4.4 Volatility

Volatility is a measure for variations of price of a financial instrument over time. This measure is an important factor in the comparison of risk and reward between stocks and other asset classes. This comparison helps to determine the appropriate strategic asset allocation for an investor, given his objectives and risk tolerance. There are different statistical and mathematical ways of calculating the volatility of a stock market. Among many, estimation of standard deviation and coefficient of variation (CV) based on market index are most widely accepted and used. As a third measure range (difference between highest and lowest stock market index of any year) can be calculated.

The calculated volatility of the Dhaka stock exchange on the DSI Index is given in Table 2.5. The range, standard deviation, and coefficient of variation for each year indicate that the market has been exposed to different levels of volatility at different times. The market was the most volatile during the year 1996 and 1997 when the capital market of Bangladesh experienced a sudden commencement of boom and a subsequent burst. However, the decreasing volatility trend after 1997 increases the market confidence. The standard deviation was highest in 2010 (range was also highest 2712.352) but the size of the market (mean index was 5476.640) captured this divergence, thus the market was not as risky as in 1996.

Table 2.5: Volatility of the Dhaka Stock Exchange

Year	Standard deviation	Range	CV	Mean	Year	Standard deviation	Range	CV	Mean
1995	48.594	185.029	0.060	804.167	2004	360.654	1017.500	0.262	1375.006
1996	860.964	2289.341	0.592	1453.960	2005	233.839	690.92.	0.171	1370.329
1997	377.757	1212.466	0.344	1098.929	2006	111.190	280.920	0.093	1194.039
1998	58.269	201.610	0.093	624.550	2007	555.585	1543.597	0.279	1989.798
1999	45.697	136.794	0.092	497.694	2008	173.514	642.675	0.071	2435.139
2000	66.560	176.486	0.115	578.741	2009	571.713	1714.225	0.222	2571.864
2001	73.297	222.180	0.108	680.530	2010	956.780	2712.352	0.175	5476.640
2002	49.392	125.460	0.061	814.704	2011	560.429	1993.750	0.111	5044.216
2003	61.364	217.040	0.075	820.672	2012	315.113	944.940	0.070	4526.672

Data source: Calculated from month end DSE all share index (DSI Index), DSE main board data.

2.4.5 Concentration

Market concentration can be measured by looking at the share of market capitalization accounted for by the large stocks or large sectors. In many economies only a few companies dominate the stock market. However, this high concentration is not desirable as it can adversely affect liquidity, and it is common to find a negative correlation between concentration and liquidity. The share of market capitalization accounted for by the four broad categories is used to measure the degree of market concentration in Dhaka Stock Exchange and it is presented in Table 2.6a. It indicates increasing market concentration by financial insititutions (FIs) and non-bank financial institutions (NBFIs) in Bangladesh stock market. Market capitalization for the largest sector during the period 2000-01 was Tk 6042.60 crores[5] (US$1.12 billion) which increased to Tk195639.44 crores (US$25.58 billion) by November 2011-12.

Table 2.6a further gives some interesting information related to market concentration, it shows that sometimes FIs and NBFIs sectors account for more than 50% of the total market capitalization and turnover in the Dhaka Stock Exchange. Altogether the DSE is very much concentrated to certain groups of shares, e.g. Banks, Fuels and Power, Telecommunication, Pharmaceuticals and other Financial Institutions are major among them. Surprisingly, about 26% of total market capitalization accounted to Banks in December 2012, which shows the dominance of this sector in Bangladesh capital market. The SEC of Bangladesh needs to be concerned about this fact otherwise over time it will negatively affect the liquidity of the market. In Table 2.6b we have further computed Herfindahl-Hirschmann Index (HHI),which is commonly accepted as a measure of market concentration. For calculation purpose we have used

[5] This is a local denomination of currency, 1 crore = 10 million. As of December 2012 the exchange rate is US$1 = 79.83.

market capitalization of fifteen major categories of industry listed in DSE. Results indicate that since 1995-96 the market was highly concentrated during 2003-04 to 2008-09 and moderately concentrated for rest of the periods. This implies market was monopolistic and only few industries were controling the over all market from 2003-2009. Table 2.6a shows that for this given periods financial and manufacturing sector were dominating other industries as they hold up to 95% of total market capitalization. In fact, according to HHI, the level of competition was always very low in DSE.

Table 2.6a : Concentration of Companies or Groups in Dhaka Stock Exchange

End of Period	FIs and NBFIs (%)	Manufacturing (%)	Service (%)	Miscellaneous (%)
1995-96	17.49	70.15	3.94	8.42
1996-97	13.78	61.38	4.22	20.63
1997-98	15.26	66.70	5.38	12.66
1998-99	17.03	66.48	4.96	11.52
1999-00	20.64	63.69	4.16	11.51
2000-01	32.16	55.20	3.24	9.40
2001-02	34.53	53.98	2.26	9.23
2002-03	33.63	54.67	2.19	9.52
2003-04	40.41	52.10	1.45	6.04
2004-05	50.20	44.05	0.81	4.93
2005-06	53.69	39.74	0.63	5.94
2006-07	59.08	35.28	0.44	5.19
2007-08	59.37	31.31	0.88	8.44
2008-09	44.17	41.91	2.85	11.07
2009-10	45.40	31.62	15.16	7.81
2010-11	47.61	34.60	10.32	7.48
2011-12	41.89	35.24	15.58	7.29

Source: Calculated from monthly economic trends of Bangladesh Bank.

Table 2.6b : Herfindahl – Hirschmann Index (HHI)

End of Period	HHI	Nature of Concentration
1995-96	0.122	Moderate
1996-97	0.120	Moderate
1997-98	0.110	Moderate
1998-99	0.113	Moderate
1999-00	0.118	Moderate
2000-01	0.145	Moderate
2001-02	0.154	Moderate
2002-03	0.147	Moderate
2003-04	0.193	High
2004-05	0.267	High
2005-06	0.284	High
2006-07	0.347	High
2007-08	0.311	High
2008-09	0.205	High
2009-10	0.148	Moderate
2010-11	0.144	Moderate
2011-12	0.138	Moderate
2012-13	0.118	Moderate

2.4.6 Foreign portfolio investment

Foreign portfolio investment is the opening of funds into a country where foreigners make purchases in the country's stock and bond markets for the purpose of realizing a financial return, which does not result in foreign management, ownership, or legal control. Foreign portfolio investment in equity and debt securities indicates the level of integration of a domestic stock market with stock market of other countries. It also indicates attitude of foreign investors to any particular stock markets. It pursues the growth of stock market as well. Bangladesh stock market is showing fluctuating trend in terms of foreign portfolio investment in equity and debt securities. Table 2.7 portrays the foreign portfolio investment situation in Bangladesh stock market for the period of 1992 -93 to 2008-09 (based on available data obtained from the Ministry of Finance and SEC, Bangladesh). From 1992 to 1994-95 purchases of shares by foreign investors exceeded the amount of shares sales and repatriation. After 1995-96 the trend was reversed and share sales and repatriation exceeded that share purchases for most of the years. During the period of 1995-96 and 1996-97 Bangladesh was experienced a massive outflow of foreign investment evidenced by Tk 633.21 crores repatriation and Tk 618.68 crores sales as against Tk 51.8 crores share purchases. Since then the trend was a declining one till 2004-05.

However, investment and repatriation both significantly increased from 2005-06 and maintained this trend till 2008-09.

Table 2.7: Foreign Portfolio Investment from 1992-93 to 2008-09 (in Crores Taka)

Year	Deposited to NRITA Funds	Investment into share Portfolios	Selling of Share Portfolios	Purchase Price of Selling Share Portfolios	Capital Gain or Loss	Profit other than Capital Gain	Repatriation
1992-93	31.69	38.75	8.12	3.54	0.58	0.33	3.86
1993-94	319.66	310.18	96.51	51.05	40.46	1.76	91.84
1994-95	309.44	298.27	133.42	92.81	40.61	9.27	138.89
1995-96	73.85	71.68	187.71	189.34	-1.63	14.68	197.2
1996-97	52.78	51.8	618.68	344.34	274.34	12.29	633.21
1997-98	30.98	31.6	51.75	69.31	-17.56	9.71	60.18
1998-99	9.51	9.56	41.07	53.16	-12.09	4.34	45.11
1999-00	27.89	39.36	58.44	878.7	-29.43	5.45	61.34
2000-01	30.44	32.35	34.43	33.79	0.64	5.18	37.76
2001-02	2.9	2.87	28.77	40.07	-11.3	3.2945	32.46
2002-03	11.66	12.01	5.13	7.3	2.99	3.09	7.71
2003-04	31.1	29.89	2.51	1.66	1.27	3.12	5.62
2004-05	7.91	5.31	26.6	9.08	17.66	3.67	31.55
2005-06	242.04	242.06	13.06	-	-	-	18.51
2006-07	848.56	835.92	119.86				184.23
2007-08	1041.05	1126.92	763.73				724.97
2008-09	363.8	382.47	1423.28				1272.94

NRITA - Non Resident Investment Taka Account, *Data source: SEC Annual Report, 2008-09*
Note: The exchange rate is US$1 = Tk. 79.83 as of December 2012. One crore is equall to Ten Million.

2.4.7 Performance of the DSE compared to other markets

The market capitalization of Bangladesh capital market was 7.068 billion US dollars in 2009, which increased to US$ 15.63 billion in December 2010 and US$ 23.55 in December 2011. It indicates a tremendous growth of Bangladesh capital market over the last couple of years. Indeed, the opportunities of this market are far-reaching. According to capital market experts Bangladesh stock markets need some structural changes (CPD, 2011). If we look at the following table (Table 2.8) then we could get a rough approximation of the economic importance of this market in Bangladesh compare to other emerging and developed capital markets over the world. It shows that the market capitalization of DSE is larger than Colombo stock exchange in South Asia but smaller than other regional and international markets. However, the market size compared to the GDP clearly shows that the DSE has scope to increase in value. The DSE was only 21.04 percent to the GDP in 2011 and that again decreased to 15.06 percent at the end of 2012. Therefore, investors in Bangladesh are looking ahead to see better performance of the DSE along with continuous legal, structural and regulatory progress.

Table 2.8: Comparisons of DSE with other Stock Markets of the world

Name of the Capital Market	Indices Name	Listed Companies	Market Cap (in US$ billions) (Dec 2012)	Turnover (in US$ Millions) (Dec 2012)	% of GDP*
South Asian Association of Regional Cooperation (SAARC) member Countries:					
Colombo Stock Exchange	CSE all share	287	16.97	96	41.30
Dhaka Stock Exchange	DSE GEN	270	23.50	18158	21.04
Bombay Stock Exchange	BSE	5191	1263.34	9065.4	114.10
Regional:					
Philippines	PSE Index (PSEi)	254	229.31	3045.1	83.20
Bursa Malaysia	FBM Emas	920	466.59	8276.2	186.70
Singapore	Straits Times Index	776	765.08	19024.7	247.70
Stock Exchange of Thailand	SET Index	558	389.76	20705.6	88.80
International:					
Hong Kong	HKEX LargeCap Index	1547	2831.95	93563.1	1197.10
Tokyo	TOPIX	2304	3478.83	315671.6	71.10
London*	FTSE 100	2891	3701.09	269352	84.10
NASDAQ OMX	Composite	2577	995.72	657391.6	26.60
Deutsche Borse	CDAX Price	747	4582.39	76144.2	43.20

*Figures are as on December 2011

Source: World Federation of Exchanges and website of respective stock exchanges.

2.4.8 Summary

From the above discussion it is evident that the DSE started in 1976, however, got the momentum since 1990. The market capitalization was less than US $1 billion in 1990 and that became 24 times larger by the end of 2011. During these years the market underwent through two major rises and fall; one in 1996 and the other one in 2010-11. Government and the Security Exchange Commission of Bangladesh are continuously taking several steps to improve the regulations and structure of the market through, e.g. the introduction of Circuit Breakers, Central Depository system, Corporate Governance Guidelines, and Over-the-counter Market.

The number of listed companies was only 9 when the market resumed after the liberation war, however the figure increased to more than 200 by 1999-00 and reached its peak in 2008-09. Currently the listed companies are 272. The traded value of stocks was only US$0.20 billion in 1995-96, which became US$45.79 billion in 2010-11. This indicates a significant growth in market liquidity. In general, like other emerging stock markets the DSE is highly volatile. However, market was less volatile till 2003 and entered into a more volatile regime since 2004. The only exception was 1996-97, when the standard deviation and the coefficient of variance of the DSE were the highest. We have found from the discussion that this market is also highly concentrated relative to the financial sector. About 42% of the market's total capitalization belongs to Banks, non-bank financial institutions and insurance companies. Finally, DSE was a profitable destination for foreign portfolio investors during early 1990s, but that significantly declined in late 1990s and early 2000s due to the effect of the major fall in 1996. Fortunately, investors are further looking back to this market and trends reflect that the foreign investment has grown in recent years. ***Appendix A*** shows some major events and their dates for the DSE.

2.5 Macroeconomic management policies in Bangladesh

The Liberation war of 1971 destroyed about a fifth of Bangladesh's economy, and the post-war dislocations left the country on a slow growth trajectory for the better part of two decade (Rahman and Yusuf, 2009). Therefore, following the liberation war the macroeconomic management of Bangladesh was primarily aimed at reviving a war-ravaged economy (Mahmud, 2004). Indeed, the macroeconomic outlook in Bangladesh, since the early 1970s[6], has undergone successive shifts in terms of policy environment, often linked with changes in the ruling political regime (Mahmud, 2004). During those early years of independence, the government's major objectives of planned macroeconomic development were increased national income, rural development, self-sufficiency in food, and increased industrial production. However, progress in achieving development goals was slow. Political turmoil and untamed natural hazards of cyclone and flooding combined with external economic shocks persistently derailed economic plans. In the mid-1970s the government shifted their policy towards privatisation and promotion of the public-sector with an overall objective to attain higher economic growth. From the late 1970s to the beginning of the 1980s, there was a short-lived episode of investment boom, with investment in both public and private sectors growing at nearly 15 percent annually in real terms (Mahmud, 2004; Rhaman and Yusuf, 2009). In fact, government had taken different steps to promote this

[6] Bangladesh was independent on 16 December, 1971.

growth such as relying hugely on the flow of foreign aid, providing cheap credit to local entrepreneurs, offering protected markets for domestic industries etc. Bangladesh's first five-year plan (1973–78) aimed to increase economic growth by 5.5% annually, but actual growth averaged only 4% per year. However, later, a special two-year plan for 1978–80 was undertaken, emphasizing on rural development, which unfortunately also fell short of its projected growth target.

In the early 1980s government adopted market-oriented liberalizing policy reforms along the guidelines of the World Bank and the IMF and implemented this reform under rigid aid conditionality (Rhaman and Yusuf, 2009). The main objectives of the 1980s reform were reducing fiscal and external deficit to a sustainable level. In 1991, with the reinstitution of elected government, a more comprehensive programme of macroeconomic reform program was initiated that included financial sector reform and liberalization measures to encourage investment, government revenue improvement efforts through fiscal policy reform, and tight monetary policy (Mahmud, 2004).

The steady growth of investment and savings rates lifted the economic performance from 1980s to 1990s. The ratio of investment to GDP increased around 23 percent in the 1990s from the 1980s due to a massive expansion of private investment. The annual rate of inflation was close to 13 percent in 1980s and came down to 5.6 percent in the middle of the 1990s. Altogether, these macroeconomic success of the 1990s could be described as a positive expansion of several fronts in Bangladesh: transmission into parliamentary democracy, strengthening of economic growth, and consolidation of economic stabilization in the face of declining foreign capital inflows.

In the following sections, the macroeconomic management policies and their trends in Bangladesh are discussed. Section 2.5.1 covers the monetary policies and their instruments used in Bangladesh. Section 2.5.2 describes the fiscal policies and their trends. Section 2.5.3 summarizes the overall macroeconomic achievements and future challenges for Bangladesh. Indeed, over the years government and central bank of Bangladesh have tried to improve the macroeconomic situation and that is why it has gone through different policy reform related to monetary and fiscal policy in the 1980s, 1990s and 2000s. The biggest policy transformation was in the early 1990s, right after the shift of political power to elected government from army government. In the following sections we explore the new stance of macroeconomic management in the twenty first century that has allowed Bangladesh to prove itself as one of the 'Next 11' emerging economies of the world.

2.5.1 Monetary policy:

Briefly speaking monetary policy is the policy adopted by the central bank for control of the supply of money as an instrument for achieving the objectives of general economic policy. As stated in the Bangladesh Bank[7] (the central bank of Bangladesh) Order 1972, the principal objectives of the country's monetary policy are: (i) to regulate currency and reserves, (ii) to manage the monetary and credit system, (iii) to preserve the par value of domestic currency, (iv) to promote and maintain a high level of production, employment and real income, and (v) to foster growth and development of the country's productive resources in the best national interest. While the long term focus of monetary policy in Bangladesh is on growth with stability like other economies, the short-term objectives are determined after a careful and realistic appraisal of the current economic situation of the country. Indeed, with the shifts of the policy stance of the government in various phases, necessary adjustments were made in the country's monetary policy (Khan and Sarker, 2006).

Major instruments of monetary control available with Bangladesh Bank are the bank rate, open market operations, rediscount policy, and statutory reserve requirement, which are summarized in Table 2.9.

[7] Bangladesh Bank was established on 16 December, 1971.

Table 2.9: Summary of Major Monetary Policy Instruments used in Bangladesh

Major Instrument of Bangladesh Bank	Description
Bank Rate	Until 1990, the use of this instrument was virtually non-existent in Bangladesh. The rate was changed on a few occasions only to align it with the re-fixation of the rates of deposits and advances of commercial banks. Moreover, the existence of refinance facilities at rates lower than the bank rate substantially eroded its significance. However, since 1990, the instrument has been put to use to change the cost of borrowings for banks and thereby to affect the market rate of interest. Bank rate was gradually lowered from 9.75% in January 1990 to 5% in March 1994 (see Figure 3.8). It was raised to 5.75% from 10 September 1995 and further, to 7.5% and 8% from 19 May 1997 and 20 November 1997 respectively. The rate was lowered to 7% from 29 August 1999, further decreased to 6% in October, 2001. However, Bangladesh Bank again reduced the rate to 5% in November, 2003. The current Bank Rate is 5% (as of 2012).
Open Market Operations (OMO)	These involve the sale or purchase of securities by the Bangladesh Bank to withdraw liquid funds from the banking system or inject the same into that system. OMO allows flexibility in terms of both the amount and timing of intervention, which did not exist in Bangladesh before 1990. Bangladesh Bank introduced a 91-day Bangladesh Bank Bill, a market-based tool for monetary intervention, in December 1990. The bank bill was subsequently withdrawn from the market. At present, OMO operations are conducted through participation of banks in monthly or fortnightly or weekly auctions of Treasury Bills.
Rediscount Policy	After the introduction of FSRP in 1989, the refinance facility was replaced by rediscount facility at the bank rate to eliminate discrimination in access to central bank funds. Refinance facility is now available for agricultural credit provided by Bangladesh Krishi Bank and for projects of Bangladesh Rural Development Board financed by Sonali Bank. Banks are advised to extend credit considering banker-customer relationship.
Statutory Liquidity Requirement (SLR) and Cash Reserve Ratio (CRR)	Cash reserve requirement (CRR) of the commercial banks has a significant potential to regulate money supply through affecting money multiplier, while statutory liquidity requirement (SLR) is generally used to affect the lending capability of the bank. Bangladesh Bank used these two instruments very infrequently before 1990 and very often after 1990. The CRR and SLR were 8% and 23% respectively on 25 April 1991 and were reduced to 7% and 22% respectively on 5 December 1991. Later, these rates were changed twice and set at 5% and 20% respectively on 24 May 1992. The CRR was further lowered to 4% from 4 October 1999. The downward revision in CRR and SLR was made to enable the banks to increase their lending capacity. The recent SLR and CRR are 19 and 6 percent respectively, declared in December, 2010.

Source: Bangladesh Bank and Banglapedia.

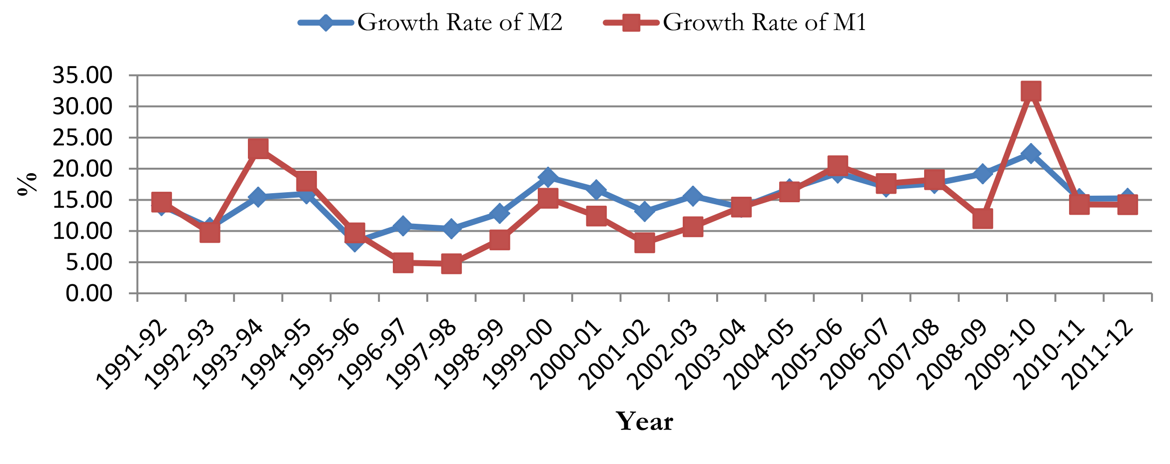
In Bangladesh, Monetary Policy Statement (MPS) was first issued by the Bangladesh Bank (BB) in January 2006. The intention was to present information on Bangladesh Bank's outlook on real sector, monetary developments over the immediate future, and the monetary policy stance it will pursue, based on its assessment of the developments over the preceding period.

In the following sections major components of monetary policy in Bangladesh and their trends are discussed.

2.5.1.1 Money supply

Since the comprehensive financial sector reform in 1990, one of the major objectives of Bangladesh Bank is to control the money supply. Indeed, a central bank takes expansionary and contractionary policy in different states to pursue the economic growth and to control the price level. The underlying assumption is that the growth of the monetary aggregates such as M2 (Broad money) has a direct impact on the domestic price levels. Broad money in any economy consists of currency plus demand deposits, travellers cheques, other checkable deposits, retail money markets, mutual fund balances, saving deposits and small time deposits. The broad money has increased to more than Tk. 5000 billion in fiscal year 2011-12 from around Tk. 250 billion of 1990-91; which indicates an average growth rate of around 15% over these periods (see Figure 2.3).

Figure 2.3: Growth Rate of M1 and M2



Source: Based on Bangladesh Bank Data

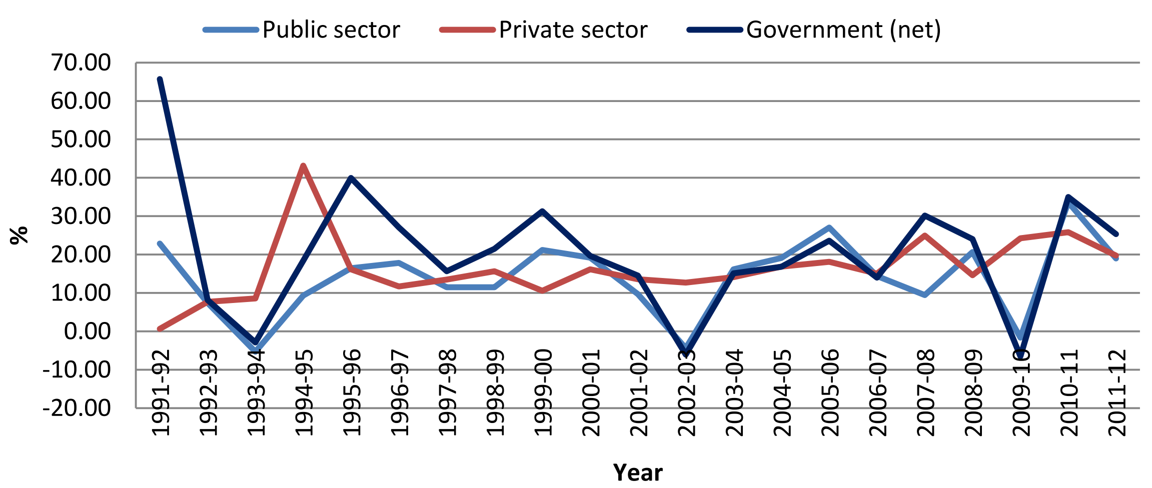
During July-December of fiscal year 2011-12, broad money increased by Tk. 349.77 billion or 7.94 percent against the increase of Tk. 362.48 billion or 9.98 percent in FY 2010-11. Of the components of broad money, currency in circulation has increased by 6.11 percent and demand deposit has increased by 3.12 percent while time deposits witnessed an increase of 8.93 percent in July-December, 2012 compared to similar period of 2011.

2.5.1.2 Domestic credit:

Domestic credit is another important macroeconomic component that measures the money supply in any economy. Domestic credit has increased by Tk. 480.13 billion or 11.08 percent during July-December in fiscal year 2011-12 whereas it increased by Tk. 421.49 billion in the same period of FY 2010-11. The amount indicates that domestic credits are increasing day by day and it is mainly due to the expansion of the credits to the private sectors. The public and private sector borrowing in fiscal year 1990-91 were Tk. 75 and Tk. 178.23 billion respectively. However, the amount of public credit increased to Tk. 928.13 billion and private credit to Tk. 3407.12 billion in 2010-11, then again Tk. 1104.33 billion and Tk. 4079.01 billion respectively in 2011-12.

Figure 2.4 is comparing the growth rate of public and private sectors credit from 1991 to 2012. The figure shows public sector borrowing was low in fiscal years 1993-94, 2002-2003 and 2009-10, however it was record high in 2005-06. The recent jump in public sector credit, indeed, breaks all the previous borrowing records. Domestic credit in public sector increased by Tk. 233.60 billion or 33.63 percent in the fiscal year 2010-11 while the growth rate was -1.66 percent in 2009-10. The Government (net) sector credit also rose to Tk. 734.36 billion or by 35.01 percent during 2010-11 while it decreased by Tk. 378.28 billion or 6.52 percent in 2009-10 from 2008-09. All these three components of domestic credit has strated to decline since 2011-12.

Figure 2.4: Growth rate of Public and Private Credit



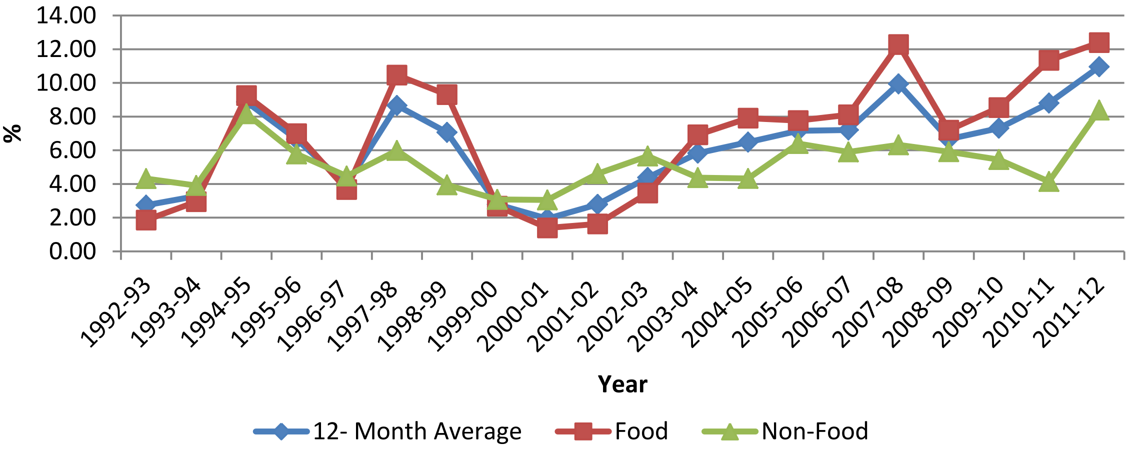
Sources: Based on Bangladesh Bank Data

2.5.1.3 Inflation

Inflation is always a big challenge for Bangladesh. The recent surge in inflation in Bangladesh is part of a longer term trend that started in fiscal year 2000-01. Inflation (General CPI) increased steadily from 1.66 percent in fiscal year 2000-01 to 9.2 percent in 2006-07 (see Figure 2.5). The increase continued in 2009 and kept hovering around 10 percent before reaching a nine year high of 11.6 percent in December, 2011. Inflation had a similar rising trend in both rural and urban areas however the growth rate of rural inflation was generally higher than that of urban inflation. Food price inflation has dominated the increase in overall inflation since 2002-03. It increased from 3.46 percent in 2002-03 to 8.11 percent in fiscal year 2006-07 and accelerated to 14.5 percent in December 2007. Indeed, the increase in food price inflation has driven overall inflation.

The persistent increase in prices of essential commodities has become a major concern for the Bangladesh government in recent years. Food inflation was 12.39 percent in February, 2012 and overall general inflation was 10.96 percent. Non-food inflation has been creeping up since October, 2006 and reached 8.2 percent in July, 2007 before declining to 3.9 percent through May, 2008. However, that again increased to 8.38 percent as of February, 2012.

Figure 2.5: Inflation



Sources: Based on Bangladesh Bank Data

To control this upward trend of inflation and also to keep the prices of essentials within the reach of the consumers, several steps were taken by the Government which include, among others, open market sale of the essential commodities, market monitoring, and ban on hoarding. Side by side, the Government pursued a contractionary monetary policy to keep the inflation at tolerable levels. To slow down the pressure of money supply Bangladesh Bank increased the CRR and SLR in December, 2010. Unfortunately, the pursued mechanism has not borught any immediate results.

2.5.1.4 Liquidity Management:

The "liquidity management" of a central bank is defined as the framework, set of instruments and especially the rules that central bank follows in steering the amount of bank reserves in order to control their price, i.e. short term interest rates consistently with its ultimate goals, e.g. price stability (Bindseil, 2000). In Bangladesh the central Bank regulates the liquidity position in the economy by the Cash Reserve Ratio (CRR), Statutory Liquidity Ratio (SLR) and the interest rate on Repurchase Agreements (commonly known as repo and reverse repo rate). Increase of excessive investments in the unproductive sectors such as consumer products and luxurious goods, real estate, and the capital markets etc. has created the stress on liquidity during the recent past. For example, excess liquidity of the scheduled banks stood higher at Tk. 27,716.99 crore[8] as of end April, 2009 as against Tk.12,988.58 crore as of end June, 2008, i.e. recorded 113.4 per cent growth. In this situation, the central bank has already taken several steps to contain credit growth. One of the steps of Bangladesh Bank is to increase the REPO rate.

On the other hand, as part of liquidity management Bangladesh Bank has set a minimum cash reserve requirement for all commercial banks of the country. The prime objective of this requirement is to ensure the operating liquidity of banks. However, the reserve ratio is sometimes used as a tool of monetary policy, influencing the country's borrowing and subsequently interest rates can affect the amount of loans available. CLR and SLR were set at respectively 6 percent and 19 percent in the Monetary Policy of December 2010.

As of June 2011, the total liquid assets of the schedule banks[9] were Tk. 1005.64 billion. By the end of December 2011, this figure went up by Tk. 1141.71 billion. Currently, the amount of required liquidity SLR is BDT 738.68 billion with the Bangladesh Bank. As a result of higher SLR and CRR from December, 2010 the excess liquidity of the schedule banks decreased by Tk. 43.50 billion in June 2011 compared to that of June 2010, which means it decreased by 28.49 percent in 2011. During 2011-12 Bangladesh Bank has 28.32 billion of excess reserve; however this value was 40.52 billion in 2010-11. That further indicates a declining trend in liquidity.

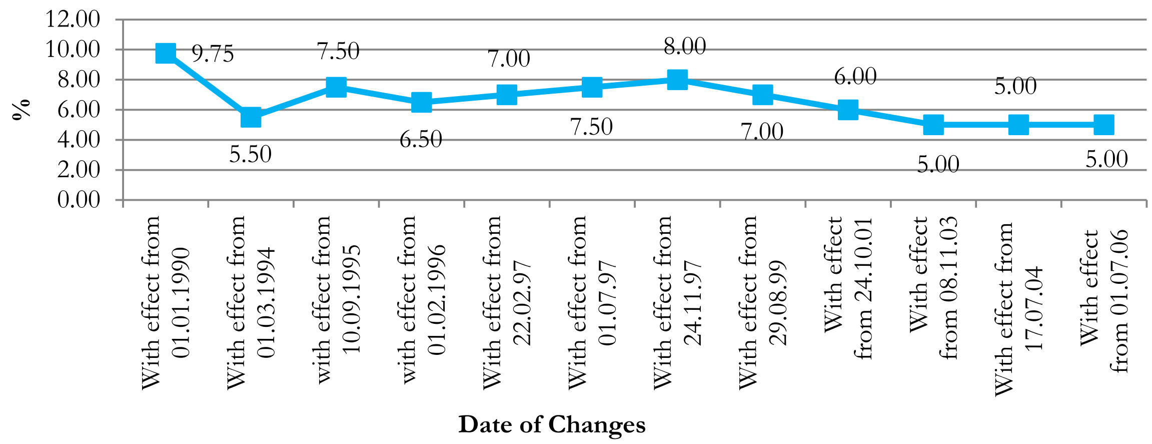
[8] One crore is equall to ten million.
[9] Schedule banks are those banks which get license to operate under Bank Company Act, 1991 (Amended in 2003) are termed as Scheduled Banks.

2.5.1.5 Bank rate and Interest rate

Since 1990-91 Bangladesh Bank has gradually been moving away from direct quantitative monetary control instruments such as credit ceilings on individual banks, direct controls of interest rate etc., to indirect controls such as bank rate, cash reserve ratio, open market operation etc.

The bank rate has now become an effective tool of monetary control by the Bangladesh Bank. With a view to ensuring adequate flow of finance to productive sectors and to boosting economic activity, the rate was gradually lowered from 9.75 percent on 30 June 1990 to 5 percent on 3 March, 1994 (see Figure 2.6). In view of an expansionary trend in credit and liquidity towards the end of fiscal year 1994-95, the rate was raised gradually on three occasions and was set at 6.5 percent on 1 February, 1996. The rate again increased to 8 percent in 1997 before coming down to 5 percent in 2003. Since 1 July 2006 Bank rate has remained at 5 percent.

Figure 2.6 : Bank Rate



Sources: Based on Bangladesh Bank Data

There was a time when Bangladesh Bank determined the interest rates for commercial banks. Later, commercial banks were allowed to fix their own interest rate within certain prescribed bands. However, under the Financial Sector Reform Programme of 1990 this regulation was further liberalized and included semi-annual reviews of the interest rate structure and its adjustment in order to reflect changes in the inflation rate and the cost of lending of the banks. Effective from April 1992, interest rate bands were abolished for all except three priority sectors: agriculture, exports, and small and cottage industries.

Table 2.10 summarizes the current interest rate trend of Bangladesh. It shows bank rate, weighted average call money rate and weighted average schedule banks' borrowing and lending rate. Call money rate is basically the overnight borrowing or lending rate of a commercial bank from another commercial bank. This rate explains the demand of money in the economy and therefore also represents liquidity position of commercial banks. The average call money rate for the last twenty months of 2012 was 10.77 percent, which usually reached a low during April and a high during December-January of any particular year. It is important to note that the call money rate has taken a dramatic upward shift since early January, 2011. Macroeconomic and financial market experts claimed this period as 'liquidity crisis' and linked it with recent fall in the capital market of Bangladesh (New Age, 2011a).

Table 2.10: Interest rate trend in Bangladesh

End of period	Bank rate	Call money market's weighted average interest rates on		Schedule banks' weighted average interest rates on		Spread
		Borrowing	Lending	Deposits	Advances	
2005	5	12.82	12.82	8.26	13.77	5.51
2006	5	11.16	11.16	7.46	12.8	5.34
2007	5	8.06	8.06	6.08	11.34	5.26
2008	5	4.39	4.39	6.29	11.51	5.22
2009	5	10.24	10.24	7.09	12.4	5.32
2010	5	7.37	7.37	6.84	12.78	5.95
2011	5	11.11	11.11	6.99	12.6	5.61
2012	5	9.57	9.57	5.9	11.25	5.35

Source: Bangladesh Bank

On the other hand, Table 2.10 also describes the weighted average schedule banks' deposits and advance rate in Bangladesh (from 2005 to 2012). Based on this information, the average spread between this deposit and advance rate is 5.45 percent, which represents banks' earnings from money management. Usually, capital market investors compare this deposit rate with the rate of return from shares and make their investment decisions.

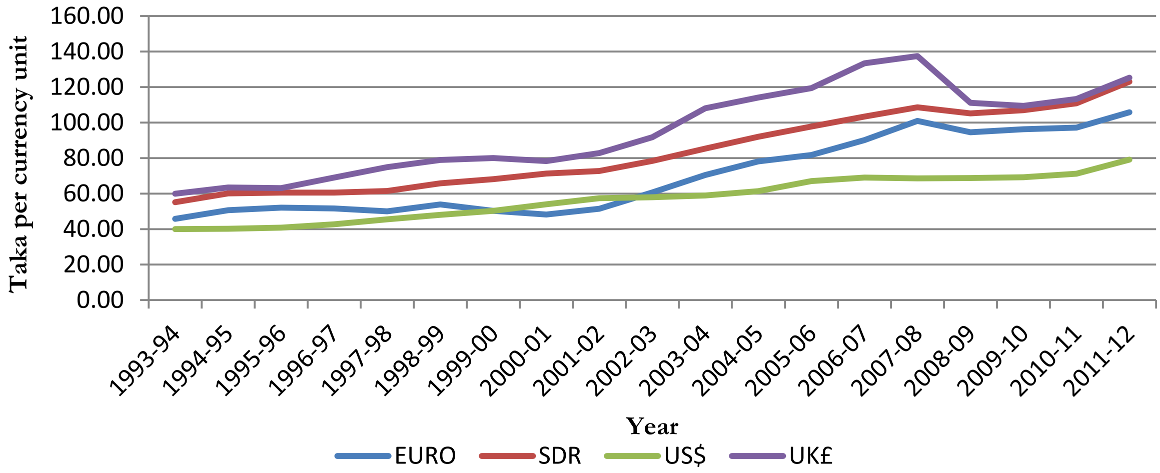
In Bangladesh commercial banks are following 'oligopolistic pricing strategy' for determining their lending rate (which makes the spread so high) and that discourages private investments. However, there are several reasons why banks maintain more than 5 percent difference between deposits and advance rate. First, to recoup the costs of their non-performing loans; second, to meet the highest corporate tax expenses; third, banks hardly earn anything on government securities which they are obliged to buy to meet the SLR; and fourth, due to lengthy court procedures and loopholes in the system involved in loan disputes.

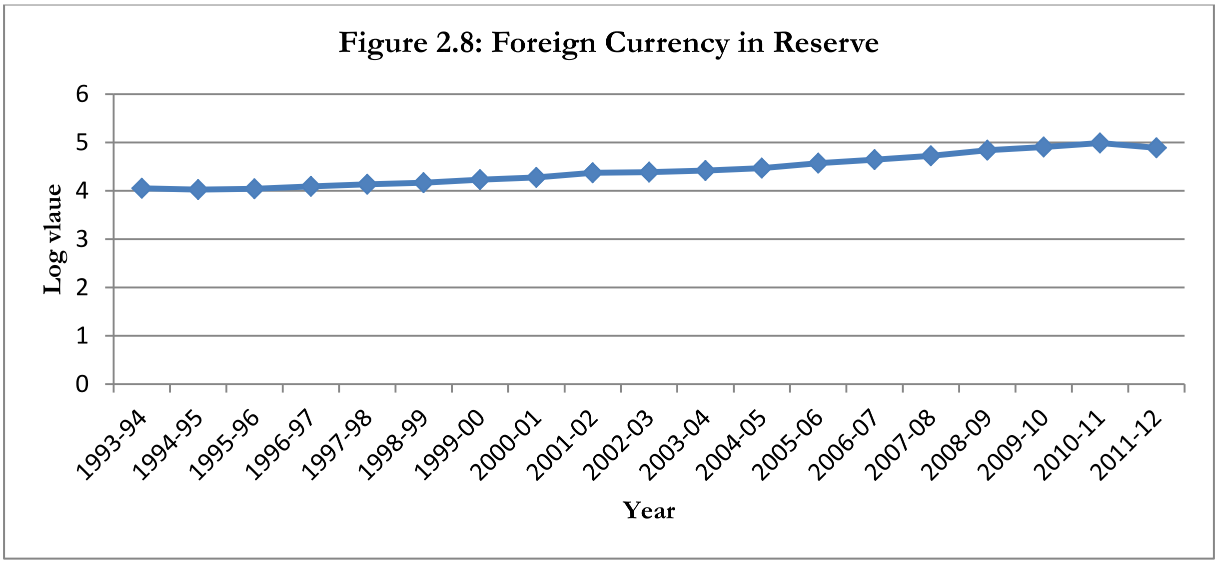
2.5.1.6: Exchange Rate

Bangladesh Bank has reformed its foreign exchange policies and implemented them with a view to creating a market friendly environment to induce investment, growth and productivity. Until January 1992, Bangladesh had a multiple exchange rate system. Thereafter, steps were taken to stop the secondary exchange market system and unify the exchange rate. On 24 March 1994 Bangladesh accepted the Article VIII obligations of the International Monetary Fund, a commitment to declare its currency convertible for current account transactions and liberalize exchange transactions on its current account. In May 2003, central bank has introduced a floating exchange rate system. Figures 2.7 and 2.8 show the exchange rate of the taka against major currencies and foreign currency reserves with Bangladesh Bank respectively. The improved reserve position together with a relatively stable external nominal value of the taka in relation to a weak domestic demand for external currency had put the real exchange rate minimum until 2002-03. But there was an upward pressure on the general price level and exchange rate since 2003-04, mainly as a result of a rise in the price of major commodities in international markets.

In the recent financial year, i.e. 2011-12, the overall increase in commodity and food prices has further raised the cost of imports while the flows of remittances have relatively declined. As a result Bangladeshi Taka against dollars has depreciated. The exchange rate against the US dollar has dropped and the US$ stands at 1:84.50 against taka on 8 February 2012.

Figure 2.7: Exchange Rate





Source: Based on Bangladesh Bank Data

2.5.2 Fiscal policy

Fiscal policy usually refers to the use of taxation and government expenditure. The fiscal policy of the government is meant to maintain balance between public income and expenditure to sustain macroeconomic stability and fostering economic growth (Daniel and Davis, 2006). Khan and Sarker (2006) mention that the fiscal policy in Bangladesh basically comprises of activities, which the country carries out to obtain and use resources to ensure optimum efficiency of the economic units. The policy influences the behaviour of economic forces through public finance. Major objectives of the fiscal policy of Bangladesh are to ensure macroeconomic stability of the country, promote economic growth, and develop a mechanism for equitable distribution of income. The main tools to achieve these objectives are variation in public revenue, variation in public expenditure, and management of public debt. These are reflected in the budgetary operations of the government, prepared and implemented on a year-on-year basis (Khan and Sarker, 2006).

In the early 1990s, the government of Bangladesh undertook some comprehensive steps towards improvement of the country's fiscal position. The major objective of government fiscal policy during that time was to restrict the growth of current expenditure to a level below the growth of the nominal GDP, thereby making more resources available to support the annual development programme (ADP). In line with the Enhanced Structural Adjustment Facility (ESAF) of the IMF, a number of reforms were initiated to enhance government revenue and to improve fiscal management (Mahmud, 2004). Some of those measures are: i) domestic revenue mobilization from value added tax (VAT), expansion of the tax base for direct taxes, and lowering of the tax rates for both individuals and corporations; ii) some rationalization of the tax structure; iii) gearing revenue collection to budget targets through better forecasting of revenue; iv) attempts have been made to rationalize the direct tax system by lowering the high corporate and personal income tax rate and by reducing exemptions etc.

These reform measures resulted in a remarkable improvement in the fiscal situation of Bangladesh after 1990. The improved fiscal trends were reflected in the government revenue to GDP ratio. On the other hand, public investment has increased as a result of higher utilization of funds of the Annual Development Programme. Some procedural improvement and better monitoring have contributed to this positive outcome. There has also been some improvement in public savings and investments. As a result, the shortage of local funds that had constrained the project implementations capacity and had shrunk the country's absorptive capacity for project aid for a long period was largely removed (Khan and Sarker, 2006).

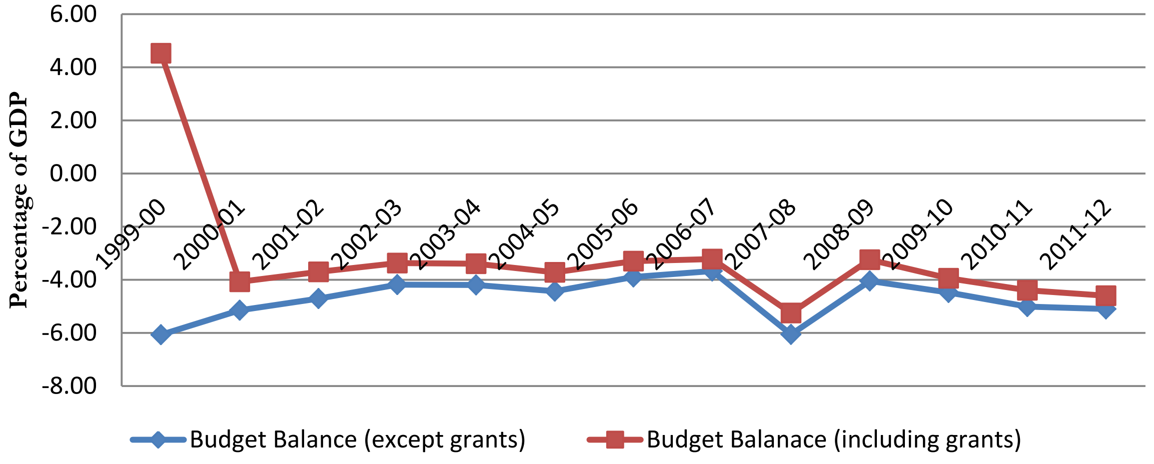
In the following sections different characteristics of the fiscal policy of Bangladesh government are briefly discussed.

2.5.2.1 Budget Deficit

Like many other emerging economies the budget deficit is always a big concern for the Bangladesh government (see Figure 2.9). The figure shows the overall budget deficit of Bangladesh with and without foreign grants as a percentage of gross domestic product (GDP) from 1999-00 till 2011-12. It is evident in the chart that the yearly budget deficit of Bangladesh was around 4 percent of GDP, but was slightly higher than 6 percent in 2007-08.

Indeed the impact of fiscal reform of the early 1990s and the improvement of the government's fiscal performance was reflected in the budgetary outcome of the country. The overall budget deficit was 8.4% of GDP during the 1980s and came down to less than 6% in 2000s, thus providing a breathing space for the government. However, there was a considerable slippage in the expenditure programme of the government due to the floods while revenue collection lagged far behind the target (Khan and Sarker, 2006). As a result, the overall budget deficit shot up to 7.8% in the FY 1998-99. Due to the significant improvement in macroeconomic performance the budget deficit ratio came to around only 3.9 percent in 2009 (USAID, 2010). In 2011-12 fiscal year, the overall budget deficit was estimated at Tk. 45,204 crore which is 5 percent of GDP and is 0.6 percent higher than that of the previous year.

Figure 2.9: Budget Balance as a percentage of GDP

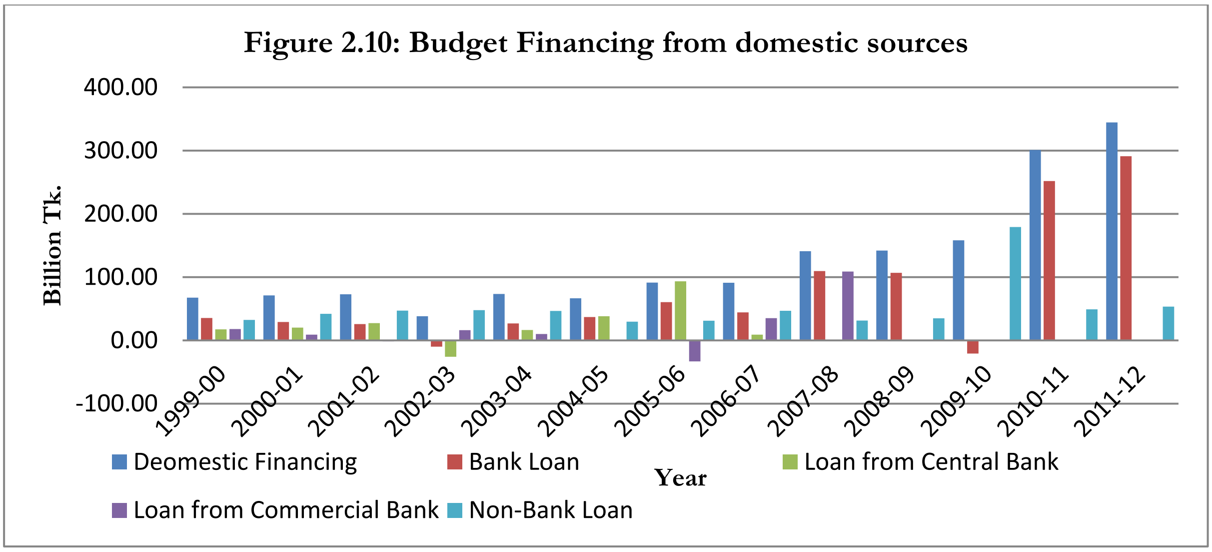


Source: Based on Bangladesh Bank Data

2.5.2.2 Deficit Financing

There are two sources of deficit financing: internal (i.e. domestic) and external (i.e. foreign debt). Economic theory tells that debt financing is inflationary when met by borrowing from the central bank whereas there is a possibility of crowding out of private sector investment if the borrowing is conducted from commercial banks (see Fisher, 1988). Further, if it is raised by issuing bonds, the cost of debt financing will be higher.

Deficit financing from the central bank and schedule banks has become a basic feature of the fiscal policy of Bangladesh. The government has become more dependent on banking sectors rather than non-banking sectors for domestic financing over time (see Figure 2.10). On the other hand, the opportunity to borrow from the public to finance the deficit budget is very limited in this country and is due to the poor savings capability of the people (Unnayan Onnesa, 2011). Therefore, the opportunity of non-inflationary financing for budget deficit is minimal.



Source: Based on Bangladesh Bank Data

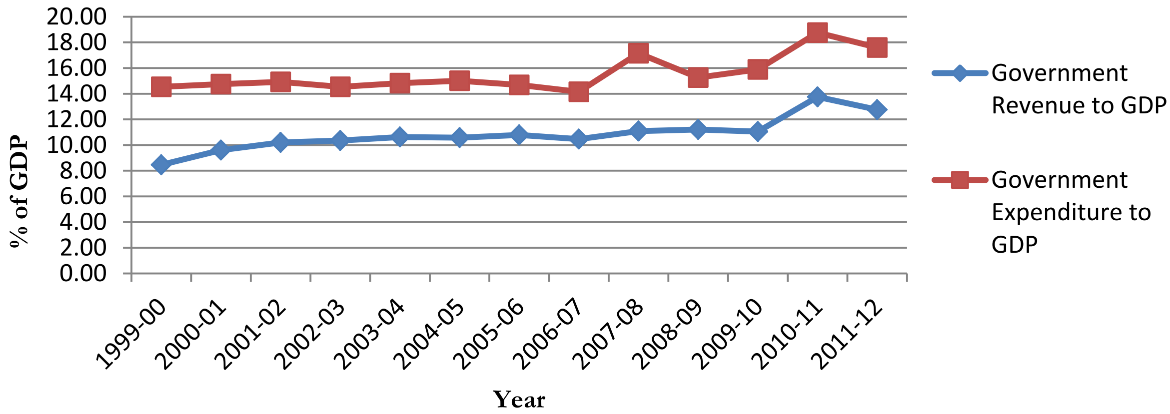
In FY 2010-11, the government has borrowed 4.43 times higher from banking sectors (BDT 11,240.5 crore) in comparison to that of FY 2001-02 indicating a sharp crowding out effect which has dampened private investment. In particular, the government has exceeded its set targets of borrowing from the banking sector in the last three fiscal years (Unnayan Onneshan, 2013). For example, government borrowing has increased to Tk. 285 billion from the banking sector in the revised budget of FY 2012-13 from Tk. 230 billion in the proposed budget in the same year.

Economists and financial market experts are worried about this high end borrowing tendency of the government from the banking sector. According to them it is not only increasing the inflation but also creating a crowding out effect, therefore private borrowing will be discouraged and industrial production will be hampered. Further, through the financial system this kind of deficit financing will also influence capital markets negatively. In addition, a significant decrease in foreign sources of deficit financing has forced the Bangladesh government to rely more on internal debt financing. Untill 1989-90, the major share of the fiscal deficit of Bangladesh was financed through foreign grants (Unnayan Onneshan, 2013). However, since then there has been a considerable shift in the sources of funds for financing the budget deficit from foreign to domestic sources (Khan and Sarker, 2006). Domestic sources had provided only 15% of the total deficit during 1989-90 and the ratio has become 75% in 2010-11. Unfortunately, in recent years foreign source of funds is heavily depending on loans rather than grants. For example, as of fiscal year 2010-11 the external debt burden was US$ 21,347.44 million while it was only US$ 65 million in 1972-73 (Unnayan Onneshan, 2011).

2.5.2.3 Revenue and Expenditure Management

The fiscal reform of 1990 increased revenue collection and some disciplinary measures in current expenditure improved the overall fiscal trend in Bangladesh. However, Mahmud (2004) argues, in spite of an appreciable improvement in revenue collection in the 1990s, the revenue to GDP ratio in Bangladesh remains very low compare to international standards. Even within South Asia, the revenue to GDP ratios of Pakistan (10.2 percent), India (17.7 percent), and Sri Lanka (15.3 percent) exceed that of Bangladesh (10 percent) by a wide margin (Heritage Foundation, 2012; Mahmud, 2004). The following chart (see Figure 2.11) shows the growth of government revenue and expenditure to GDP respectively for the last 13 years. The graph shows that the government revenue to GDP ratios of Bangladesh was always between 10 and 12 percent until 2009-10. Only in recent fiscal years (2010-11) it has touched 13.75 percent, however, the ratio was only 8.47 percent to GDP in 1999-00. Both percentages have slightly declined in the 2011-12.

Figure 2.11: Government Revenue and Expenditure toGDP



Source: Bangladesh Bank

Like any other tax based economy, tax is the main source of revenue for government expenditures. However, Banagladesh has a very low tax to GDP ratio, Mahmud (2004) claims that this results from huge tax evasion and from the fact that agriculture and other informal sectors are virtually excluded from the tax net due to weak tax administration. In fact, most of the revenue gains during the early 1990s were due to the introduction of the value added tax (VAT). In fact efforts have been taken by the government to generate higher domestic resources based on various tax reforms as well as reforms in the financial sector. As a result, tax revenue has increased to 11.42 percent to GDP in 2010-11 from only 6.78 percent in 1999-00. However, both NBR[10] and Non-NBR revenue[11] declined in 2011-12, government has failed to meet its target.

On the expenditure side, public spending patterns have undergone significant changes in the last two decades, reflecting the changing development role of the government under economic reforms (Mahmud, 2004). The government has given increased emphasis to human resource development and poverty alleviation programmes. Gradually government has been concentrating more on providing public goods in the form of education and health, physical infrastructure, and rural development.

2.5.3 Summary

In the macroeconomic management of any country, monetary and fiscal policies are two very important instruments which should be used in a complementary and flexible manner by the central banks and governments to achieve growth and inflation objectives. Coordination of the management of monetary, fiscal and other policies depends on the knowledge of macroeconomic relations among the financial and real economic variables and ideally, such relations need to be quantified and incorporated into a workable economic model. In Bangladesh such a model is absent and therefore these issues are resolved and such coordination takes place through regular high level consultations among concerned ministries. However, the good news is

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[10] The National Board of Revenue (NBR) is the central authority for tax administration in Bangladesh. Administratively, it is under the Internal Resources Division (IRD) of the Ministry of Finance (MoF). MoF has 4 Divisions, namely, the Finance Division the Internal Resources Division (IRD), the Banking Division and the Economic Relations Division (ERD). Each division is headed by a Secretary to the Government. Secretary, IRD is the ex-officeo Chairman of NBR. NBR is responsible for formulation and continuous re-appraisal of tax-policies and tax-laws in Bangladesh. Negotiating tax treaties with foreign governments and participating in inter-ministerial deliberations on economic issues having a bearing on fiscal policies and tax administration are also NBR's responsibilities. The main responsibility of NBR is to mobilize domestic resources through collection of import duties and taxes, VAT and income tax for the government. Side by side with collection of taxes, facilitation of international trade through quick clearance of import and export cargoes has also emerged as a key role of NBR. Other responsibilities include administration of matters related to taxes, duties and other revenue related fees/charges and prevention of smuggling. Under the overall control of IRD, NBR administers the excise, VAT, customs and income-tax services consisting of 3434 officers of various grades and 10195 supporting staff positions.

[11] NBR taxes mainly come from income and profit, value added tax (VAT), import duty, export duty, excise duty, supplementary duty and other taxes and duties. In contrast, non-NBR taxes consist of narcotics duty, motor vehicles tax, land tax and stamp (non-judicial). Non-tax revenue is collected from dividend and profit, interest, administrative fees, penalty and forfeiture, services, rent and leasing, tolls and levies, non-commercial sale, defence, non-tax receipts, railway, post office department, T&T Board, and capital receipts.

that Bangladesh has made a start in converting the gains of macroeconomic stabilisation into sustained and accelerated growth (USAID, 2010; Mahmud, 2004).

Bangladesh experienced solid average growth of 6.3 percent between 2004 and 2008 (USAID, 2010). In fiscal year 2009, despite the global financial crisis, Bangladesh recorded 5.9 percent real GDP growth, which was only a 0.3 percent decline from the 6.2 percent growth rate of 2008. In 2010-11 the GDP growth rate was again higher than 6 percent. This was largely due to the sound macroeconomic policies implemented by the government over the period (USAID, 2010; ADB, 2011). This macroeconomic success, i.e. strong growth and gains in poverty reduction have also caught the attention of the international community. In 2005, Goldman Sachs coined the term 'Next 11' for Bangladesh and ten other countries with growing consumer markets and significant industrial potentials.

From our discussion, we can draw some conclusions regarding the macroeconomic managmenet in Bangladesh. First, the current low tax-GDP ratio has to be increased to support higher public expenditure and to increase the contribution of the government's fiscal operations to domestic savings. Government needs to widen the tax base and improve the overall tax system so that people feel encouraged to submit their tax files. Second, to achieve sustained rapid growth Bangladesh must achieve higher levels of investment. Removing impediments to investment will require a multifaceted approach of business environment and administrative reforms coupled with workforce development and major improvement in infrastructures (USAID, 2010).

Third, there is a serious concern regarding the quality and efficiency of public development expenditure which need to be addressed (USAID, 2010 and Mahmud, 2004). Fourth, financial sector reforms must be strengthened in order to reduce the cost of financial intermediation and institutional sectors reforms must address the whole range of factors which are adversely affecting the investment incentives and production efficiency.

The other big challenges to the government of Bangladesh are inflation and deficit financing. Present food price hikes in the international market and continuous money supply to the economy for financing the government deficit budget create extra pressure on price levels and increase the inflation rate to an all time high. The current inflation rate is close to 12 percent (2011-12); it was lower than 3 percent in 1992-93. The central bank has taken steps to meet this challenge through contractionary monetary policy; however, expansionary fiscal policy of the government is creating a counter force to that. Therefore it is difficult for the Bangladesh Bank to control the inflation ramble. In addition to that, the power supply has become another problem for Bangladesh on the way to economic growth and macroeconomic stability. In fact the government and the central bank have to work jointly to achieve a sustainable macroeconomic growth.

2.6 Chapter summary

Following the economic assumption that the stock market is independent from inflation and macroeconomic policies (Fisher, 1988), the central bank and government of Bangladesh have given little attention to the impact on capital market while formulating monetary and fiscal policies. However, the recent stock market collapse which started from late 2010 has created concerns among market experts and investors. They claimed it is due to the conflict between the contractionary monetary policy of the Bangladesh Bank and the expansionary fiscal policy of the government.

Economic growth and macroeconomic stability had been given priority by the Bangladesh government since 1990. Therefore both the monetary and fiscal policies were in expansion to attain those objectives. As a result the economy had achieved 5 percent plus GDP growth rate till the fiscal year 2002-03 and more than 6 percent thereafter except a small deviation in 2008 and 2009. Indeed, Bangladesh Bank had taken different expansionary monetary measures to pursue this successive economic growth. For example, to increase the money supply through banking channel Bangladesh Bank reduced the bank rate from 9.75 percent (in 1990) to 5.50 percent in 1994 and then again 5 percent from 2003. On the other hand, central bank also focused on domestic money and credit expansion, therefore, the aggregate broad money supply increased to Tk. 5659.06 billion in December 2012 from Tk. 250 billion in 1990-91. Further, aggregate domestic credit also increased to Tk. 5516.12 billion in December 2012 from only Tk. 253 billion in 1990-91.

Nonetheless, the biggest challenge to Bangladesh Bank was inflation; this continuous expansionary policy, coupled with huge money supply in the economy and increasing food prices in the world market lead to the consumer price index plunge in 2000s. Point to point inflation rate has reached to double digit (10.17 percent) in the fiscal year 2011-12; however, it was only 1.66 percent in 2000-01. Therefore, Bangladesh Bank had no choice other than issuing a contractionary monetary policy, which they did in December, 2010. Bangladesh Bank had declared a new monetary policy on 1 December, 2010 and increased the cash reserve ratio (CRR) and statutory liquidity ratio (SLR) by 50 basis point respectively. According to the new policy commercial banks were asked to maintain 5.5 percent cash reserve instead of 5.0% and SLR to

19 percent rather than 18.5 percent. Banks were also asked to comply with this new stance from 15 December, 2010.

The quickest impact of this contractionary monetary policy was on stock markets, Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE). Both the markets had lost more than 35 percent index value within 60 days.

The contractionary monetary policy is not solely responsible for this stock market crisis; the expansionary fiscal policy of the government is also creating a counter pressure on this market through liquidity and inflation channel. In fact, Bangladesh is now experiencing with expansionary fiscal and contractionary monetary policy, and unfortunately none of these policies bring any positive results for the economy.

Budget deficit and its financing in Bangladesh, like in many other developing countries, is a very important parameter for analyzing monetary and fiscal effect on the country's overall economic development (Unnayan Onneshan, 2011). In the early years, from independence to 1989-90, Bangladesh government was mostly dependent on foreign aid to finance the budget deficit. But in recent years financing from Bangladesh Bank and schedule banks has become a common phenomenon (CPD, 2011). On the other hand, very low tax revenue to GDP ratio, food price hikes in international markets, higher costs of energy, and a huge budget allocation for social safety net is continuously enhancing the gap between revenue and expenditure in annual budget, and ultimately force the government to rely heavily on borrowing from banking sectors.

Deficit financing, money supply and inflation are interlinked. The government has to ensure adequate money supply for financing the deficit budget which in turn increases inflation. Moreover, taking loans from domestic sources is increasing the market interest rate and hindering private investment. The outcomes are lesser actual production than potential production and more inflation (Unnayan Onneshan, 2011). Overall, the current fiscal policy of Bangladesh government is affecting stock markets from different perspectives. For example, it creates crowding out effects thus small borrowers (i.e. small companies) become negatively affected to get access to bank loans, which, therefore, leads to slow down the industrial productions. On the other hand, higher inflation and larger demand for bank funds increase the market interest rate and ultimately negatively affect the profitability of firms by raising the cost of capital.

However, all these arguments are critically run-out of proper empirical evidence. This thesis is trying to fill that gap by developing and explaining the empirical relationship between monetary policy, fiscal policy and the stock market. Therefore, responsible regulatory bodies (i.e. central bank, ministry of finance, SEC and stock exchange) will be able to design their rules and regulations based on these developed linkages. Further, countries with similar economic characteristics can also apply this causal relationship and accordingly can make their strategic plans.

In the next chapter this study discusses the theoretical development of linkage between macroeconomic management policies and the stock market. The chapter also reviews related empirical evidence on this relationship as well as other micro and macro perspectives of the stock market around the influence on stock returns, volatility and market liquidity.

Chapter 3:
Theoretical Review

3.1 Introduction:

This chapter presents the theoretical discussions related to the concepts of macroeconomic management, its framework, and execution. It also reviews the empirical linkage between the changes of macroeconomic management policy variables and their impact on stock markets. It is asserted in economic theory that the government and the central bank of any certain country can apply fiscal and monetary policy instruments such as government spending, taxation, interest rate, reserve requirement, open market operation etc., to achieve objectives, i.e. sustainable economic growth, full employment, price stability, and stable capital market. This chapter investigates the existing theory and literature to identify how the government and the central bank can influence the stock market trend through all these instruments while designing the overall macroeconomic policy to reach those objectives. In addition, this chapter also reviews the empirical documentation related to other micro and macro perspectives. In particular, literature on the relationship between market liquidity with monetary and fiscal policy, transmission of information between markets and investors preference in processing information are discussed.

This chapter is divided into three sections and organized as follows. In Section 3.2 we design the theoretical framework related to the definition, importance and instruments of macroeconomic management. The linkage between macroeconomic policies and capital markets is also discussed in this section. The definition and importance of macroeconomic management are explored in section 3.2.1 and 3.2.2 respectively. Section 3.2.3.1 and 3.2.3.2 describes monetary and fiscal policy with particular focus on their instruments and their impact on capital markets. Section 3.2.4 summarizes the theoretical discussion.

Section 3.3 is dedicated to explore the existing empirical findings on the association of stock markets with monetary policy, fiscal policy and financial crises and also critically linked with the theoretical arguments. The aim here is to identify the key issues investigated and the empirical evidence obtained for different time periods, events (e.g. crises) and countries (e.g. developed, emerging, frontier). Because, there exists a multitude of such issues in the literature, including among others, the effect of inflation over stock returns, exchange rates over international portfolio investment, currency crises (e.g. the Asian one) over stock market crises, credit episodes (e.g. 2008) over stock markets etc.

For the comprehensive discussion on relevant aspects of monetary policy in particular, we divide section 3.3 into several subsections, i.e. how money supply and policy shocks affect the equity markets (section 3.3.1.1), how changes in interest rate, inflation and exchange rate influence stock returns and volatility (section 3.3.1.2 from 3.3.1.4); how fiscal policy (section 3.3.2) and financial crises (section 3.3.3) affect prices and market liquidity. This section is not aim at giving an exhaustive theoretical foundation of each and every one of those issues; instead, we create smaller subsections, each dedicated to one issue, dealing with it from both a theoretical and an empirical perspective. We summarize this section in 3.3.4.

Finally, in section 3.4 we discuss the limitations of existing literature, demonstrate how the discussion in section 3.3 motivates the identification of the research gaps or issues for this thesis and postulate the importance of this study on this newly defined emerging market. We also put concluding remarks of this chapter in section 3.4.

3.2 Macroeconomic Management:

In this section we try to explore macroeconomic theory to define macroeconomic management, its significance for economic stability, history, instruments and link with capital markets. Since all the macroeconomic variables are interrelated, when the government and the central bank use these policies, they affect everything from commodity to financial markets (Stevenson et al., 1988). In their book, Stevenson et al. (1988) also show that fiscal and monetary policy shift the IS and LM curve[12] by changing every economic component to reach the desired levels of aggregate demand, which further affects real income, employment, price level and capital market (Fisher, 1988). Therefore, when the government and the central bank change macroeconomic policies they affect the stock market and this section investigates that theoretical linkage.

3.2.1 Definition:

Macroeconomics deals with the economy "in the large", or "as a whole" and is concerned with the individual components that make up the aggregate economy: consumers, firms, industries, and markets (Ackley, 1978). Therefore, macroeconomic management means the deployment of monetary and fiscal instruments, exchange rate, and debt policies, to seek or to influence the

[12] IS refers to Investment-savings and LM refers to Liquidity preference-money supply. The IS-LM model is a macroeconomic tool that explains general equilibrium in commodity and money markets (see Stevenson et al., 1988 for further discussion).

path of aggregate economy for achieving a particular outcome (Adam, 2011). The outcomes or objectives, Vane and Thompson (1985) explain, that macroeconomics wants to achieve through macroeconomic management are – growth, employment, stable price level, and satisfactory balance of payments. Fisher (1988) says, in certain circumstances, a stable capital market is another target of macroeconomic management.

By examining, Vane and Thompson (1985) continue, the various economic factors which lead to fluctuations in these outcomes, economists are able to advise macroeconomic policy makers how to improve the overall performance of the economy. Thus, macroeconomic management is the management of overall economic performance by the government, using such controls as interest rates, taxes, government spending etc. (Baldock et al., 2007), which are the instruments of monetary and fiscal policy. Macroeconomic management can also be defined as an attempt to understand the causes and consequences of short-run fluctuations in the business cycle; and an attempt to understand the determinants of long-run economic growth.

Macroeconomic management is achieved through different macroeconomic policy instruments (Peston, 1982; Vane and Thompson, 1985; and Fisher, 1988). These policy instruments refer to macroeconomic quantities that can be directly controlled by the government and the central banks. Instruments can be divided into two subsets: monetary policy instruments and fiscal policy instruments (Peston, 1982; Vane and Thompson, 1985; and Fisher, 1988). Monetary policy is conducted by the central bank (for example, Federal Reserve Bank in the US or Bangladesh Bank in Bangladesh) of a country (Fisher, 1988). Fiscal policy is conducted by the executive and legislative branches (for example, Ministry of Finance, National Board of Revenue etc. in Bangladesh) of the government and deals with managing a nation's budget (Fisher, 1988). It is important to note that macroeconomic policy conclusions should vary according to whether the domestic economy is large or small relative to the rest of the world, and according to the degree of competitiveness of world markets and the international mobility of capital (Stevenson et al., 1988).

In short, monetary policy is the process by which the monetary authority of a country controls the supply of money, often targeting a rate of interest for the purpose of promoting economic growth and stability. This policy can be either expansionary or contractionary for the economy (Hutchison et al., 2010). Expansionary policy is traditionally used to try to combat unemployment in a recession by lowering interest rates in the hope that easy credit will entice businesses into expanding. Contractionary policy is intended to slow inflation in hope of avoiding the resulting distortions and deterioration of asset values.

On the other hand, based on economics and political science, fiscal policy is the use of government expenditure and revenue collection (taxation) to influence the economy (Sullivan, 2003). This involves the expansion or contraction of government expenditures (Gravelle and Hungerfor, 2011; Hutchison et al., 2010; Ahtiala and Kanto, 2002) related to specific government programs such as building roads or infrastructure, military expenditures and social welfare programs. Weil (2008) describes fiscal policy as expansionary when the government runs a deficit, spending more money than it collects in taxes. Contractionary fiscal policy means the government has a surplus, with revenues exceeding expenditures. Weil (2008) notes that economists often focus on the change in a deficit rather than the deficit itself; this means that a reduction in the government's budget deficit from the prior year represents contractionary fiscal policy even though a deficit remains in the economy.

3.2.2 Importance of Macroeconomic Management:

The need for macroeconomic management policy arises because the economic system does not adjust appropriately to the shocks (for example, demand and supply shocks) to which it is constantly subjected (Peston, 1982). In his book, Peston (1982) explains the significance of macroeconomic management policy by referring to two different perspectives; one view is that over the range of economic behaviour the system (economic system) does not adjust at all, rather settles down to a new equilibrium some distance from its desired state. Thus economy requires a certain mechanism to intervene to reach the desired equilibrium and that mechanism is macroeconomic policy. A second view, as Peston (1982) describes, is that there is an equilibrium to which the economy has a tendency to return, but this tendency is too slow and must be accelerated if at all possible. Apart from that, the system may have a tendency to return to an equilibrium condition, but that condition or equilibrium path may have certain undesirable properties (for example, excessive unemployment, or too violent fluctuations) which it would be desirable to remove. Therefore, the economy entails a method to minimize the unexpected fluctuations, in other words, macroeconomic policy may be introduced to influence where the system goes and to influence how it gets there (Peston, 1982).

The most frequently mentioned objectives of macroeconomic management policy are a high, stable and growing level of real income, stable or slowly increasing prices, a balance of payment surplus, full employment, and a fair distribution of income between people and between regions (Peston, 1982; Vane and Thompson, 1985; Fisher, 1988; Stevenson et al., 1988). Vane and Thompson (1985) state that the question arises as to how the policy makers (the government and the central bank) can achieve these objectives.

In a democratic society, Vane and Thompson (1985) explain, these objectives are not under the sole control of the government and the central bank. For example, the level of employment depends on the decisions not only of the government but also of private firms as to how many workers they wish to employ. Policy makers therefore have to operate on other variables in order to try and attain their targets. Vane and Thompson (1985) defined these variables as instrumental variables (instruments of fiscal and monetary policy). A distinction is sometimes made between actual or primary instruments and nominal or intermediate instrumental variables to attain those objective of macroeconomic policy (Peston, 1982; Vane and Thompson, 1985; Fisher, 1988; Stevenson et al., 1988). The government and the central bank can directly change the primary instruments but it is the nominal instruments which lead ultimately to changes in the target variables or macroeconomic objectives. Vane and Thomson (1985) give an example on how it works: the government may change a tax rate (i.e. primary instrument) but it is the resulting change in total tax payment (i.e. an intermediary instrument), which affects expenditure, output, employment, and profit of a company.

To signify the importance of macroeconomic management Leon (2011) use the financial system model. Leon (2011) states that the financial system of any country includes banks, securities markets, pension funds, insurers, market infrastructures, central bank, and regulatory and supervisory authorities. These institutions and markets provide a framework for carrying out economic transactions and monetary policy. Thus they help to efficiently channel savings into investment and spur economic growth. In his paper, Leon (2011) emphasises on the learnings from past financial crises. Sometime financial systems can undermine the effectiveness of monetary policy, exacerbate economic downturns, and trigger capital flights or create large fiscal costs related to rescuing troubled financial institutions. Moreover, as he describes, with increasing financial and trade links between countries, financial shocks in one state can rapidly spill over across national borders. Therefore, resilient and well-regulated financial systems, through macroeconomic management, are essential for both domestic and international economic and financial stability.

The functions and importance of macroeconomic management are also synthesized by George (2008), former Governor of the Bank of England. George (2008) states macroeconomic management with the broad objective of managing what is seen to be a trade-off between growth and employment on the one hand and inflation and the balance of payments on the other. If growth slowed and unemployment started to rise, both the fiscal and monetary policy levers are pushed forward to “go” together, until inflation, or the balance of payments, threatened to get out of hand. He emphasises that stability is a necessary condition for sustainable growth.

The crisis 2008-09 also has addressed on the primary objectives of macroeconomic management – a balanced coordination between macroeconomic policies and fit financial market into it (Berkerly, 2009). Berkerly (2009) states that today's financial dilemmas are prompting new research: which form of fiscal stimulus is most effective for the economy and how do central banks best loosen their monetary policy? He emphasizes the broader change in the mindset of economists: macroeconomists must understand finance, and finance needs to think harder about the context within which markets work.

Fisher (1988) states that there was an early belief that the stock market (equity market) is efficient and investors are rational. After Keynes, for a time, it was often argued that monetary policy had little effect on the stock market; since equities operate as a hedge against price-level movements, i.e. corporate earnings and therefore corporate equity prices would be expected to keep up with changes in the price level, at least on average (Fisher, 1988). Berkerly (2009) refers to this assumption as a blind-spot of macroeconomics. Berkerly (2009) gives importance on everybody working harder on understanding asset bubbles and what happens when they burst. Economics is a social science, trying to understand the real world and now the financial crisis has changed the world (see Berkerly, 2009).

The government and the central banks should also target the capital market operation while setting strategies for macroeconomic management (Fisher, 1988) and this lesson should be well adopted to avoid further financial catastrophe (Berkerly, 2009).

3.2.3 Instruments of Macroeconomic Management

According to sticky-price models[13] short-run changes in real GDP, unemployment, interest rate, and inflation are all driven by changes in the economic environment and by shifts in two kinds of macroeconomic policies: fiscal policy and monetary policy. Broadly speaking, the fiscal policies have an impact on the goods market and the monetary policies have an impact on the

[13] 'Sticky' is a concept in economics that describes a situation when something is resistant to change. Sticky prices are prices that do not adjust immediately to changing economic conditions. The resistance of a price to change, despite changes in the broad economy that suggest a different price is optimal. The causes of stickiness include: menu costs, inadequate information, consumers' dislike of frequent price changes and long-term contracts with fixed prices. Prices change only when the cost of leaving them unchanged exceeds the expense of adjusting them. In financial markets, part of price stickiness is also attributed to imperfect information in the markets, or non-rational decision-making by company executives.

asset markets (Muscatelli et al. 2004), thus affecting the entire economy. These policies and the economic environment together set the level of aggregate demand (Fisher, 1988). They move the economy along the Phillips curve[14], raising and lowering inflation, and unemployment (Hoover, 2008). In a nutshell, these policies help government to manage macroeconomics and ensure economic growth.

Conventionally, both policy instruments were under the control of governments (Beetsma and Jensen, (2005). But in recent years, transfer of control with respect to monetary policy formulation to Central Banks, formation of monetary unions and attempts to form fiscal unions, there has been a significant structural change in the way in which fiscal-monetary policies interact and work (Beetsma and Jensen, 2005).

The following two sections – 3.2.3.1 and 3.2.3.2 respectively explain a detailed theoretical background of monetary policy and fiscal policies. The linkage of respective macroeconomic policies with the stock markets is also explained within this discussion.

3.2.3.1 Monetary Policy

Monetary policy is the process by which the government, central bank, or monetary authority of a country controls the supply of money, availability of money, and cost of money or rate of interest to attain a set of objectives oriented towards the growth and stability of the economy (Labonte and Makinen, 2008). By changing the rate of growth of demand for money; by shifting the base rate of interest, monetary policy can influence the growth of aggregate demand, the money supply and price inflation of a country (Adelina-Geanina, 2011; Bank of England, 1999). Adelina-Geanina (2011) states that any changes in short term interest rates should affect the spending and savings behaviour of households and businesses and therefore feed through the circular flow of income that affects the entire economy.

Monetary policy depends on the fundamental relationship between the rates of interest in an economy, that is the price at which money can be borrowed, and the total supply of money. Indeed, central bank controls the money supply through monetary policy in order to achieve the objectives of price stability or low inflation rate, full employment, economic growth, and exchange rate (Friedman, 1968; Fisher, 1988; Vane and Thompson, 1985; Peston, 1982). This action of the central bank is necessary because money is a medium of exchange and changes in

[14] In economics, Phillips curve sates that an inverse relationship between inflation and unemployment. According to the Phillips curve, the lower an economy's rate of unemployment, the more rapidly wages paid to labour increase in that economy. In other way, decrease unemployment is correlated with higher rates of inflation.

its demand relative to supply, requires spending adjustment (Arestis and Sawyer, 2003). To ensure effective application of monetary policy, central bank needs to adjust some variables, e.g. monetary aggregate, an interest rate, or the exchange rate, in order to affect the goals (Arestis and Sawyer, 2004).

The monetary policy and its significances are also summarized by Tobin (2008). He describes the monetary policy as a demand-side macroeconomic policy, since these policies work by stimulating or discouraging spending on goods and services. He further describes that the economy-wide recessions and booms reflect fluctuations in aggregate demand rather than in the economy's productive capacity. In fact, monetary policy tries to dampen, perhaps even eliminate, those fluctuations (Tobin, 2008).

On the other hand, the role of monetary policy is described by Friedman (1968) himself. According to Friedman (1968) "The stock of money [should be] increased at a fixed rate year-in and year-out without any variation in the rate of increase to meet cyclical needs." Friedman's (1968) view was that the main policy to be avoided is countercyclical monetary policy, the standard Keynesian policy recommendations at the time of the Great Depression. Friedman (1968) believed giving governments any flexibility in setting money growth would lead to inflation and therefore, the central bank should follow a pro-cyclical monetary policy and expand the money supply at a constant rate, equivalent to the rate of growth of real GDP (Friedman's k-percent rule, 2011) and thus can achieve sustainable economic growth (Tobin, 2008; George, 2008).

The central bank has several mechanisms to attain the primary objective of management of money and interest rates. For example, as a "Bankers' Bank", central bank holds deposit from and lends money to other depository institutions, such as commercial banks and savings institutions at a certain rate. This is generally known as bank rate. The Bank Rate sets the floor for the interest rate regime in the money market (the nominal anchor rate) and thereby affects the supply of credit, the supply of savings (which affects the supply of reserves and monetary aggregate) and the supply of investment (which affects full employment and GDP). Open market operation is another way of central bank to manage the money demand and supply in the economy. The central bank constantly buys or sells reserve securities on behalf of the Fiscal Authorities (the Treasury) to the banking and non-banking institutions. One such security is Treasury Bills. When the Central Bank sells securities, it reduces the supply of reserves and when it buys (back) securities-by redeeming them-it increases the supply of reserves to the Deposit Money Banks, thus affecting the supply of money. The decision also affects the interest rate.

Other instruments of central bank include, Statutory Liquidity Reserve (SLR) and Cash Reserve Ratio (CRR), buying or selling foreign exchange, direct control over domestic credit, moral suasion and prudential guideline. The moral suasion and prudential guidelines are direct supervision or qualitative instruments, where the others are quantitative instruments because they have numerical benchmarks.

Economists have agreed that tools of monetary policy, affect the economy; but sometimes they disagree on the exact mechanisms through which this occurs. They also disagree on the strength of those mechanisms and on the ways in which monetary policy should be used by the central bank. Generally, central banks apply the instruments of monetary policy under two broad spectrums: expansionary monetary policy also known as easing monetary policy and contractionary monetary policy also known as tightening monetary policy (Gravelle and Hungerford, 2011; Hutchison et al., 2010). These policies affect the economy by changing money supply to ensure full employment, low inflation, economic growth and stable financial markets (Mishkin, 2004). For example, expansionary policy increases the total supply of money in the economy, and contractionary policy decreases the total money supply (Tobin, 2008). Expansionary policy involves the lowering of interest rates, for instance, in order to reduce unemployment in a recession and contractionary policy is related to raising the interest rates in order to reduce inflation (see Friedman, 2001).

Under expansionary monetary policy central banks would increase the amount of money in circulation which would increase the rate of inflation and increase the availability and affordability of credit (Tobin, 2008). With credit being easier to obtain, businesses and individuals will find it easier to get a loan (Mishkin, 2004). On the other hand, contractionary monetary policy involves removing money from a society by contracting the money supply. It also makes credit less accessible and more expensive to borrowers because local commercial banks have less money to lend (Tobin, 2008). Generally, low inflation is the primary target of contractionary monetary policy in any economy (Mishkin, 2004). Among many other, Christiano et al. (1996) explain that the qualitative effect of an increase in the interest rate (monetary policy shock) shows a decline in aggregate output, employment, profits and various monetary aggregates.

For many years, most central banks agreed that monetary policy should take asset price into account (Issing, 2011) and stock-market participants are influenced by the measures of central bank, specifically the monetary policy (Mankiw, 2009). Because the central banks can influence interest rates and economic activity of any country, thus it can alter the value of stocks. But central bank should not target asset price, should not try to prick a bubble and should follow a "mop-up-strategy" after the burst of a bubble, which means injecting enough liquidity to avoid a macroeconomic meltdown (Issing, 2011). Indeed, central bank has no reason to care about stock prices in themselves, but it does have the job of monitoring and responding to developments in the overall economy, and the stock market is a piece of that puzzle (Mankiw, 2009). When the stock market booms, households become wealthier, and this increased wealth stimulates consumer spending. In addition, a rise in stock prices makes it more attractive for firms to sell new shares of stock, and this stimulates investment spending. For both reasons, a booming stock market expands the aggregate demand for goods and services.

As part of its objective, central banks want to stabilize aggregate demand, because greater stability in aggregate demand means greater stability in output and the price level (minimize the inflation). To do this, the central banks might respond to a stock-market boom by keeping the money supply lower and interest rates higher than it otherwise would (Mankiw, 2009). When the central bank raises interest rates by reducing the money supply, it makes owning stocks less attractive for two reasons. First, a higher interest rate means that bonds, the alternative to stocks, are earning a higher return. Second, the central bank's tightening of monetary policy risks pushing the economy into a recession, which reduces profits. As a result, stock prices often fall when the central bank raises interest rates.

Alternatively to commercial banks money market rates are the costs of funds which they could lend to their customers or invest in securities (Tobin, 2008; Mishkin, 2004). Thus when central banks raise these costs, banks raises their lending rates and become more selective in advancing credit. In addition, higher reserve requirement reduces commercial bank's capacity of lending. The exchange rate could be another mechanism for transmitting monetary policy impact to the stock market. For example, higher interest rate attracts more Foreign Direct Investment (FDI) and this capital inflow appreciates the local currency. All in all exchange rate appreciation attract foreign portfolio investors in local stock market. However, this is a long-run policy and many other factors are related to this conclusion.

3.2.3.2 Fiscal Policy

In economics and political science, fiscal policy is the use of government expenditure and revenue collection (taxation) to influence the economy (Sullivan and Steven, 2003). Fiscal policy is carried out by governments to influence the level of aggregate demand in the economy, with an effort to achieve economic objectives - price stability, full employment, and economic growth

(Keynes, 1936; Rittenberg and Tregarthen, 2011). According to Weil (2008) fiscal policy is the use of governments' spending and taxation to influence the economy. When the government decides on the goods and services it purchases, the transfer payments it distributes, or the taxes it collects, it is engaging in fiscal policy. The term "fiscal policy" is usually used to describe the effect on the aggregate economy of the overall levels of spending and taxation, and more particularly, the gap between them (see Weil, 2008).

Fiscal policy is based on the theories of Keynes (1936), also known as Keynesian economics. According to Keynesian economics increasing government spending and decreasing tax rates are the best ways to stimulate aggregate demand (Fisher, 1988). This can be used in times of recession or low economic activity as an essential tool for rebuilding the framework for strong economic growth and working towards full employment (Rittenberg and Tregarthen, 2011). For example, before the Great Depression of the US, the government's approach to the economy was laissez-faire, fundamentals macroeconomic thought of Classical Economics (Snowdon and Vane, 2005). But the economic situation following the Second World War, determined that the government had to take a proactive role to regulate unemployment, growth, inflation and the cost of money (Snowdon and Vane, 2005). Indeed, government and monetary authority can control the economic phenomenon by using a mixture of both monetary and fiscal policies. However, this is also depending on the political manifesto and the philosophies of the political party that is in power (Fatas and Mihov, 2004).

Governments use fiscal policy primarily to control local and national economy (Tobin, 2001). According to Keynesian Economics fiscal policy promotes higher growth, employment and stabilization into the economy by changing the aggregate demand (Tobin, 2001; Weil, 2008). From the macroeconomic perspective fiscal policy instruments mainly fall into two categories: government expenditures or expenditure policy and taxation or revenue generation policy (Peston, 1982; Vane and Thompson, 1985; and Fisher, 1988). For example, an increase in government expenditure will increase aggregate demand and reduce the level of unemployment. Conversely a reduction in government expenditure will reduce the level of aggregate demand and hence employment. Yet, in fact it is not very easy to manipulate government expenditure in such a way to fine-tune the economy. Many government programmes take a long time to complete. Thus, variations in government expenditure are undertaken in the context of a much longer time horizon than that envisaged for short-run stabilization policies.

Unlike government expenditure, tax revenue can be varied quickly and has therefore been the main instrument of fiscal short-run stabilization policies. Taxes are two of types: direct taxes and indirect taxes. Direct taxes are taxes paid to the appropriate revenue department by the economic unit assessed, for example – income tax paid by individuals. On the other hand, indirect taxes are mainly expenditure taxes and in this case the tax is paid by the manufacturers or providers of the service who in turn attempts to pass the tax on to their customers by making the necessary adjustments to the prices charged by him, for example – value added tax (VAT).

Similar to monetary policy, fiscal policy can be contractionary and expansionary. In theory expansionary fiscal policy is defined as an increase in government expenditures and/or a decrease in taxes that causes the government's budget deficit to increase or its budget surplus to decrease (Gravelle and Hungerford, 2011; Ahtiala and Kanto, 2000). On the other hand, contractionary fiscal policy is defined as a decrease in government expenditures and/or an increase in taxes that causes the government's budget deficit to decrease or its budget surplus to increase.

The general effect of expansionary fiscal policy is to increase aggregate demand (Gravelle and Hungerford, 2011). However, the changes in taxation and spending have different multiplier effects on the level of economic activity (Vane and Thompson, 1985). Barro and Redlick, (2011) assert that an increase in government expenditure will have a greater impact on the economy than a rise in tax payments of the same amount. This is because, higher government expenditure should increase disposable income of citizen which further increases aggregate demand (Vane and Thompson, 1985). This is called balanced budget multiplier or simply, multiplier (Vane and Thompson, 1985; Gravelle and Hungerford, 2011). In addition, Vane and Thomson (1985) note that tax rates can be varied quickly and therefore have been an important instrument for government to stabilize the economy in short-run.

Weil (2008) stresses that in an open economy fiscal policy can affect the interest rate, exchange rate and the trade balance. For example, during a deficit, government can meet some of its expenses by issuing bonds into the market (Vane and Thompson, 1985; Fisher, 1988;). In doing so, government basically compete with private borrowers, thus, holding other things constant, fiscal expansion will increase the interest rate and crowd out some private investment, reducing the fraction of output composed of private investment (Vane and Thompson, 1985; Fisher, 1988; Gravelle and Hungerford, 2011). On the other hand, higher interest rate during expansionary fiscal period can positively attract foreign investment (Darrat and Suliman 1991; Weil, 2008) and increase the demand of local currency. Furthermore, strong local currency makes foreign products cheap and affects the trade balance negatively as import increases and export decreases (Vane and Thompson, 1985; Weil, 2008;).

To the extent fiscal policy impacts the economy through changing aggregate demand, it also has a direct effect on stock markets (Tobin, 1969; Blanchard, 1981). Broadly speaking, both government spending and taxation influence the movement of this asset market (Blanchard, 1981; Shah 1984). Shah (1984) states that the long-run effects of fiscal policy ought not to neglect the interrelationship between investment, stock market, and fiscal policy.

In case of expansionary fiscal policy, governments increase spending and reduce taxation (Gravelle and Hungerford, 2011). This higher spending immediately can affect the firm performance in five different ways (Vane and Thompson, 1985) and thus the stock market. An increase in government expenditure financed by net open market sales of government bonds will put upward pressure on interest rates (see Geske and Roll, 1983 as well). The rise in interest rates will in turn cause a reduction in the level of private investment as firms will cancel investment projects they had planned to finance by borrowing before interest rates increased. Moreover, increased sales of government bonds will lead to a significant reduction in the quantity of finance available to private firms.

Vane and Thompson (1985) claim that even if the higher government expenditure is financed by taxes rather than borrowing, still it could affect the firm and the stock market. They refer to balance budget multiplier effects and explain that as income rises the transactions demand for money will increase and with a fixed money supply cause interest rates to rise. This in turn will cause some reduction in the level of private investment. Indeed, government tax policy such as corporate tax, personal tax, capital gain tax, investment tax credit etc. can directly or indirectly affect the stock market growth. Personal tax rate can also be a determinant of stock market return (Poterba, 1987; Dammon et al., 1989). Under the expansionary fiscal policy governments generally reduce tax rates, for example, the personal tax rate. A low personal tax rate increases the disposable income of individuals and thus people have more savings to invest in capital markets. Furthermore, this lower rate also increases investors' returns from cash and stock dividends. Tax law related to how the dividends and capital gains are taxed also affect the capital markets (see, Golob, 1995).

Investment tax credit is another mechanism that affects firm performance by increasing investment. As Feldstein (2009) states, experience confirms that some form of investment tax credit could stimulate business investment, especially if it is not recaptured later. He further adds, a larger R&D tax credit could help to offset the currently predicted decline in private R&D spending. Firms can also earn higher return by enjoying tax incentive on depreciation and interest. Government can also indirectly intervene into the capital market by offering different stimulus packages to change the business cycle and subsequent effects will be on stock market. For example, during the financial catastrophe of 2008 the US government had declared a total of $152 billion stimulus package (US Budget Report, 2008).

3.2.4 Summary of Monetary and Fiscal Policy Theories

Theory illustrates the influence of monetary policy (Hume, 1752; Friedman, 1968) and fiscal policy (Keynes, 1936) on financial markets through different channels (Tobin, 1969; Blanchard, 1981; Shah, 1984; Fischer and Merton, 1984). This study tries to summarize those theoretical relationships in Figure 3.1, where the government and monetary authority (the ministry of finance and the central Bank) are at the top to formulate fiscal and monetary policy respectively (Fisher, 1988); with specific objectives of economic stability, sustainable growth, stable financial market and full employment (Peston, 1982; Vane and Thompson, 1985; and Fisher, 1988). To explain the interconnections, Figure 3.1 has incorporated three properties of the economic model – macroeconomic policies, financial system, and circular flow of income. The circular flow of income comprises of real flow and money flow; financial system includes financial markets and financial intermediaries; and macroeconomic policy contains fiscal and monetary policy. The arrows show expected reciprocal influence on each other as described in macroeconomic theory.

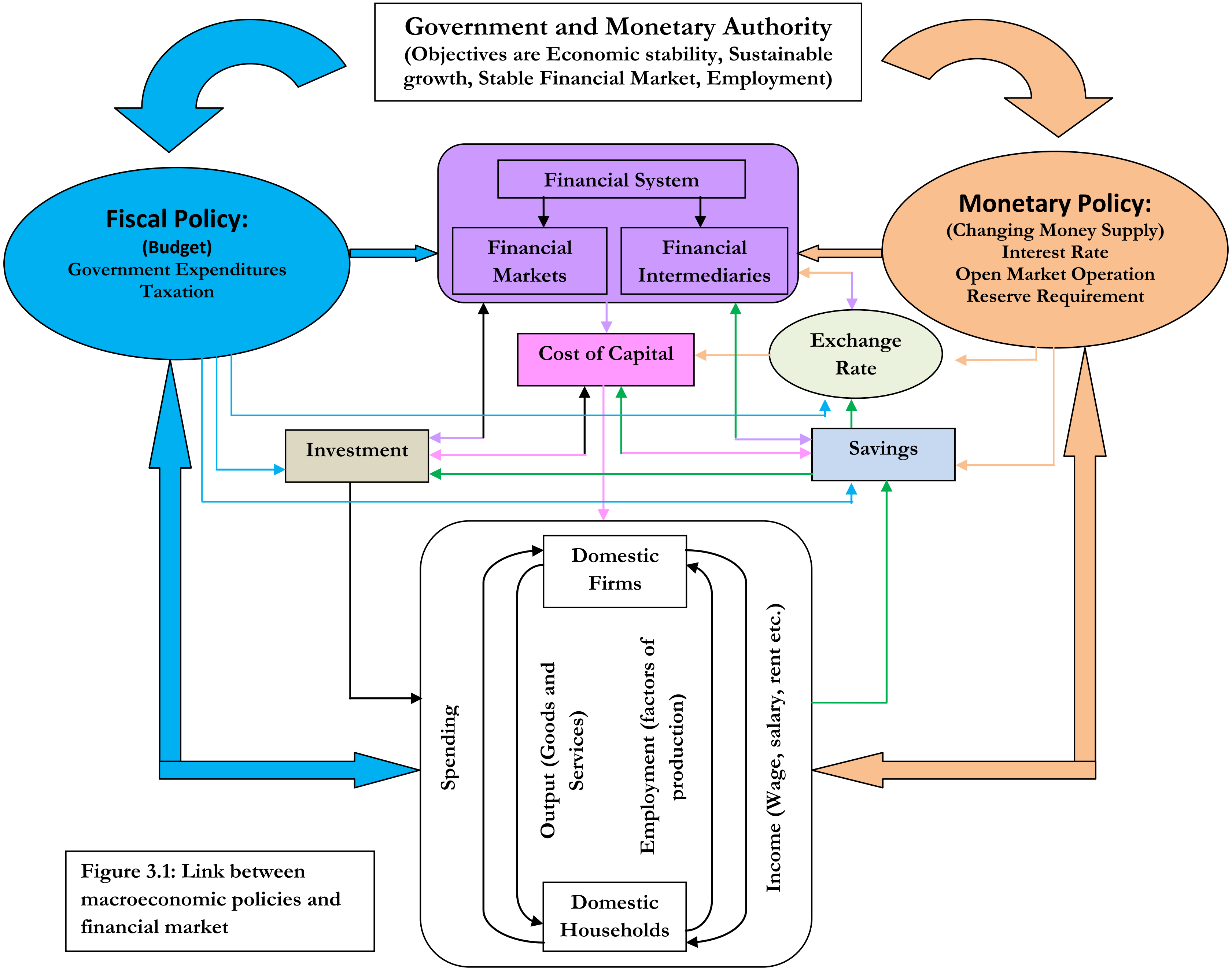


Figure 3.1: Link between macroeconomic policies and financial market

Here, the circular flow of income assumes a simple two sector economy – firms and households (Vane and Thompson, 1985; Mankiw, 2009). The households provide factor services to firms, which in return provide goods and services to them as a reward (Vane and Thompson, 1985; Mankiw, 2009). Since there is an exchange of goods and services between the two sectors in physical form without involving money, therefore, it is known as real flow (Vane and Thompson, 1985; Mankiw, 2009). On the other hand, firms provide monetary payment to households for their factor services and in return monetary payments from households to firms against their goods and services, thus, it is known as money flow. Household sector gets monetary reward in the form of rent, wages, interest, and dividend etc. from firm sector and spends it for obtaining various types of goods to satisfy their wants. Money acts as a helping agent in such an exchange (Vane and Thompson, 1985; Mankiw, 2009). Fiscal and monetary policy influences these reciprocal flows (real and money flow) by changing aggregate demand. For example, expansionary fiscal policy increases the government spending that further enhances the expenditure pattern of households and investment attitude of firms (Vane and Thompson, 1985; Geske and Roll, 1983). Moreover, lower taxation increase disposable income for individuals and profit after tax for firms together that increases private savings, sum of households and firms (Poterba, 1987; Dammon, Dunn, and Spatt, 1989). These higher savings again come back into circular flow by direct lending, reinvestment, and borrowing from financial intermediaries. On the other hand, the impact of contractionary fiscal policy on the circular flow is opposite. However, it increases the government savings (Weil, 2008).

Borrowing from the financial market and financing the deficit budget is the strategy of expansionary fiscal policy (Blanchard, 1981; Vane and Thomson, 1985; Fisher, 1988). The result is government competing with other business firms for money that raises the market interest rate or cost of capital and subsequently create negative impact on investment, and production etc (Peston, 1982; Vane and Thompson, 1985; Fisher, 1988; Stevenson, 1988). However, people find it as an opportunity to deposit their money into commercial banks. Contractionary fiscal policy has no such 'crowding-out' effect but reduces the aggregate demand and employment (Vane and Thompson, 1985; Cebula, 1997; Weil, 2008).

Figure 3.1 also summarizes how the central banks can channel their influence on financial markets directly and indirectly through circular flow of income. Under expansionary monetary policy central banks want to increase money supply into the economy and do it by reducing interest rates, or purchasing treasury securities, or decreasing reserve requirements (Fisher, 1988; Mishkin, 2004; Mankiw, 2009). All these eventually bear a positive impact on the aggregate demand. Reducing interest rates directly or feeding more money into the economy, reduces the cost of capital for business units to borrow money from financial institutions (Tobin, 2008;

Oliver, 2011). For example, purchasing treasury securities by the central banks make liquid money available to commercial banks and reduce interest rates or cost of capital (Berkman, 1978). Thus, business organizations find it as an opportunity to invest more for their expansion. In such cases, people will also find it attractive to invest into stock markets rather keeping their money into banks, as low discount rates increase present value of future cash inflows from stocks such as dividends and capital gains (Thorbecke, 1997). All the way, the central bank takes this policy to boost the economy, increase aggregate demand, outputs, and employment (Vane and Thompson, 1985; Fisher, 1988). In contrary, when target is inflation central bank takes contractionary monetary policy – increase the bank rate, reserve requirement or sell government securities (Thorbecke, 1997). Ultimately that reduces the economic activities by reducing money supply.

As shown in Figure 3.1, exchange rate could be another channel to influence the economy (Tobin, 2008; Weil, 2008). Because higher interest rates can attract more foreign direct investment and portfolio investment, greater demand of local currency will appreciate the exchange rate (Vane and Thompson, 1985; Weil, 2008). Thus imports will be cheap, exports will be expensive and finally, the balance of payment will negatively be affected (Weil, 2008). However, exchange rate and interest rate can, in some cases, be a reason for channelling out capital over the border which is obviously not a good sign for any economy (McLeod, 1993).

To summarize, this section fulfils the thrust for a theoretical framework in line with the primary objective of this study, to identify the influences of macroeconomic management on stock market from different dimensions. Macroeconomics has substantiated that connection which is summarized in Figure 3.1. Indeed, economists justify the importance of this interrelationship and urge for comprehensive analysis on this field by referencing the reasons of global financial crisis 2008-09. In the next section, this study will investigate existing research works on this link with an endeavour to find gaps with respect to empirical evidence. This research will also try to link macroeconomic theories and existing research findings related to the impact of macroeconomic management policy changes on stock returns, volatility and liquidity.

3.3 Macroeconomics Management and the Capital Markets

Tobin (1969), in his general equilibrium model of the financial sector, highlights the role of stock returns and states that stock return act as the linkage between the real and the financial sectors of the economy. In the capital account approach, he shows how both monetary policy and fiscal policy can have an important impact on stock returns. For example, he states, by controlling the money markets and commercial banks the central banks can influences interest rates, asset prices, and credit flows throughout the financial system. Later, the theoretical discussion on this linkage between macroeconomic policies and stock markets was put forward by Blanchard (1981) and Shah (1984). Using IS-LM approach, Blanchard (1981) develops a simple model of the determination of output, the stock market and the term structure of interest rates. To explain the interaction, he asserts that assets values, rather than the interest rate, are the main determinants of aggregate demand and output; current and anticipated output and income are in turn the main determinants of asset value. He also demonstrates the link between fiscal expansion, increase output, profit and the interest rate. In line of this thought, Shah (1984) shows how fiscal policy can affect real variables (i.e. output) when it operates within a model in which the presence of the stock market valuation of capital allows for some effects of anticipations on the long-term impact of policy on the current equilibrium. Subsequently, Fischer and Merton (1984) expanded the idea and postulate that macroeconomics has traditionally had an interest in finance in the modelling of financial markets and asset pricing.

Motivated by these theoretical background and discussions in the previous section, this study makes a drive to explore the empirical evidence on the connection between various perspectives of stock markets and macroeconomic variables. Our major objective of doing this is to find the research gaps and importance of this study for this newly emerging market. We make further discussions on empirical findings and relate them to research opportunities and significances for DSE in each of our chapters from five to eight. Here, in section 3.3.1 we present the relationship between monetary policy variables and stock markets. This section is also divided into four subsections. Discussion of empirical findings on each area of monetary policy variables, such as money supply, interest rate, inflation and exchange rate and their influences on equity price are presented in section 3.3.1.1 to 3.3.1.4. On the other hand, section 3.3.2 and 3.3.3 show how changes in fiscal policy variables and how financial crises are empirically found linked with stock markets' returns and volatility. Finally, section 3.3.4 concludes this section through opening up the research gaps, which we then discussin in section 3.4.

3.3.1 Monetary Policies and Stock Markets:

There are several views that describe how monetary policy affects the stock market (Laopodis, 2013). One view is that increases in the money supply lead to increases in stock prices which, in turn, stimulate the stock market and the economy at large. Given that stock prices are determined by expected dividends and interest rates, any surprises in monetary policy are likely to influence stock prices directly via the interest-rate channel or, indirectly, through changes in the determinants of dividends (as well as the equity premium). Another view suggests that an expansionary monetary policy, by raising asset prices, lowers their expected returns and thus depresses the stock market. This occurs because rising equity prices are considered a possible indication of future inflation, which would trigger subsequent central bank's counter action.

There are numerous studies on the effect of 'tight' money – and occasionally 'easy' money – on financial market (see Smith, 1959; Tobin and Brainard, 1963; Homa and Jaffee, 1971; Fisher, 1976; and Hansen, 1953). Fisher (1988) states that the obvious place, therefore, to do research on capital market to see the effect of unexpected economic shocks. In the case of bond markets there are considerable literatures available, e.g. Huberman and Schwert (1985); Nichols et al., (1983); Cronell (1983a,b), Urich (1982), Grossman, (1981); Urich and Wachtel (1981). However, with regard to stock market there was an early awareness of the possibility that the equity market is efficient and investors are rational, since equities operate as a hedge against price-level movement (Fisher, 1988). Thus monetary policy has little effect on stock market, but two events in the 1970s changed the perspective: first, stocks have performed relatively poorly among the broad sets of financial assets and second, savings have appeared to increase sharply after any large changes in inflation (see Fisher, 1988). Economists have given various explanation for these scenarios but researchers wanted to see the 'macroeconomic policy–ineffectiveness' debate on stock market.

An efficient securities market is often described as one in which prices, 'fully reflect' all available information (see Fama, 1976) and an obvious consequence of efficiency is that expected returns anticipated by market participants equal true expected returns. This perspective of market efficiency closely related to the property of 'rational expectations theory' introduced by Muth (1961). The theory suggest that agents are forward looking and have rational expectation thus investment decision based, in part, on their expectations of future prices and that expectations will not differ significantly from optimal forecasts made using all available information (see Pennings et al., 2011; Mishkin, 2003; Lewellan and Shanken, 1997). In this context, rational expectations require that the price function implied by consumer behaviour is the same as the price function on which decisions are based (see Pennings et al., 2011; Shiller, 2003; Lewellan and

Shanken, 1997 for further discussion). This means, e.g. an anticipated change in the policy interest rate will only small effects on financial variables as the change is already "priced in". However, one of the criticisms of this approach has been that empirical tests of the expectations hypothesis generally fail (Pennings et al., 2011). In addition, the cost of obtaining and analysing information may be quite high for many agents in the economy, and their expectations in decision making might not be quite "rational" (see Shiller, 1978). Although the existence of rational expectations in all markets in the economy can be questioned, it seems sensible that behaviour in speculative auction markets, such as those in which bonds and common stocks are traded would reflect available information (Mishkin, 2003). He asserts that the economy should respond faster to monetary stimulus than most structural macro-econometric models indicate and the monetary policy rules must be designed that decrease unwanted fluctuations in the economy. Therefore, measuring the response of financial variables to monetary policy shocks is something of focus in this study. In following sections we are presenting the empirical findings related to the impact of various monetary policy information and variables on the equity markets.

3.3.1.1 Money Supply and Policy Shocks on Stock Prices

According to the conventional wisdom, changes in monetary policy are transmitted through the stock market via changes in the values of private portfolios (the 'wealth effect'), changes in the cost of capital, and by other mechanisms as well (see Bernanke and Kuttner, 2005). Some observers also view the stock market as an independent source of macroeconomic volatility, to which policymakers may wish to respond. They state that for these reasons, it will be useful to obtain quantitative estimates of the links between monetary policy changes and stock prices. Indeed, there are contradictory results available on the response of stock price to changes in money supply in the economy. For example, in the early year's research on the relation between money supply and equity prices find that money-supply increases and their lags are associated with higher equity price (Homa and Jaffee, 1971; Keran, 1971; and Hamburger and Kochin, 1972). Their findings suggest that knowledge of the past money supply could be used in a stock price forecasting model and which is capable of generating abnormal stock returns; however, this conclusion is inconsistent with the notion of market efficiency and expectations hypothesis. In contra, works by Pesando (1974), Cooper (1974), Rozeff (1974), Rogalski and Vinso (1977), and Sorensen (1982) find that investors' expectations incorporated the monetary policy information in such a way that stock returns impounded future changes in the supply of money. That means money-stock changes simply do not have useful information for investors, Fisher (1988) concludes.

Finance has a traditional interest in evaluating the efficient-markets hypothesis, and so it is not surprising to find doubt about the wisdom of using actual money-supply changes rather than anticipated changes as theory requires (Fisher, 1988). Similarly, Bernanke and Kuttner (2005) explain, estimating the response of equity prices to monetary policy action is complicated by the fact that the market is unlikely to respond to policy action that were already anticipated. Distinguishing between expected and unexpected policy actions is therefore essential for discerning their effect. One early study by Tanner and Trapani (1977) does make this distinction and finds that only the unanticipated change in the money-stock matters and it is quickly assimilated as the efficient-market theory predicts. In line with this, Bonomo and Tanner (1983) use the capital asset pricing model along with three different approaches for distinguishing the unexpected money supply from the expected money supply. Their results show broad confirmation of the rational-expectations theory but with one qualification: forecast revisions seem to have relative price effect (Fisher, 1988). Berkman (1978) also makes the difference between actual and unanticipated money-supply changes to see the impact on stock price in the US market. Berkman (1978) looks at the interest rate effects too and finds that only unexpected increase in the money-supply work and that actually lower equity price in the US. This finding is also confirmed in many other separate studies, e.g., Pearce and Roley (1983), Hardouvelis (1986), Hafer (1986), and Loderer et al. (1986). In their study, Pearce and Roley (1983) find that stock price respond only to the unanticipated changes in money supply as predicted by the efficient-market hypothesis. In particular, an unanticipated increase in the announced money supply depresses stock prices while an unanticipated decrease elevates stock price. In similar vein, Hardouvelis (1986) and Hafer (1986) using the US data and Loderere et al. (1986) using Swiss data, confirm the conclusion that stock prices are negatively related to unexpected money supply. The negative association of money announcement to stock price is also reported by Lynge (1981). However, Lynge (1981) does not distinguish between expected and unexpected money supply.

Much of the existing literature explore that stock market is influenced by the monetary environment and monetary policy shocks. For example, Jensen et al. (1996, 2002, and 2006) conduct a number of significant studies on this issue and find that stock returns can be significantly influenced by the prevailing monetary environment. Working on short run stock return variability to monetary policy shocks, Cook and Hahn (1988) and Rigobon and Sack (2001) find that changes in monetary policy affect short run stock returns in the United States. Following the line, Patelis (1997) examine whether shifts in monetary policy affect the predictability of excess stock returns and find that monetary policy variables are significant in predicting future stock returns, although they are not the only relevant factors; there are other variables also influence the stock return, e.g., dividend yield is also relevant. In a later research, Lastrapes (1998) analyzed the response of asset prices to monetary policy shocks in eight industrialized countries (Canada, France, Germany, Italy, Japan, the UK, and the US). Lastrapes (1998) finds that real stock prices respond positively and significantly to unexpected changes in nominal money supply shock for most of the countries. However, there is a wide variation in the magnitude of effects across different countries.

Since firms' sizes differ in terms of equity capital, Cooley and Quadrini (1999) develop a value weighted index and employed a general equilibrium model to examine the response of stock market index to monetary policy shocks. Their study shows that one per cent monetary shock is accompanied by about 0.2 percent decline in stock market index. In an event study on EU area, Bredin et al. (2007) examine the impact of unexpected changes in UK and German/euro area policy rates on UK and German aggregate and sectoral stock returns. Their result shows that UK monetary policy surprises have a significant negative influence on both aggregate and industry level stock returns in both the UK and Germany but the influence of German/Euro area monetary policy shocks appear insignificant for both countries. For European (France, Germany, Switzerland and the UK) and the US stock markets, Hussain (2011) examines the effect of monetary policy actions on both returns and volatilities. He applies a comprehensive intraday dataset on 5-min price quotes along with a broad dataset on monetary policy decisions and macroeconomic news announcements. The results indicate a significant impact of monetary policy surprises on both stock index returns and volatilities for European and the US equity markets. Result further reveals that European stock index volatilities are significantly influenced by the European Central Bank's press conferences that are held 45 minutes after the monetary policy decisions on the same day.

Recently for the US market, Cheng and Jin (2013) investigate the dynamic interactions between asset prices, monetary policy, and aggregate fluctuations during the Volcker-Greenspan period. Results from a simple structural vector autoregression indicates that monetary policy reacts directly to the term spread and indirectly to stock prices and house prices via output and inflation. They also report that there is an asymmetry in the interactions between asset prices and aggregate activity, and that asset prices exhibit positive comovement. Similarly, Laopodis (2013) examines the linkage between monetary policy and stock market during three distinct monetary regimes of Burns, Volcker and Greenspan since the 1970s. He asserts that significant asymmetric effects of monetary policy on the stock markets were observed throughout each monetary regime but these were more pronounced during bear markets than bull markets.

Researcher also investigates, specifically, the link of expansionary and contractionary monetary policy on stock market as it is asserted in literature that expansionary monetary policy e.g. causes interest rates to fall, encouraging a rebalancing from risk-free investments to more risky assets such as stocks. Following this argument, Jensen and Johnson (1995) focusing on the long run monthly as well as quarterly performance of the stocks using data from the United States covering from 1962 to 1991. They find that expected stock returns are significantly greater during expansionary monetary periods than in restrictive periods. A subsequent study by Thorbecke (1997) indicates that expansionary monetary policy increases ex-post stock returns which are consistent with theoretical arguments. Thorbecke (1997) explains following the lower interest rate, economic activity of a firm increases, leading to larger cash flows, and subsequently higher the returns. In a recent study Detken and Smets (2004) investigate a large sample of industrial countries (38 boom periods since 1970s to 2001 for 18 OECD countries) and their result indicate that the boom phase typically featured with rising money, output and credit gaps, and low interest rates.

On the other hand, Ehrmann and Fratzscher (2004) find that a contractionary monetary policy shocks have immediate significant effect on stock price in the US economy. A tightening of monetary policy by 50 basis points reduces the US stock returns by about 3 percent on the announcement day. In a similar study, Neri (2004) evaluated the effects of monetary policy shocks on stock market indices in the G-7 countries and Spain using the methodology of structural VARs. He finds that contractionary shock negatively affect stock market index. However, this effect is small and transitory and varied across countries in terms of persistence, magnitudes and timing of these effects. Using VAR approach, Bernanke and Kuttner (2005) report a 1-day gain of roughly 1% in the CRSP value-weighted index following a hypothetical unanticipated 25-basis-point easing. Chevapatrakul (2014) revisits the impact of monetary conditions on stock market returns at different point on the return distributions. To determine whether the monetary environment is expansive or restrictive, he focuses on the most recent changes in the effective federal funds rate. Using the quantile regression technique he finds that at the upper quantiles, the association between stock returns and monetary conditions is strong, statistically significant and asymmetric. His results suggest that the stock market's response is more sensitive to change in monetary policy when the return is high than when the returns is low.

3.3.1.2 Interest Rate and Stock Markets

Interest rate is one of the primary instruments of monetary policy that the central banks apply to control the money supply (Fisher, 1988) and most of the existing research investigate the impact of interest rate changes on bond-markets rather equity markets (see Urich and Wachtel 1981;

Grossman, 1981; Urich 1982; Cronell, 1983; Nichols et al., 1983; Huberman and Schwert, 1985). However, Smirlock and Yawitz (1985) have asserted, starting from dividend discount model for stock valuation, monetary policy which affects market interest rates is predicted to affect stock prices through two main channels. First, a contractionary monetary policy which may be conducted through increasing policy rates, will eventually lead to a rise in the market interest rates that are used by investors to discount expected future cash flows resulting in lower stock price. The second channel is through its impact on expectations of future cash flows such as earnings of the firm.

The theoretical link, how the changes of interest rates can influence the equity price, also highlighted in Chen et al., (1986). They assert that the discount rate is an average of rates over time, and it changes with both the level of rates and the term-structure spreads across different maturities. Unanticipated changes in the riskless interest rate will therefore influence pricing, and, through their influence on the time value of future cash flows, they will influence returns. They further state that the discount rate also depends on the risk premium; hence, unanticipated changes in the premium will influence returns. On the demand side, changes in the indirect marginal utility of real wealth, perhaps as measured by real consumption changes, will influence pricing, and such effects should also show up as unanticipated changes in risk premia (see Chen et al., 1986 for more discussion).

In line of thought, Bernanke and Gertler (1995), for instance, explained that a rise in interest rates caused by a monetary tightening can reduce firm's net cash flows by the extent that it leads to a fall in aggregate demand and consumer spending and an increase in interest expense paid. On the other hand, the tight monetary condition can curtail the supply of credit provided by commercial banks to firm. In both situations, stock prices of any firm are get affected by the monetary policy. In a separate study, Bernanke and Kuttner (2005) investigate the impact of changes in monetary policy on equity prices, with the objectives of both measuring the average reaction of the stock market and understanding the economic sources of that reaction. Following earlier studies, they have made a separation between anticipated and unanticipated response of equity prices to monetary policy actions. They find that, on average, a hypothetical unanticipated 25-basis-point cut in the Federal funds rate target is associated with about a 1% increase in broad stock indexes. They also find that the effects of unanticipated monetary policy actions on expected excess returns account for the largest part of the response of stock prices.

Conover et al. (1999) include this interest rate variable into their study to examine the relationship with stock market and extend their analysis to international context. Conover et al. (1999) find that 12 out of 15 countries suggested that stock prices tend to be greater during periods in which the Federal Reserve was lowering the discount rate and vice-versa. In another contemporary study using thirty eight years US data, Conover et al. (2005) conclude that by using an interest rate to determine the monetary policy stance, investors can outperform the US market. Similar result is also reported in Cornell (1983a) that monetary policy affects ex ante interest rate. In his another paper, Cornell (1983b) finds announcement of an unexpected jump in money supply is accompanied by increase in interest rate and appreciation of dollar in the US. On the other hand, Ciccolo (1978) does not find any relationship between stock prices and money, Ciccolo (1978) has used the US quarterly, interwar data to reach this conclusion. Similarly, Durham (2003) argues that investors could not earn superior returns by fed watching the Federal Reserve steps.

A study by Blanchard (1981), using Tobin's *'q'* theory of investment in an IS-LM framework, represents the most comprehensive attempt to pull equity price directly into the standard macroeconomic policy debate (Fisher, 1988). In this model Blanchard (1981) includes effect of money stock on interest rate, cost of capital, value of the firm in stock market, output and profit. According to him, if the money supply increases in this system, then, both output and equity prices will increase. He also states, the higher money stock lower the real interest rate and thus the cost of capital. This lower cost leads to a higher stock market value, higher spending, higher output and profit. In his paper, he comprehensively links the stock market with monetary policy.

In line with earlier studies and theoretical groundwork, Hsu and Chiang (2011) also investigate the impact of monetary policy on the US stock market. In this paper, they have applied smooth transition autoregressive (STAR) models with an objective to see the nonlinear effect of monetary policy on the US stock return. They note that the change in the Federal funds rate is used as an endogenous measure of monetary policy, and the growth rate of industrial production is also considered in this model. They argue the main advantage of using a STAR model is that its threshold variable is a function not an indicator variable, therefore, the transition process between regimes are smooth. Their results demonstrate the relationship between the monetary policy and excess returns on stock prices is positive and nonlinear. They express their results are consistent with the idea that because of financial constraints, monetary policy has a larger impact on stock returns in a bear-market regime than in a regular regime. Furthermore, Hsu and Chiang (2011) add, their analysis confirm that an increase in the Federal funds rate has a negative effect on excess returns in the extreme low excess return regime.

Markov regime switching model is also applied by Chang (2009) to investigate whether macroeconomic variables have regime-dependent effects on the US stock return. This study uses various regime switching GJR-GARCH models to analyse the impact of interest rate, dividend yield, and default premium on stock return movements including conditional mean, conditional variance, and transition probabilities. The empirical results of Chang's (2009) study show that S&P stock returns and volatility depend on macro factors, and the degree of influence changes along with stock market conditions. The effects of the three economic variables on returns are influences on returns are non-time-invariant, but are closely related to stock market fluctuations, and the strength of predictability in a volatile regime is far greater than that in a stable regime, he describes.

3.3.1.3 Inflationary Impact on Stock Prices

The ultimate objectives of monetary policy are expressed in terms of macroeconomic variables such as output, employment, and inflation (Bernanke and Kuttner, 2005). Abouwafia and Chambers (2015) claim that stock prices form important channels, through which monetary policy affects inflation and output target variables. Alchian and Klein (1973) argue that asset prices should be included in the measurement of inflation as they represent current prices of claims on current and future consumption. Adding with this argument, Vickers (2000) contends that including asset prices would reduce the bias of the delayed response of monetary authorities to inflationary pressures. The interaction between inflation and stock returns is also explained in Geske and Roll (1983). They state that a positive stock price reaction to unexpected inflation is suggested by the traditional idea that equities are 'hedges' against (unanticipated) inflation because they represent claims to real assets. They further argue that stock returns should be positively related to expected inflation according to the Fisherian theory of interest; the nominal expected return on any asset equals real interest and a real risk premium (if appropriate), plus expected inflation.

In a paper on the US stock market, Laopodis (2006) tries to show the dynamic interaction among the equity market, monetary policy, economic activity and inflation over a period from 1970 to 2002. To develop the argument for this interlink, he states that a change in any one of the monetary policy instruments, such as the money supply or central bank rate (e.g., the federal funds rate) leads to changes in market interest rates and which in turn, forces investors to revalue their equity holdings. The reason is, he explains, the value of investors' wealth given by the sum of the discounted future cash flows (e.g., dividends) is affected by an easing or tightening of monetary policy through either expected earnings or the discount rate. Therefore, a shift in monetary policy stance will induce changes in the consumption patterns of individuals and investment plans of firms, causing further changes in real economic activity and ultimately affecting inflation. Laopodis (2006) summarize his argument by stating that the transmission of monetary policy via changes in the short-term interest rate influences asset prices which, in turn, affect borrowing costs, private wealth, and ultimately real economic activity. To justify his argument, he divide the time period into three monetary regimes – 1970s, 1980s and 1990s, and apply bivariate and multivariate vector autoregressive co-integrating specifications. The bivariate results weakly support a negative correlation between real stock return and inflation for the 1970s and 1980s, in contrast to the widely held view that stocks are an inflation hedge, Laopodis (2006) concludes.

However, Bodie (1976), Fama (1981), Geske and Roll (1983), Pearce and Roley (1983, 1985), and Flannery and Protopapadakis (2002) document a strong negative impact of inflation on equity return. The bivariate and multivariate results in Laopodis (2006) analysis also show a negative relationship between stock returns and the federal funds rate in 1970s and 1980s with a unidirectional relationship in 1990s. The negative link between fed rates and stock return is also found by Fama and Gibbons (1982) and Conover et al. (1999). Finally, Laopodis (2006) states that it is not possible to conclude that there is a consistent dynamic relationship between monetary policy and stock market.

In a recent study, Chortares and Noikokyris (2014) use inflation news to provide empirical evidence on the influence of monetary policy on stock market. They examine the implications of the introduction of the Monetary Policy Committee (MPC) under inflation targeting. Using event study methodology and the UK data, they find that the stock market returns are negatively related to monetary policy shocks on days of MPC meeting following news about a unanimous decision in the previous meeting, and positively on MPC meeting following news about dissent voting. Moreover, they report that the distance of an MPC meeting from an inflation report release does not affect the magnitude of the monetary policy news content of that meeting.

3.3.1.4 Equity Market and Exchange Rate Policy

Monetary policy has a direct influence on the exchange rates, where a contractionary policy that increases the domestic interest rates and makes domestic currency deposits more attractive than foreign currency deposit. This leads to an inflow of capitals and a higher demand of local currencies, thus appreciating the home currency relative to foreign currencies. Taylor (1995) asserts that assuming the rational expectations and nominal rigidities this will in turn, at least in short run, affect the real exchange rate, real net export and therefore, the real GDP. However, during the financial crisis this relationship might not hold, where interest rates hikes could increase the risk of bankruptcy which further leading to loss of confidence and capital outflow (see Stiglitz, 1999). In addition to its impact on aggregate demand, exchange rates can have a substantial impact on consumer prices especially in small open economies (Abouwafia and Chambers, 2015).

The connection between stock price and exchange rate is not as straightforward as between other financial variables and monetary policy. Yet, it is stressed in theory that foreign exchange rate could be a channel to transmit the effect of monetary policy shocks on stock markets (Tobin, 2008). For example, Dornbusch and Fischer (1980) postulated 'flow oriented' model and Branson et al., (1977) proposed 'stock oriented' model to explain the interactions between exchange rate and stock price. The flow model emphasize the role of exchange rates in determining the international competitiveness of exporting firms and the stock model stress on the role on the stock markets play in determining the capital flow movements. In particular, a rise in domestic stock prices can attract foreign portfolio investments which increases the demand of domestic currency and casus it to appreciate.

Based on this argument, Walid et al. (2011) explore the impact of foreign exchange rate changes on stock market volatility. In this paper, they use weekly data for four emerging market (Hong Kong, Singapore, Malaysia and Mexico) and their methodology is based on a two regime Markov switching-EGARH model. They believe this model has allowed separate estimation of the relationship between stock and FX market in "calm" and "turbulent" periods. To develop the relationship they refer to the stock-oriented approach, where FX rate is determined by the demand and supply of financial assets. They also state that there are two types of stock-oriented approach – the portfolio balance and monetary models, to link the stock market and FX rate. Their results provide strong evidence of regime-switching behaviour in volatility on emerging stock markets and reveal the presence of two volatility regimes; first corresponds to a high mean-low variance regime and the second regime is characterized by a low mean and a high variance. They also present strong evidence that the relationship between stock and foreign exchange markets is regime dependent and stock price volatility responds asymmetrically to the event in foreign exchange market. Finally, they claim that their results may be helpful for governments and central banks to formulate policies for financial stability, as it provides insight into volatility spillovers and risk transmission between FX market and stock market.

In a recent study, Abouwafia and Chambers (2015) argue that most studies investigate the relationship between stock prices and monetary policy have done so for developed economies, while only a few papers have attempted to empirically verify this relationship for emerging markets. In their paper, they use a structural vector autoregression model to examine the impact of real exchange rate and other monetary policy shocks on the equity market performance of Kuwait, Oman, Saudi Arabia, Egypt and Jordan. The main result to note from this empirical investigation is that a monetary tightening leads to fall in stock prices in all countries with different dynamics and magnitude. For Kuwait and Egypt the real exchange rate can significantly affect stock prices, although the direction of the impact depends on the type of firms (i.e. export or import) listed in the stock markets and the stability of the exchange rate regime.

3.3.2 Fiscal policy and Stock Markets

Perhaps the most fundamental achievement of the Keynesian revolution was the re-orientation of the way economists view the influence of government activity on the private economy (Blinder and Solow, 1973). Before Keynes, Blinder and Solow (1973) state, it was a commonplace that government spending and taxation were considered powerless and could only redirect resources from the private to public sectors. However, now it becomes a commonplace that, Blinder and Solow (1973) add, not only would a dollar of additional government spending raise national income by the original dollar but this expenditure would have multiplier effects of perhaps several dollars more in the economy. Fisher (1988) expands this idea and states that bonds issued by a government agency can be perceived as net wealth by the private sector so that anything that changes their value, broadly interest rate and price level changes, will tend to produce wealth effects on, for example, consumption, investment, and money-holding decisions. Similarly, Choudhry (1976) also explain the link that the total flow of government expenditure can affect the private wealth (i.e. wealth effect). He states that the total flow of financing of government expenditure includes taxes, net government borrowing from the public, and the net amount of new money issued. Budget deficits or surplus alter the size of public debt, and the method of financing such deficits or disposing of such surpluses affects the composition of private wealth. However, this concept is rejected by Bailey (1962, 1971). He states that deficit financing might not affect the real spending decision, i.e., might not affect the private sector. According to Bailey (1962, 1971) an increase in government consumption spending financed by a bond issue would have the effect of substituting public consumption for private consumption and of shifting actual tax from the present to future.

But later, Tobin (1969) in his general equilibrium model shows that budget deficit is important and states that the money growth and budget deficit affect the stock market. Moreover, Blanchard (1981) and Shah (1984) have advanced theoretical models in which they show that monetary and fiscal policies have important effects on stock price (Darrt, 1990). Nonetheless, the empirical front on this issue has been lagging and perhaps this is due to the assumption of Barro's (1974) Ricardian Equivalence or Debt-neutrality Proposition (Laopodis, 2009).

Darrat (1988, 1990) in his series of papers empirically tested the stock market efficiency with respect to both monetary and fiscal policy. Darrat (1988) argues most of the empirical research on the Stock Market Efficiency has been primarily focused on whether stock prices fully reflect available information on monetary policy, however, very little attention has been devoted to assessing the possible effects of fiscal policy, or movements in budget deficits, on stock prices. Therefore, Darrat (1988) investigates the empirical relationship between aggregate quarterly stock returns and a number of macro variables, including monetary and fiscal policy action in the case of Canadian stock market over the period from 1960 to 1984. Based on the analysis, he finds broad support for market efficiency with respect to monetary policy; however, does not find similar evidence of efficiency with respect to the government's fiscal policy actions. He conclude that changes in the stance of fiscal policy play an important role in determining stock returns even when the path through interest rates is excluded. This result of Darrat (1988) is due to the fact that both anticipated and unanticipated lagged fiscal policy variables were statistically significant in the estimated stock return model. That implies incomplete dissemination of publicly available fiscal policy information by the stock returns (Ali and Hasan, 1993). In contrast to the quarterly data, Darrat (1990) use monthly data and applies FPE/multivariate Granger-causality modelling techniques (Granger, 1969) in this paper to test whether changes in Canadian stock return are caused by the economic variables including money and fiscal policy. Again, Darrat's (1990) empirical results show that lagged changes in fiscal deficits, in particular, Granger-cause stock returns.

On the other hand, Ali and Hasan (1993) reinvestigate the efficient market hypothesis of the Canadian stock market and oppose the findings of Darrat (1988). Ali and Hasan (1993)state, Darrat's (1988) study is based on single instrument variable approach which takes sufficient care to ensure the statistical robustness but nevertheless, this model is primarily an empirical model. Not only that Ali and Hasan (1993) also refer the statement of Darrat (1988) about the possibility of measurement errors, model misspecifications or other estimation problems for the inefficiency evidence. Hence, Ali and Hasan (1993) use vector auto-regression (VAR) technique and consider this technique as appropriate to empirically test the efficiency issue of the stock market with respect to fiscal policy. According to Ali and Hasan (1993), VAR is a reduced form method which avoids 'imposing spurious a priori' restrictions on the model, thus making the model more flexible. Furthermore, Ali and Hasan (1993) add, the VAR procedure is useful in capturing the empirical regularities embedded in the data, which consequently helps to obtain deeper insight into channels through which fiscal policy variable penetrates the system in influencing the stock returns. Contrary to Darrat's (1988) finding, Ali and Hasan (1993) using the VAR technique find no support for the inefficiency of the Canadian stock market with respect to the government's fiscal policy actions.

Darrat and Brocato (1994), and Lee (1997) have examined stock market efficiency with respect to fiscal actions of the US and four Pacific Basin Countries (Hong Kong, Singapore, South Korea and Taiwan) respectively. Darrat and Brocato (1994) conclude on the US data that the stock market may be inefficient with respect to the federal budget deficit variable. Darrat and Brocato (1994) state that the federal budget deficit exerts a significant lagged impact on current US stock returns. Darrat and Brocato (1994) remark, their result remains same even when information on industrial production, inflation, base money, term structure, and default risk are taken into account. This finding clearly contradicts with the stock market efficiency theory. On the other hand, Lee (1997) also investigates the stock market efficiency of the four Pacific Basin countries, i.e., Hong Kong, Singapore, South Korea and Taiwan. Lee (1997) finds that the stock markets in all four countries are inefficient with respect to fiscal and monetary policies. Rezessy (2005) and Ewing (1998) also report inefficiencies of the stock market to budget deficits for the cases of Hungary and Australia, and France, respectively. Hancock (1989) tests the efficient market hypothesis with respect to expected and unexpected monetary and fiscal variables on the US and finds support for the hypothesis for both policies.

Government actions are likely to influence future monetary policy (Thorbecke, 1997; and Patelis, 1997) and that can be channelled into the stock market. For instance, actions by the government authorities that increase spending and add to existing debt are likely to increase the interest rate. To the extent that a higher interest rate will put pressure on economic growth, the central bank will be forced to act to reverse or ease that pressure by increasing money supply or decreasing its main policy tool that means the central bank's funds rate. Therefore, it is necessary to explicitly include a monetary policy variable in the investigation of the dynamics between fiscal policy and the stock market. Using a flexible semiparametric varying coefficient model specification, Jansen et al. (2008) examine the role of fiscal policy directly and indirectly through monetary policy on the US asset markets. The results show that the impact of monetary policy on the stock market varies, depending on fiscal expansion and contraction, consistent with the notion of strong interdependence between monetary and fiscal policy.

Laopodis (2009) finds dynamic linkages between the federal budget deficit, monetary policy and the stock market for the US by analysing the period from 1968 to 2005. Findings are consistent with the hypothesis that past budget deficit influence current stock returns and thus the stock market shows inefficiency. He concludes that unexpected increases in the Fed funds rate lower the expected stock returns leading to lower corporate profits and thus, ultimately lower corporate tax revenues for the government. He adds that the explicit modelling of inflation along with the deficit, Fed funds rate and stock prices indicates a negative response of the stock market. This negative relation is also supported by Fama and Schwert (1977), Geske and Roll (1983), and McCarthy et al. (1990). Geske and Roll (1983) state, government budget deficit exert upward pressure on the nominal interest rate or the discount rate or cost of capital, as applied to the firm which, in turn, lowers expected returns as the risk premium increases. Geske and Roll (1983) also note that an increase in risk premia, due to federal deficits, exposes investors to uncertainty surrounding the action and reaction of the central bank and thus further confound the equity market.

The relationship between fiscal deficit and interest is also extensively covered in Evans (1985). In his paper, Evans (1985) surveys US history to explore whether the US budget deficit produces a higher interest rate that could restrict capital formulation and economic growth. He uses short-run IS-LM model to describe this relationship. According to him, under the usual slope conditions an increase in the deficit will, first, shift the IS curve outward with spending constant and current taxes falling to balance the government's budget; and second, will raise nominal interest rates. Using several sets of US data he finds that a growing deficit does not produce higher interest rates. He concludes this result as the efficiency of the US stock market, households react to the higher deficit and low taxation by increasing their savings. This is because in a perfect capital market households know that the current deficit is equal to the present value of future taxes to service the extra debt.

One of the major arguments asserted in economic theory is that budget deficit creates crowding out effect, i.e., government borrowing creates competition for private savings where business firms suffer from lack of credit opportunity (Peston, 1982; Vane and Thompson, 1985; Fisher, 1988; Stevenson, 1988). The crowding out effect of a budget deficit is investigated in Cebula's (1997) and Darrat's (2000) paper. Both of them, Cebula (1997) and Darrat (2000), work on the US markets to see whether budget deficit creates any crowding out effect. Cebula (1997) works with quarterly data and focus on intermediate-term interest rate yield in the US from 1960 to 1994. The results of Cebula (1997) show that budget deficits do raise intermediate-term rate and strengthen arguments for crowding out effects of fiscal deficit. This positive result is also found in Barth et al. (1985) and Tanzi (1985). On the other hand, Darrat (2000) does not find any evidence of Cebula's (1997) conclusion and reject the presence of crowding out effect of budget deficit in the US data.

The effect of taxes and government spending on quarterly market returns are analysed in Tavares and Valkanov's (2003) paper. Tavares and Valkanov (2003) work on the US stocks and bonds markets and cover data from 1960 to 2000. They (Tavares and Valkanov, 2003) find that the share of tax receipts in GDP is statistically and economically significant and affect the stock returns; moreover, an increase in government spending has a positive impact on expected stock returns. In their study fiscal policy shocks accounted for 3-4% of the variation in unexpected stock returns. When fiscal and monetary policies are jointly identified, their results remain qualitatively unchanged. Therefore, their results strongly suggest that fiscal policy shocks should be given more serious consideration in asset pricing, Tavares and Valkanov (2003) conclude.

In many of the recent studies, researchers have explained various linkages between fiscal policy and stock markets. For example, Afonso and Sousa (2011) find that the fiscal policy shocks, in particular government debt and deficit of the US, the UK, Germany and Italy have impact on their equity markets. In another study, Agnello and Sousa (2013) investigate the sample from nine European countries and report that positive fiscal shocks lead to temporary fall in stock prices; and asset prices become more sensitive to fiscal policy shocks following the process of financial deregulation and mortgage liberalization. Belo et al. (2013) argue that government spending can influence firm's expected cash flows and uncertainty about government policies can affect the rate at which cash flows are discounted.

3.3.3 Financial Crisis and Stock Markets

With the integration of national economies through international trade and finance, the exploration of financial market interdependency has become profoundly important among market participants and scholars. Among many, Bekiros (2014) asserts that since the beginning of 90s, the deregulation of capital movements leads to a systematic interrelation of the major financial markets. This dependence indicated a growing similarity in reactions towards macroeconomic policies or financial crisis. Schwert (1989b) has identified that stock volatility increases after stock price fall, it increases during recessions, and it increases around major financial crises.

There are several theories about the relation between stock volatility and macroeconomic behaviour (Schwert, 1989b). Shiller (1981, 1984) and Summers (1986) advocated that random or sociological factors have large effects on stock volatility and from this perspective, stock volatility has adverse effects on economy when rational investors bear unnecessary risk. An alternative theory, as Schwert (1989b) describes, posits that the stock market discounts expected future events into current prices. From this perspective, stock prices reflect increased uncertainty about the future course of the economy, which shows up later in the realized growth rates of nonfinancial macroeconomic variables such as the money supply, consumption, and investment. This rational expectations/efficient markets approach implies that time-varying stock volatility (conditional herteroskedasticity) provides important information about future macroeconomic behaviour (see Schwert, 1989b for further discussion). Schwert (2011) finds that financial crisis of 2008 was associated with historically high levels of stock market volatility in the US market but was relatively short-lived compare to the Great Depression. Similar finding is also reported for the UK and Japan.

Indeed, analysing the stock market volatility is profoundly important because not only it represents uncertainty and risk but also large changes in the expected market volatility have negative effect on risk-averse investors. Therefore, we need to know the empirical relationship between financial crises and stock markets.

In several studies the impact of financial crises on stock markets has been examined by testing the cross-market correlation coefficient and contagion effect. Forbes and Rigobon (2002) state that correlations between stock markets increase during times of macroeconomic stress, they tend to be biased upwards. Thus they define contagion as a significant increase in cross-market linkage after a shock to one country (or group of countries). There is an extensive theoretical literature on the international propagation on these shocks. Many theories assume that investors behave differently after a crisis. Other theories argue that most shocks are propagated through stable real linkage between countries, such as trade (see Forbes and Rigobon, 2002 for further discussion). Studies, such as King and Wadhwani (1990) test for an increase in stock market correlations between the US, the UK and Japan and find that cross-market correlations increased significantly after the US market crash in 1987. Lee and Kim (1993) extend this analysis to 12 major markets and find further evidence of contagion; average weekly cross-market correlation increased from 0.23 before the 1987 US crash to 0.39 afterward. Calvo and Reinhart (1996) use this approach to test for contagion in stock prices and Brady bonds after the 1994 Mexican peso crisis. They find that cross-market correlations increased for many emerging markets during the crisis.

Allen and Gale (2000) examine contagion caused by contractual linkages among banks. When one region suffers a banking crisis, banks from other regions that hold claims against the affected region have to account for the devaluation of these assets and their capital is eroded. They refer this nature of spillover effect as self-fulfilling expectations: if shocks from a region serve as signals that improve the prediction of shocks to another region, then a crisis in the former region creates the expectation of a crisis in the later region. Rather contagion, Sheng and Tu (2000) investigate interrelations among 11 major stock markets in the Asia-Pacific region and the US in the pre- and post-Asian crisis periods in 1997-1998 via the utilization of multivariate cointegration and error correction models. They showed that long-run cointegration relationships emerged during and not before the period of the financial crisis. Similarly, Fidrmuc and Korhonen (2010) examine the transmission of the subprime crisis to China and India, with the application of dynamic correlations, and conclude that it had a significant effect on their business cycles.

The transmission of volatility across markets is important for pricing of securities, trading strategies, hedging strategies, and regulatory strategies within and across market. Therefore, there is another approach for analysing the influence of financial crises on stock markets by estimating the volatility transmission mechanisms between countries. For example, Hamao et al. (1990) use ARCH or GARCH procedure to examine stock markets around the 1987 US stock market crash and find evidence of significant price-volatility spillovers from New York to London and Tokyo, and from London to Tokyo. Edwards (1998) examines linkages between bond markets after the Mexican peso crisis and shows that there were significant spillovers from Mexico to Argentina, but not from Mexico to Chile. Indeed, empirical studies have applied various methodologies to capture the dynamics of volatility spillovers around the financial crises. For example, Ellis and Lewis (2001) applied a vector autoregression (VAR) model for Australian and New Zealand stock market data spanning from the beginning of 1994 to August 1999. They found that shocks arising in the US markets and own markets increased the volatility in both Australia and New Zealand stock markets more than the shocks arising in the Asian crisis economies during their financial crisis.

Using a VAR-GARCH approach Polasek and Ren (2001) analyse the volatility transmission during the Asian crisis. They apply daily data of the US, Germany and Japan stock markets for two years period, 21 June 1996 to 22 June 1998. They identified that different volatility transmission patterns occurred among the stock market of the US, Germany and Japan before and after the Asian crisis. Similarly, Caporale et al. (2006) use the multivariate GARCH model for causality-in-variance with bootstrapped critical values for different samples of daily data from the US, Japan, European, and South East Asian stock markets covering the Asian financial crisis. They found that unidirectional causality links from the markets in turmoil to other markets following the commencement of crisis.

In a separate study, Angkinand et al. (2010) explore the spillovers from the US financial crisis to many developed economies by utilizing a structural vector autoregressive framework, and their results indicate that the interdependencies increased dramatically when crisis emerged. In a recent study, Maderitsch (2014) investigate the impact of dotcom bubble, crisis 2007 and the European sovereign crisis on volatility transmission between three major financial markets. He uses daily data for the Hang Seng Index, the Euro Stoxx 50 and the S&P 500 Index over a sample period from January 2000 to September 2011.He finds the dynamics of volatility spillovers to be unstable and highly time-varying. In particular, his rolling window estimations of HAR-DL models reveal strong and sudden upwards shift in volatility spillovers in all markets, solely during the financial crisis of 2007. On the other hand, Bekiros (2014) investigates both contagion and spillover effects for the BRIC markets. His sample covers daily stock index returns of the US, Europe and the BRIC stock markets from January 5, 1999 to February 28, 2011. That means data set considers the after-Euro period and includes the financial crisis and the Eurozone debt crisis. The empirical results show that the BRICs have become more internationally integrated after the US financial crisis and contagion is further substantiated.

Financial crises can dry up the liquidity and affect the financial markets. For example, Cornett et al. (2011) mention that liquidity dried up during the financial crisis of 2007-2009 and the effort to manage the liquidity crisis by banks lead to a decline in credit supply. This ultimately affects the available funds in stock markets and reduces the stock price (see Blanchard et al., 2010). All over the world central banks and government have adopted various changes in monetary and fiscal polies to increase the liquidity and boost up the financial markets (see Woodford, 2011; Fernández-Amador et al., 2013; and Gagnon and Gimet, 2013). Hence, as Chordia et al. (2005) suggest, such liquidity shocks are a potential channel through which asset prices are influenced by financial crises. In this line of thought, *Næs* et al. (2011) mention there is a possible causal link between a decline in the liquidity of financial assets and economic crises. In several other studies, such as Amihud et al. (1990), Brunnermeier and Pedersen (2009), Rösch and Kaserer (2013) and have highlighted the relationship between equity market liquidity and various financial crises.

3.3.4. Summary of Macroeconomic Policy Information and Stock Markets

Following the strong theoretical background on the relationship between stock market and macroeconomic management policies (Tobin 1969; Blanchard, 1981; Shah, 1984), different researches have been dedicated to find the empirical evidence on this linkage. However, Laopodis (2009) claims that the empirical front on this issue has been lagging and he claims this is due to the assumption of Barro's (1974) Ricardian Equivalence or Debt-neutrality Proposition. On the other hand, Fisher (1988) explains there was an early awareness of the possibility that the equity market is efficient and investors are rational since equities operate as a hedge against price-level movement. Moreover, some early works, e.g. Pesando (1974), Rogalski and Vinso (1977), and Sorensen (1982) have shown that investors and stock markets are efficient with regard to these macroeconomic policy announcements.

Beside all these, researchers are continuously exploring the connection between monetary policy, fiscal policy and the stock market for empirical support. For example, Homa and Jaffe (1971) find that expansionary monetary policy increases stock prices significantly. Berkman (1978) show that unexpected changes in money supply lower equity prices in the US, similar to Pearce and Roley (1983), Hardouvelis (1987), and Hafer (1986). In a number of studies Jensen et al. (1996, 2002, and 2006) stress that stock returns are significantly influenced by the prevailing monetary environment. In another study, Jensen and Johnson (1995) point out that stock returns are greater during expansionary periods than in contractionary periods. The interest rate channel is also explored and found that stock return is higher when central banks follow a low interest rate (Conover et al., 1999 and 2005). Exchange rate (see Walid et al., 2011; and Abouwafia and Chambers, 2015) and inflation (see Laopodis, 2006; and Chortares and Noikokyris, 2014) can be other two major channels those influence the equity prices.

On the other hand, empirical evidence on stock markets and fiscal policy is also found in different studies. For example, Darrat (1988, 1990) finds that the Canadian stock market is not efficient to fiscal policy information. However, this finding has been challenged by Ali and Hasan (1993). Later, Darrat and Brocato (1994) and Lee (1997) examine the US and four Pacific Basin countries respectively. They (Darrat and Brocato, 1994; Lee, 1997) find that markets are inefficient to the federal budget deficit. In addition to that, Rezessy (2005) and Ewing (1998) also report inefficiency of stock markets to fiscal policy for Hungary and Australia, and France respectively. Thorbecke (1997) and Patelis (1997) show that government action can influence the future monetary policy and that can be channelled to stock market. Tax and government spending are also found significant for the movement of stock prices as suggested in Tavares and Valkanov (2003).

The existing literature also supports the notion that market and firm level liquidity is influenced by changes in various macroeconomic policy variables and financial crises. Particularly, Fernández-Amador et al. (2013), Rösch and Kaserer (2013), *Næs* et al. (2011), Goyenko and Ukhov (2009), and Chordia et al. (2001) have found that monetary policy, fiscal policy and financial crises are determinants of stock market liquidity other than firm specific information. Researchers have further documented that information from one equity market may transfer into other markets and could affect the returns and volatility (Lin et al., 1994; Gagnon and Karolyi, 2006; Ng, 2000; Kohonen, 2013). It is evident in several studies that during financial crisis periods volatility are significantly transferred between markets (see Maderitsch, 2014; Bekiros, 2014; and Angkinand et al., 2010). Even the correlation between markets has increased during the periods of macroeconomic stress (see Fidrmuc and Korhonen, 2010; Forbes and Rigobon, 2002; and Allen and Gale 2000). Therefore, following efficient market hypothesis investors should make their investment decisions based on domestic, regional and global information. Moreover, it is highlighted in earlier literature that there is a difference in information processing and trading pattern between individual and institutional investors (Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994). This creates a certain trend in stock returns and volatility for a market (see Harris, 1986; Agrawal and Tandon, 1994; Ho and Cheung, 1994; Choudhry, 2000; Berument and Kiymaz, 2001, 2003).

3.4 Limitations of Literature and Chapter Summary

This chapter has described the theoretical and empirical foundations for the interrelationship between stock markets and macroeconomic policies. Particularly, various channels of the central bank and government that can influence stock returns and variance are described. To gain a complete understanding on the dynamics of macroeconomic variables and their impact on the stock market we also discussed the influence of financial crises. It has been found from our discussion that there are several important dimensions of the connection between macroeconomics and stock markets. Many of those linkages have been mentioned and empirically explored in earlier studies. Surprisingly, however, most of those researches have focused on developed markets and little or no evidence is available from emerging or frontier equity markets. In addition, conclusions from those earlier studies are not homogenous. Furthermore, evidence is very rare on some other related micro and macro aspects of stock markets. In this study we, therefore, triy to find a few research gaps and fill them by empirically investigating a stock market from a frontier but recently being classified as an emerging economy.

First, for example, the stock market crash of 1987 in the US has opened a new dimension of research for financial markets – test of volatility spillover effect. Researchers become interested to see how disturbances from one financial market transmit to others (Lin et al., 1994; Gagnon and Karolyi, 2006). Former literatures, such as Hilliard (1979) and Jaffe and Westerfield (1985a, b), have only investigated the contemporaneous and lagged correlation in daily closing price changes across several developed equity markets. It is early 90's when researchers have started to use various ARCH (Autoregressive conditional heteroskedasticity) family models to explore volatility spillovers. Hamao et al. (1990) is probably the first paper to apply conditional variance approaches to see the short-run interdependence of prices and price volatility for Japan, the US and the UK. There are many other studies available from developed markets, such as Susmel and Engle (1994), Koutmos and Booth (1995), Baele (2005), and Jiang et al. (2012). On emerging equity markets, Aggarwal et al. (1999), Ng (2000), Kohonen (2013), and Balli et al. (2013) have applied various techniques and reported different degrees of spillover effects. In addition, there are studies where time-zone has tinted as factor for analysing the comovement among stock markets. For example, Engle and Susmel (1993) have grouped their sample markets based on time-zone and examined a common regional news factor that influences them all. However, there is no or little evidence available for daily transmission of volatility to an emerging market from other equity markets, which are separated based on time-zones. Hence, this study will fill the research gap and help to understand the dynamics of daily volatility spillover from markets located in similar time-zones and markets located in separate time-zones. Moreover, we will also come to know that if the trading time of home equity market is different than other markets then how that affect the nature of volatility transmission.

Second, there is a growing body of empirical evidence that suggests liquidity can predict stock returns, both at the firm level and in the time series of the aggregate market For example, Chordia et al. (2000, 2001) document that there is considerable time-variation in market wide liquidity, and Amihud (2002) show that these market-wide movements in liquidity also forecast aggregate returns. Theoretically, the liquidity of equity market is linked with the monetary and fiscal policy variables. For example, Brunnermeier and Pedersen (2009) explain that there is a spiral relationship such as, in one hand traders' funding, i.e. their capital and margin requirements depends on the assets' market liquidity and on the other hand traders provide market liquidity, and their ability to do so depends on the availability of funding. Expansionary or contractionary macroeconomic policies, therefore, restrict the traders' financing opportunities and influence market liquidity. Chordia et al., (2001), Fujimoto (2003), Chordia et al. (2005), Choi and Cook (2006), Goyenko and Ukhov (2009), and Fernández-Amador et al. (2013) have empirically document strong, mixed, modest and no association of market and firm level liquidity with various macroeconomic management variables. Many of them also have been remarked and investigated the influence of financial crises on market liquidity. Yet, there is only one study (i.e. Gagnon and Gimet, 2013) which has focused on the impact of monetary and fiscal policy influence on the market liquidity. In addition, evidence from emerging market is scant. This research gap has motivated us to empirically examine the interdependence between monetary policy, fiscal policy, recent financial crisis (i.e. crisis 2008-09) and a newly emerging market.

Third, the combined influence of macroeconomic and non-macroeconomic variables on size sorted portfolios from this emerging market will be new evidence. Because earlier studies have only examined the connection separately and firm level evidence from emerging markets are limited. For example, Guo (2004) examines the US market and finds that monetary shocks are significantly stronger on small firms. Similarly, Dedola and Lippi (2005) investigate the effect of monetary policy for 21 OECD countries and report that impact of monetary policy is significant on, e.g. smaller firms. However, Donadelli and Persha (2014) use industry level data from 19 emerging markets to explore the impact of country-level governance and macroeconomic policy uncertainty. For other factors, evidence is also available, e.g. on the connection of equity markets with political risk (see Bilson et al., 2002), national elections (see, Bialkowski et al., 2008), and changes in regulations (see, Bengtsson et al., 2014). However, limited or no documentation is found on the combined influence of all these variables, particularly the effect of fiscal policy changes on aggregate and firm level data are rare. In addition, credible research is lacking from emerging markets and this study fills that gap.

Finally, from microstructure perspective, it is well established that investors including the market-makers have access to different sets of information including macroeconomic news (see King and Wadhwani, 1990). And there is a difference in the nature of gathering and evaluating those information between individual and institutional investors (see Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994). In fact, their pattern of investment decision making processes is also different. For example, Abraham and Ikenberry (1994) claim that it is practically costly for the individual investors to make investment decision during weekdays when these people are usually employed in other activities; therefore, weekends provide a convenient, low-cost opportunity for them to process the gathered information and execute their decisions when markets reopen. A similar explanation is also cited in Osborne (1962). He claims individual investors devote their weekend to making investment decisions and are relatively active on Monday. However, to institutional investors Monday is a day for strategic planning. According to Miller (1988) and Lakonishok and Maberly (1990), brokerage firms usually offer more buy than sell recommendation during weekdays; since they (i.e. institutional investors) are inactive during the weekend, net selling by individual investors increases significantly on Monday. This differential behaviour of individual and institutional investors around the weekend is well documented in developed economy; however, evidence from emerging market, in particular, firm level evidence is limited. We try to provide results from this micro perspective of equity market to fill that gap.

In this study, therefore, considering above mentioned research gaps, we have identified our research objectives to examine the Dhaka stock market, main exchange of Bangladesh. Indeed, the economy of Bangladesh is growing and highlighted for its macroeconomic performance. However, the equity market, which had also been entered into record books for several times, unfortunately faced dramatic rises and falls due to conflicting policy measures from the central bank and the government. Moreover, the market has some interesting characteristics, which will attract the attention of foreign investors, policy marker, regulatory bodies, academics and researchers across the world. For example, (i) the market is largely dominated by individual investors; (ii) it has low integration with world markets; (iii) it is significantly influenced by political uncertainty; (iv) in this economy stock market performance is considered as an indicator of political success and hence, government frequently intervene into market through central bank and budgetary policies to ensure their core vote; (v) there is a small scale bond market but there are strong alternative investment opportunities (e.g. national saving deposit, wage earners' bond), however, the country has predominantly Muslim population and according to the Islamic faith, *riba* (usury) is prohibited. Thus many Muslim investors consider any fixed interest savings instruments as being unacceptable (see Islam and Khaled, 2005). Given all these facts Bangladesh is an ideal emerging market to investigate the impact of macroeconomic policies on market price, volatility and liquidity. Besides, this market has been lagging behind in terms of comprehensive empirical research linking the macroeconomic information and the stock market, or the behaviour of investors around the weekend, or nature of volatility transmission, or influence of monetary policy, fiscal policy and financial crises on market liquidity. While Ahmed, Aktaruzzaman and Barua (2006) have only examined the stock market connection with monetary policy, other researchers (e.g. Chowdhury et al., 2006; Ahmed and Imam, 2007) have focused on different aspects of the influence of macroeconomic variables on the DSE.

Therefore, in the next four empirical chapters (i.e. chapter five to eight), we are going to examine various micro and macro prespectives of association of equity prices with macroeconomic information. Review of existing literatures, identifying research gaps and importance of this study are further mentioned in-detail in each of these empirical chapters, along with data collection, sources of data and methods of data analysis. The findings will help local and international investors, policy makers and academics in designing investment decisions, regulations and research.

Chapter 4:
Investors' Behaviour and the Sunday Effect

4.1 Introduction

Negative stock returns on Monday are one of the most puzzling empirical findings reported in finance (Wang et al., 1997). Since the evidence provided by Fields (1931) and Cross (1973) for the US market, the 'day-of-the-week effect', 'Monday effect' or simply 'weekend effect' has become one of the most widely documented calendar-based anomalies. Collectively it refers to the fact that average stock returns are higher on some days of the week than on other days (e.g. Lakonishok and Smidt, 1988; Barone and DeGennaro, 1990). Typically, stock returns on Monday are negative (e.g. French, 1980; Rogalski, 1984) and returns variance is higher on Monday (e.g. Godfrey et al. 1964; Fama, 1965; Gibbons and Hess, 1981).

Despite substantial efforts by researchers to explain and rationalize the phenomenon, the causes of this particular pattern of returns and variance on the opening day of the week are still debated. Two of the most credible explanations for this weekend effect from earlier studies are 'information content theory' and 'information processing hypothesis'. According to information content theory, information that accumulates when financial markets are closed is reflected in prices after the market reopens (see Damodaran, 1989; Fortune, 1991; Choudhry, 2000). The information processing hypothesis, on the other hand, explains that individual investors gather and process information during the weekend and become active traders on the next trading day (see Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994), which influences mean and variance of returns.

Differential behaviour of individual and institutional investors as a reason for weekend effect is also evident in other studies. For example, in consistent with Keim and Madhavan (1995), Kamara (1997) claims that institutional investors enjoy substantially lower transaction costs to trade large stocks, yet their cost of trading small stocks is not much less than that faced by individuals. Hence changes in institutional versus individual trading have a significant effect on Monday effect. He finds empirical support for this conclusion from the S&P 500 index and NYSE's smallest capitaltization deciles. Similarly, Chan et al. (2004) further document from the US market that the Monday effect is related to the trading activities of individual rather institutional investors. In addition, behavioural finance also provides support to the conjecture that individual's moods and perceptions are subject to a Monday effect in the equity market (see Rystrom and Benson, 1989). Contrary to all these evidences, Sias and Starks (1995) assert that the trading behaviour of institutional investors is the primary source of the Monday effect, which is further supported by Brockman and Michayluk (1998). These empirical evidences suggest that the findings related to investors' trading behaviour and weekend effect are not decisive.

While the trading behaviour of individual versus institutional investors as a reason for the Monday effect has been rigorously investigated for equity markets from developed countries, little or no substantiation has been documented in emerging markets. This is possibly due to the difficulty of obtaining similar data for these markets (Venezia and Shapira, 2007). Nevertheless, they explore the Israeli stock market for the trading patterns of amateur and professional investors following the weekend. They report that market returns are correlated in general with the behavioural patterns of investors. Individuals increase their trading, while institutions trade less after the weekend. Yet they do not address the influence of investors' trading patterns on returns variance and also the possible impact of investors' behavioural preferences for investment. In this study we use a new set of data from an emerging market that allows us to investigate the impact of trading activities of institutions and individuals both on equity returns and variance following the weekend, considering their investment preference.

The weekend effect or day-of-the-week effect is mostly evident in countries where equity markets operate from Monday to Friday, such as Japan, Canada, Germany, China, India, the US and UK. However, little attention has been given to countries with different trading hours. There are only a few studies available for countries with trading hours from Saturday to Wednesday or Sunday to Thursday. For example, Al-Loughani and Chappell (2001) examine the day-of-the-week effect for the Kuwait stock exchange which operates from Saturday to Wednesday. They report a higher positive return on Saturday using the KIC index. Recently Farag (2013) investigated the Egyptian market using the EGX 30 index and found positive average returns for the first day of trading. The results of both Al-Loughani and Chappell (2001) and Farag (2013) are not in line with the arguments of information content theory and they do not address the information processing hypothesis.

In this study, therefore, we investigate the information content and processing hypotheses for an emerging market – Dhaka Stock Exchange (DSE) of Bangladesh, which operates from Sunday to Thursday rather than the usual Monday-Friday cycle. Our first objective is to test whether information advantage works on the pattern of returns series and whether the day-of-the-week effect exists on the first trading day (Sunday). We also examine the proposition of Fama (1965) and French (1980) concerning the variance of returns and its significance on the first day of trading. The second objective of this study is to examine the information processing hypothesis. If this is true, there should be firm-level evidence demonstrating that those stocks traded by individual investors on the first trading day are actually the stocks that cause the higher negative returns and higher variance on Sunday. We conjecture that there is an association between the weekend effect and individual investors' trading behaviour as suggested in earlier literatures (e.g. Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994; Chan et al. 2004). Finally, we aim to explore the 'feedback effect' between equity prices on Sunday and prices on the previous Thursday. We investigate whether this relationship is robust to the trading behaviour of any particular group of investors, i.e. institutions or individuals. Because, if the information processing hypothesis is true, then Sunday's returns should show signs of a delayed reaction of investors to information that is stronger than for other weekdays (see Abraham and Ikenberry, 1994).

The weekend anomaly has been thoroughly studied and documented for various stock markets in developed countries (e.g. French, 1980; Gibbons and Hess, 1981; Keim and Stambaugh, 1984; Cho et al., 2007) and emerging economies (e.g. Jaffe and Westerfield, 1985; Agrawal and Tandon, 1994; Chia et al., 2008). Yet, relative to previous work, this study is significant and makes several original contributions. First, the day-of-the-week effect on Sunday provides an opportunity to add to the evidence that following the information advantage, stock returns and the volatility pattern shift in step with the change in trading days. Second, the trading behaviour of individual investors after the weekend and any positive Thursday-Sunday feedback effect should confirm that the information processing hypothesis holds irrespective of time, size, location and characteristics of the equity market. In this equity market more than 99 percent investors are individual as evident in other emerging stock markets, such as in China (see Ng and Wu, 2007). They hold, on average 40 percent of the traded stocks of DSE in 2012, whereas less than one percent of these traders are institutions and hold around 17 percent [15] (including foreign portofolio investment) stocks. However, an opposite picture is evident in developed markets, such as institutions hold 67 percent of all stocks traded in US markets in 2010 (see Blume and Keim, 2012). Therefore, if the weekend effect is a result of the trading behaviour of investors then it might be individuals in DSE.

Third, it is asserted in earlier literatures that firm size can make a preferential difference between individuals and institutions and cause weekend seasonal (see Abraham and Ikenberry, 1994; Kamara, 1997; Brusa et al., 2000, 2005; Chan et al., 2004). Institutional investors tend to invest in stocks that are larger and more liquid (Gompers and Metrick, 2001; Chan et al., 2005), because investing in these stocks is considered more prudent (Del Guercio, 1996) and transaction costs to trading these stocks are less (Kamara, 1997). Individual investors, on the other hand, are generally

[15] Sponsor (38.63%) and government (4.29%) are holding the rest of the traded stocks of DSE, as of December 2012.

perceived to have greater holdings in smaller firms relative to their ownership stake into large firms (Lakonishok et al., 1992; and Barber and Odean, 2005). Hence, to link the investors trading patterns with weekend and feedback effects we divided all listed firms of DSE into size sorted portfolios. Yet, the size of firms in DSE is significantly different than firms studied in earlier researches. Such as, the market value of largest company listed in DSE is only around 1.5 percent of largest company traded in the US market. That means the largest firm traded in the US equity market is 66 times larger than the largest firm traded in DSE. It implies that the dynamics of largest to smallest firms on the weekend effect in DSE might be unlike the findings in other markets. Thus it would be interesting to investigate the possible influence of firm size and investors' preference on seasonality for this equity market.

Fourth, in this study we use divided yield as a possible reason for investment preference between institutions and individuals and impact on seasonality. The tax-based dividend clientele hypothesis assumes or predicts that high dividend-paying firms attract institutional investors (see Shleifer and Vishny, 1986; Redding, 1997; Allen et al., 2000). Black (1976b) asserts that corporations are the only investors with a tax preference for dividends. In addition, Brav and Heaton (1998) find that firms that cease paying dividends usually experience a reduction in the number of institutional shareholders. All these arguments are true where the institutions face lower effective marginal tax rates on dividends and higher tax on capital gains than individual investors. In the US, corporate shareholders have always been allowed to deduct their taxable income on at least 70% of any dividend they receive (Barclay et al., 2008). In contrast, the effective marginal tax rate for dividends in Bangladesh is higher for institutional investors. According to the National Board of Revenue (NBR), corporate shareholders are subject to a 20% tax rate, whereas individuals pay 10% tax on dividends.

However, due to the category restrictions of the DSE, large and more liquid companies generally pay high dividends on a regular basis. For example, to be in the best category, which is category A on the DSE, companies have to pay at least 10% dividends in every calendar year. (We should however mention the context that Bangladeshi inflation rates have varied from 7% to 11% in recent years.) To be in this group, large and prudent firms usually maintain a good dividend rate in their fiscal years. A similar finding is also reported in Smith and Watts (1992), i.e. larger firms usually have higher dividend yields. We therefore conjecture that institutions prefer to invest in high dividend paying firms although there is a slight tax difference, and individual investors prefer to invest in low dividend yield firms, as there is no capital gains tax for them in Bangladesh. Finally, if the trading behaviour of individuals is partly responsible for the weekend effect then this must be evident in the lower dividend yield stocks and it would add new perspectives in existing literatures.

Fifth, Bangladesh has distinctly different economic, institutional, and microstructural features compare to other emerging markets such as China, India or Brazil. For example, it has low integration with world markets; political institutions are very strong and they frequently intervene in the market, sometime for political gains; there is a small scale bond market, however, treasury bonds are only traded by institutions; most of the investors are Muslim and they prefer not to invest in fixed interest-earning assets, thus the stock market is a good alternative for them. Therefore, an investigation of returns and variance trends for DSE can substantiate the reports of this market anomaly. Our evidence confirms the notion that the weekend effect is not just a feature of developed countries but also of emerging stock markets. Finally, due to its economic progress and low integration with developed markets, Bangladesh could be a good diversification alternative for international investors. Knowing the confirmed presence of the 'day-of-the-week' effect will give advantages to foreign as well as domestic investors for setting their investment strategies in advance.

The paper is divided into five sections. Section 4.2 reviews the existing literature for evidence of the impact of individuals versus institutions on weekend effect in line with the information content and processing hypotheses. Our data and methodology for investigating the weekend effect on returns and volatility are discussed in sections 4.3 and 4.4 respectively. Section 4.5 reports our empirical findings. Section 4.6 presents our conclusions based on the empirical findings.

4.2 Literature Review

There are several calendar-based anomalies documented in the literature, such as the January effect, the weekend effect, the week of the month effect, the week of the year effect, the semi-monthly and turn-of-the-month effect, and the holiday effect. Nevertheless, some of the most anomalous empirical findings are associated with the distribution of daily stock returns through the week. This is the "day-of-the-week effect" or "weekend effect" (Jaffe and Westerfield, 1985), where stock returns are negative and returns variance is higher on Monday (see Fama, 1965; French, 1980).

Researchers have tried to provide explanations to rationalize the weekend effect in both returns and volatility rather than simply defining it as a market anomaly. For example, Lakonishok and Levi (1982) argue that the Monday effect is due to the delay between trading and settlement in stocks and in clearing checks. Dyl and Maberly (1988) suggest that managers of publicly owned firms may tend to delay announcements of bad news, or at least news that is not favorable, until the end of the week, after markets have closed. In that line of thought, Damodaran (1989) shows a link between the disclosure of bad news and the weekend effect. Firms usually tend to announce bad news on Fridays and Damodaran (1989) suggests that delaying the announcement of bad news until then might cause the negative Monday returns. Fortune (1991) asserts that firms and governments release good news during market trading, when it is readily absorbed, and store up bad news until after the close on Friday, when investors cannot react until the Monday opening. Focusing on the seasonality in volatility, Barclay et al. (1990) and Foster and Viswanathan (1990) add that stock returns variance should be highest on Mondays, when the informed trader has maximum information advantage. Variance should decline as the working week progresses as public information arrives. This decrease in the advantage of private information leads to lower returns variance on Fridays. According to Ho and Cheung (1994) volatility variation exists due to noise traders who usually do not trade based on the fundamental value of stocks, but rather trade for liquidity needs. To explain the day-of-the-week effect, Kyle (1985) reports that there is a structural link between trading volume and stock returns variances, particularly on Monday.

Investors' trading patterns and the weekend effect are extensively examined in Lakonishok and Maberly (1990), Abraham and Ikenberry (1994), Kamara (1997), Chan et al. (2004), Brusa et al. (2005), and Venezia and Shapira (2007). For example, Lakonishok and Maberly (1990) explain that the higher level of trading activity by individual investors on Monday (particularly more selling transactions) creates this weekend effect. They claim that for sell decisions individuals are basically left on their own and there is a tendency to make decisions over the weekend. Abraham and Ikenberry (1994) provide additional support for this hypothesis using the CRSP equally-weighted index of NYSE and ASE firms over the period 1963 to 1991. They report selling pressure by individuals is not only higher on Mondays, but is substantially heavier following a decline in the market on the previous Friday. These findings are consistent with individual investors having a positive feedback trading strategy. Abraham and Ikenberry (1994) assert that the negative Monday returns are actually conditional upon the previous Friday's returns. In addition, conditional returns appear to be a function of firm size, with small and medium sized firms exhibiting a stronger conditional effect than large firms. Kamara (1997) claims that individual trading is an important cause of the Monday effect and finds that its magnitude on the S&P 500 declined significantly over the 1962-1993 period, when institutions greatly increased their trading activities. He reports that lower transaction costs and increasingly intensive collection of information reduced the risk of weekend surprises for the institutions. Yet the marginal cost of transactions in the NYSE's smallest capitalization stocks is not much lower for institutions than for individuals, and therefore the Monday effect exists for small capitalization stocks.

In contrast to the previous findings on the US equity market, Sias and Starks (1995) find that stocks with higher institutional holdings exhibit a significantly greater day-of-the-week conditional returns pattern than do stocks held primarily by individual investors. Their data consist of all firms listed on the NYSE for 15 years, from 1977 through 1991. They report two pieces of evidence that are consistent with the institutional investor hypothesis. First, stocks with large institutional holdings exhibit significantly greater turnover on Monday and second, there is a strong positive feedback effect between Friday and Monday for stocks with higher institutional holdings. Chan et al. (2004) take a large data set and re-examine the behaviour of institutional and individual investors on the US markets concerning the Monday effect. Their sample includes all firms listed on the NYSE, Amex and NASDAQ during the period 1991–1998. They provide direct evidence that the Monday seasonality is typically strong in stocks with low institutional holdings. The active participation of institutional investors may reduce the magnitude of the Monday effect.

An interesting outcome is reported in Brusa et al. (2000 and 2005). They find a 'traditional' weekend effect and a 'reverse' weekend effect related to firm size. The 'reverse' weekend effect tends to be associated with large firms, whereas the 'traditional' weekend effect tends to be associated with small firms. They have reached to this conclusion by studying the CRSP value weighted index, NASDAQ, S&P 500 and DIJA indices over the period 1963–1998. They also report a positive feedback effect in large firms, Monday returns follow Friday returns particularly when previous Friday returns are positive. They further find evidence that Monday returns are positively related to the volume of medium-sized and block transactions; however, they are negatively related to odd-lot transactions.

Venezia and Shapira (2007) categorized investors on the Israeli stock market into amateur and professional, and investigated their trading pattern after the weekend. Using data from 1994 to 1998, they find that the weekend influences both categories of investors but in opposite directions. Individuals increase both their buy and sell activities, and their propensity to sell is greater than their propensity to buy. Professionals, on the other hand, carry out fewer transactions with almost equal amount of buying and selling.

In this empirical research we jointly investigate the weekend effect on the return and volatility and whether investors' trading behaviour influences the effect using DSE all-share price index. Particularly, our major interest is to see how the information content and processing hypotheses work in an equity market which is significantly different than other developed and emerging markets. We examine return and variance jointly because for rational financial investment decision making, returns constitute only one part of the decision process and risk-averse investors are interested to know the variations in volatility (Engle, 1993; and Charles, 2010). Our conditional variance approach overcomes the arguments related to characteristics of time series data, such as error distributions and asymmetry in volatility mentioned in Kiymaz and Berument (2003), Baker et al. (2008) and Charles (2010). In addition, findings from previous empirical studies are not conclusive whether return and volatility on the opening day reflect the active participation of institutional or individual investors, e.g. Sias and Starks (1995) and Chan et al. (2004). Therefore, for testing the information processing hypothesis and trading pattern this study consider the behavioural preferences of investors by dividing the listed firms into size-based portfolios, where institutions tend to invest in larger and more liquid stocks (Kamara, 1997; Gompers and Metrick, 2001; and Chan et al., 2005). We also create portfolios based on dividend yield and link the presence of weekend effect and feedback effect in DSE with investors, since high yield attract institutional investors (see Shleifer and Vishny, 1986; and Allen et al., 2000). Altogether, this is to confirm whether the effect is not only a feature of developed economies but can also exist in an emerging market such as Bangladesh, which is an increasingly popular destination for investment. The presence of the 'Monday effect' on Sunday will further validate the fact that information advantage theory and the information processing hypothesis work, irrespective of which days the stock market trades on.

4.3 Data

In this study we use four different daily observations, i.e. market index, stock price, market capitalization and dividend yield from January 1st 2000 to December 31st 2012. All these data were collected from Datastream. We collected the market capitalization and dividend yields for all listed companies on the Dhaka Stock Exchange, which is on an average 265 firms over the sample period. Following the 'information content theory' and 'information processing hypothesis' we used the daily DSE All-Share Index to test the weekend effect and investors' behaviour on both returns and volatility. We calculated the returns series as the first difference in logarithms of the daily stock index.

Table 4.1 summarizes the daily trend of information disclosure from various sources for the period January 2000 to December 2012. We have identified around one hundred information sources and categorized them into four major groups, namely the Security Exchange Commission, Government, Media and Newspapers, and announcements by firms. We want to see the general trend of news and information release in Bangladesh that helps individual investors process news over the weekend and trade actively on Sunday with maximum information advantage. These news and information sources relate to earnings and dividend announcements, the national budget, changes in trading laws, market and company enquiry reports, margin loan rules, market and company level reports and analysis, announcements of the cash reserve ratio, bank rate, deposit rate, capital gain tax and personal tax.

Table 4.1: Timings of Economic and Financial Announcements in Bangladesh

Source(s)	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Firm level	8.50	11.43	14.35	20.00	40.00	2.86	2.86
SEC and DSE	13.33	13.33	20.00	20.00	33.34	0	0
Government	6.67	16.67	13.33	20.00	40.00	0	6.67
Media and	5.00	10.00	10.00	10.00	20.00	30.00	20.00

Sources: Based on information collected from Bangladesh Bank, the National Board of Revenue, the Security Exchange Commission, the Dhaka Stock Exchange, The Daily Star, The Financial Express, television channels and annual reports. All data are in percentage form.

It is evident from Table 4.1 that most authorities release their information on Thursday and over the weekend, when investors cannot trade until Sunday. We therefore conjecture that on Sunday individual investors should be more active and create a pattern of returns and volatility that differs from other weekdays.

Based on the data available from Central Depository Bangladesh Limited (CDBL), Table 4.2 gives us an idea of the number of domestic institutional and individual investors active in the Dhaka Stock Exchange from 2007 till 2012.

Table 4.2: Number of Investors on the DSE

Category of investors	Number of Accounts in Operation 2007	2008	2009	2010	2011	2012	Growth Rate
Individual	848,808	1,091,532	878, 752	1,581,505	1,702,052	1,713,607	101.88
Institutional [a]	3,671	4,865	4,096	5,941	6,660	7,263	97.85%

Source: Annual report of Central Depository Bangladesh Limited (CDBL)
[a]The institutional investors in Bangladesh are: Investment Corporation of Bangladesh, Schedule Banks, Merchant Banks, Bangladesh Development Bank Limited, Non-Bank Financial Institution, Insurance companies, Leasing companies, Pension funds, Provident funds, Postal savings schemes, Postal life insurance, Co-operative land mortgage banks, Employees insurance funds and Securities deposits.

Table 4.2 shows clearly that the market is dominated by individual investors and there are only a few institutional investors trading in this equity market. Over the last six years, total investors more than doubled, from 0.85 million to 1.71 million. However the vast majority of them consist of individuals, (more than 99.99%) and only 0.0042% is institutional accounts in 2012. This few institutional investors hold on average 17 percent stocks traded in DSE in 2012, whereas individual investors hold around 40 percent stocks[16]. In developed stock markets a form of polarization between individual and institutional investors is evident, yet domination by individuals is fairly common in emerging markets. For example, Ng and Wu (2007) report that on the Shanghai and Shenzhen Stock Exchanges 99.5% of accounts belong to individuals out of 68.8 million investors and hold about 80 percent of total trade value of the sample. Conversely, in the US the mean percentage of institutional holdings of stocks traded in all the three markets (NYSE, Amex and NASDAQ) was 14.6% in 1981, 21.9% in 1990 and 31.0% in 1998 (see Chan et al., 2004). It has further increased to 67 percent of all US stocks in 2010 (see Blume and Keim, 2012). This implies that between developed and emerging equity market, it is in the latter most of the investors are individual. Therefore, if investors' trading behaviour influences the price of any equity market then it should be evident on a recently-emerging market such as the DSE.

4.4 Methodology

Many previous studies investigated the weekend effect by regressing returns on four daily dummy variables (e.g. French, 1980; Jaffe and Westerfield, 1985; Smirlock and Starks, 1986). However, the use of this methodology has two drawbacks and could give misleading inferences (Kiymaz and Berument, 2001, 2003). First, errors in the model may be autocorrelated and second, error variance may be heteroskedastic. French, Schwert and Stambaugh (1987) and Nelson (1991) also emphasize these characteristics of autocorrelation and conditional heteroskedasticity. To address the first issue, we include lagged values of the returns in equation (i). To avoid the second limitation, we allow the variance of errors to be time-dependent. This conditional heteroskedasticity will capture any time variation in stock returns variance (Kiymaz and Berument, 2001, 2003). As Connolly (1989) mentions, there is much evidence that stock returns have time varying variance and many previous studies of market anomalies failed to take that into consideration.

We therefore model our returns using the following stochastic model:

$$R_t = a_0 + a_1 D_{1t} + a_2 D_{2t} + a_3 D_{3t} + a_4 D_{4t} + \sum_{i=1}^{n} b_i R_{t-i} + \varepsilon_t \qquad \text{(i)}$$

[16] As of December 2012, the 17% holdings of traded stocks by the institutional investors are distributed among 19 industries and 236 listed companies (out of 283). The percentages of each sectoral investment by these investors are given in **Appendix B** (see page 335). The figures in Appendix B shows that institutional investors generally have greater holdings in firms with higher market capitalizations; which mean in DSE, institutions prefer larger companies for investments. For example, they hold an average of around 25% traded stocks of banks and the banks have the highest percentage (i.e. 26.72%) of market capitalizations in the market. Similarly, institutional investors hold around 20% traded stocks of Pharmaceuticals, Cements and Fuel and Power industries. The market capitalizations of these three sectors are also higher in the DSE than others industries. Altogether, data reported in Appendix B indicates that institutional/foreign investors mostly target large cap stocks in DSE.

Where R_t is the daily return, D_1, D_2, D_3, and D_4 are dummy variables for Sunday, Monday, Wednesday and Thursday at time *t,* and *n* is the lag order. ε_t is the error term that follows the Generalised Error Distribution (GED) with mean zero and with a time changing variance, h_t $[\varepsilon_t \sim GED(0, h_t)]$. The dummy variable for Tuesday is excluded from the equation to avoid the dummy variable trap. Tuesday is selected as it is middle of the week and we are examining trading pattern around the weekend.

We next apply the generalized autoregressive conditional heteroskedasticity (GARCH) model to investigate the weekend effect in terms of volatility. The GARCH model, developed by Bollerslev (1986), has been a major tool to capture the three empirical features most often observed in stock returns data: leptokurtosis, skewness and volatility-clustering. Here the assumption is that conditional variance, h_t is a function of three terms – a constant (ω), shocks or news-impact from the previous period (ε_{t-1}^2) measured as the lag of the squared residual from the mean equation, and last period forecast variance (h_{t-1}^2). A simple time varying variance model using a GARCH (1,1) process is:

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 \qquad \text{(ii)}$$

Engle (2001) states, "GARCH (1, 1) is the simplest and most robust of the family of volatility models" and it is also the most widely applied. We therefore use the GARCH (1, 1) model to investigate the weekend effect on volatility. However, many previous papers have included exogenous variables in the variance equation to check their significance for the returns volatility (e.g. Choudhry, 2000; Balaban, 2001; Berument and Kiymaz, 2001 and 2003; Baker et al., 2008). Following those studies, some exogenous variables are allowed in the GARCH (1, 1) model, which could possibly affect the variance. To be specific, this study allows the constant term of the conditional variance equation to change for each day of the week to check the weekend effect on volatility. Thus the specific GARCH (1,1) model becomes:

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \sum_{m=1}^{n} D_m \pi_m \qquad \text{(iii)}$$

Where *D* represents the exogenous variables, particularly each weekday and π is the corresponding weight for *D*. Therefore, if π is found statistically significant for any weekday then we can assert that the weekend effect exists in the variance equation. We determine the structural shift in the daily data using the Bai and Perron (1998) method and exclude those date from the series to increase the persistence of GARCH (1,1) model.

The study uses a GARCH process under the assumption that the conditional distribution of the error term, ε_t, follows a Generalized Error Distribution (GED hereafter) as suggested in Nelson

(1991). The GED includes the normal as a special case, along with many other distributions, some more fat tailed than the normal and some thin tailed such as the uniform distribution (Nelson, 1991). Therefore to capture the distributional characteristics of equity returns we apply GED in this study to model the GARCH process.

For the GED errors, the contribution to the log-likelihood function is:

$$l_t = -\frac{1}{2}\log\left(\frac{\Gamma\left(\frac{1}{\gamma}\right)^3}{\Gamma\left(\frac{3}{\gamma}\right)\left(\frac{\gamma}{2}\right)^2}\right) - \frac{1}{2}\log h_t - \left(\frac{\Gamma\left(\frac{3}{\gamma}\right)\left(R_t - X_t'\theta\right)^2}{h_t\Gamma\left(\frac{1}{\gamma}\right)}\right)^{\gamma/2} \quad \text{(iv)}$$

where R_t is the endogenous variable, X_t' is a vector of exogenous variables and γ is a tail-thickness parameter. The GED is a normal distribution if $\gamma = 2$, fat-tailed if $\gamma < 2$ and thin-tailed if $\gamma > 2$. The Marquardt technique is used to maximize the log likelihood function of the GED.

To investigate the degree to which the weekend effect is related to firm size, we follow the methodology of Keim (1985) and Brusa et al. (2000). We initially divide all the listed firms on the DSE into ten deciles. We then create three sub-portfolios from them based on ranking firms' market values. The firms in the first and second deciles are the "smallest group", the third to seventh deciles are the "medium sized group" and the last two deciles are the "largest group". We apply the time varying conditional variance model to judge the significance of returns and volatility of each value weighted sub-portfolio on Sunday. The returns equation is as follows:

$$R_{st} = \alpha_0 + \alpha_1\psi_{1t} + \alpha_2\psi_{2t} + \alpha_3\psi_{3t} + \alpha_4 R_{st-1} + \varepsilon_t \quad \text{(v)}$$

Where R_{st} is the Sunday return, ψ_1, ψ_2 and ψ_3 are the value weighted returns of the largest, mid-sized and smallest firms at time *t,* and R_{st-1} is the one period lag value of Sunday returns to minimize the autocorrelation problem. ε_t is the error term that follows the Generalised Error Distribution (GED) with mean zero and with a time changing variance, h_t $[\varepsilon_t \sim GED(0, h_t)]$. Based on the statistical significance of each sub-portfolio, i.e. ψ, we should be able to assert which category of investors and their trading activities influence the Sunday returns.

Next, we use a modified variance equation to examine how the volatility of each sub-portfolio affects the variance of Sunday returns:

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \sum_{m=1}^{p}\xi_m\,\pi_m \quad \text{(vi)}$$

Where ξ is the exogenous variable, i.e. each sub-portfolio, and π is the corresponding coefficient. Therefore, if π is found to be statistically significant for any portfolio then we can state that the weekend effect on volatility is the result of trading patterns of a certain group of investors; since investors have different preferences for risk holding.

Further, we investigate how the dividend preference of equity investors influences the weekend effect. If individuals' trading activity determines the pattern of returns and variance on Sunday then it should be reflected in lower dividend paying firms. Therefore we further break down all the listed firms on the DSE into two portfolios (i.e. high and low dividend yield portfolios) based on the daily value weighted dividend yield from January 2000 to December 2012. We use median dividend yield to define the categories, where high dividend yield firms have larger annual median dividend yields than low dividend yield firms. The use of the value weighted dividend yield helps us to control the size effect and make the estimation unbiased[17]. Finally, we run the time varying conditional variance model as stated in equations (vii) and (viii) for each portfolio to see which type of stock activity influences the returns and variance on Sunday:

$$R_{st} = \alpha_0 + \alpha_1 \delta_{1t} + \alpha_2 \delta_{2t} + \alpha_3 R_{st-1} + \varepsilon_t \qquad \text{(vii)}$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \sum_{m=1}^{q} \emptyset_m \, \theta_m \qquad \text{(viii)}$$

Where R_{st} is the Sunday returns and δ_{1t}, δ_{2t}, and $\emptyset_m$ are the portfolios (low and high) based on dividend yields. To minimize the problem of autocorrelation between returns we use the one period lag of Sunday returns, R_{st-1}. We assume that the error term ε_t follows the Generalised Error Distribution (GED) with mean zero and a time changing variance h_t [$\varepsilon_t \sim GED(0, h_t)$]. Based on the statistical significance of each coefficient for the sub-portfolios, i.e. α_1 and α_2 in the returns equation and θ_m in the variance equation, we should be able to compare the influence of institutions' and individuals' trading patterns on Sunday.

4.5 Empirical Results

This section starts with a summary of the data in 4.5.1. We examine the trading time hypothesis in section 4.5.2. In section 4.5.3 we apply a stochastic model using dummy variables, as suggested in French (1980), Gibbons and Hess (1981) and many other previous studies, to examine the Sunday effect. We also explore the weekend effect on volatility within this dummy variable

[17] This study uses value weighted dividend yield because Kim (1985) asserts that the difference in abnormal returns across dividend yield portfolios may be related to systematic differences in market capitalization (i.e. size of the firms) among portfolios. Furthermore, positive dividend yields and market value are inversely related (see Kim, 1985 for further discussion). Therefore, to control these effects and associations, here, portfolios are created based on value weighted dividend yields. In addition, due to the categorical restrictions (see Page 36) large and prudent firms in DSE are used to declare dividends on a regular basis. By creating portfolios based on value weighted dividend yields we also control their influences.

structure, using the time-varying conditional variance model proposed by Engle (1982) and Bollerslev (1986). In Section 4.5.4 we discuss the trading preferences and patterns of institutions and individuals with regards to their influence on returns and variances after the weekend. Finally in section 4.5.5 we check the robustness of the link between individual investors and weekend effect, by extending the analysis to feedback associations between Thursday-Sunday returns and variances.

4.5.1 Summary of the Data

Table 4.3 presents the summary statistics of the daily returns generated from the DSE All-Share price index.

Table 4.3: Summary Statistics of Daily Returns on the DSE

	All days	Sunday	Monday	Tuesday	Wednesday	Thursday
Mean (%)	0.0391***	-0.1575***	-0.1321***	0.1817***	0.0665***	0.2477***
Median (%)	0.0700	-0.0689	-0.0372	0.1366	0.0353	0.1543
Variance (%)	0.00186***	0.0265***	0.0197***	0.0214***	0.0174***	0.0142***
Skewness	-0.3439	-0.5814	-1.2096	1.0009	-0.0277	-0.0139
Kurtosis	10.9429	8.7124	9.6960	9.3100	7.9569	11.5191
Jarque-Bera	8978.294***	856.6814***	1292.609***	1121.163***	630.752***	1814.376***

***, **, * denotes the significance at 1%, 5% and 10% level

The average daily returns are negative for Sunday and Monday, followed by positive returns for other days of the week. The lowest returns are reported on Sunday (-0.1575) and the highest on Thursday (0.2477). On the other hand, the variance of returns is highest on Sunday (0.0265) and lowest on Thursday (0.0142) again. All these daily returns and variances are statistically significant. Similar findings are reported in many existing studies, e.g. French (1980), Rogalski (1984) and Smirlock and Starks (1986). Furthermore, the returns on the first day of the trading week (Sunday) at -0.1575% is more negative than the returns on the second day (Monday) of -0.1321%, which is also in line with the previous literature. Interestingly, Farag (2013) reports positive average returns on Sunday (the opening day) for the Egyptian market using the EGX 30 index. Similarly, Al-Loughani and Chappell (2001) find higher positive returns on Saturday (the opening day) for the Kuwait stock market using the KIC index. However, the returns variance of the EGX 30 index is highest on Sunday (Farag, 2013). Based on these results we can see that in comparison to the stock markets of other Islamic countries which do not operate from Monday to Friday, the behavior of the DSE is far more in line with developed equity markets. The Sunday effect does exist here too.

Table 4.3 also shows that the daily returns are negatively skewed except on Tuesday. Each of the daily returns shows excess kurtosis, i.e. they are fat-tailed compared to the normal distribution. The Jarque-Bera (JB) test confirms the non-normal distribution of daily returns. Finally we run the LB (Ljung and Box, 1978) test for detecting possible autocorrelation in daily returns series upto 15 lags (results are not reported). The LB statistics are not found statistically significant for Sunday and Tuesday returns. This implies that there is no serial correlation between returns on these respective weekdays. Nevertheless, significant autocorrelations exist between the returns of Monday, Wednesday and Thursday, up to at least 15 lags (three weeks).

4.5.2 Examining the trading time hypothesis

The trading time hypothesis suggests that the returns for all five days represent one-day investments and the mean returns will be the same for each day (French, 1980). Following this empirical study of French (1980), we investigate the presence of the day-of-the-week effect on the DSE by testing the equality of means between the daily stock returns series. The equality of means test is a single-factor, between-subjects analysis of variance (ANOVA). If the subgroups have the same mean then the variability between the sample mean (between groups) should be same as the variability within any subgroup (within group). When the subgroup variances are heterogeneous, the Welch (1951) version of the test statistics can be applied. Table 4.4 reports the results.

Table 4.4: Test of Equality of Means of Daily Returns on the DSE

Method	df	Value	
Anova F-test	(4, 3042)	10.12632***	
Welch F-test [a]	(4, 1517.3)	10.33362***	
[a] Test allows for unequal cell variances			
Analysis of Variance:			
Source of Variation	df	Sum of Sq.	Mean Sq.
Between	4	0.008037	0.002009
Within	3042	0.603595	0.000198
Total	3046	0.611632	0.000201

***, **, * denotes the significance at 1%, 5% and 10% levels.

Table 4.4 strongly confirms that the means differs across the daily stock returns. Both the standard ANOVA and Welch adjusted ANOVA statistics are more than ten with probability values near to zero. The analysis of variance decomposes the total sum of squares into between and within groups. Where the values are different that further assures us of the inequality of means within daily returns series. Based on all these results we can confirm that the trading time hypothesis does not work on the DSE: returns are not the same across days, hence the day-of-the-week effect may exists.

On the other hand, Fama (1965) emphasises the difference in the variance of daily stock returns. Fama tests his calendar time hypothesis by comparing the variance of Monday's stock returns with the variance of other weekdays and report higher variance on Monday. In order to examine the weekend effect on volatility, we therefore check whether the variances are similar across the days. Since Table 4.3 show a non-normal distribution of average daily returns, we apply the Brown-Forsyth (1974a, 1974b) test to check for differences in variance between the series. Other authors have used the Bartlett (Sokal and Rohlf, 1995; Judge et al., 1985) test and Levene (Levene, 1960) test to check for the equality of variances between daily returns series. Nevertheless, the Brown-Forsythe test appears to be superior in terms of robustness and power when groups are unequal in size and the absolute deviation scores (deviations from the group means) are highly skewed, causing violations of both the normality and equal variance assumptions (Baker et al., 2008). The Brown-Forsythe (1974a, 1974b) procedure can be expressed as:

$$Z_{ij} = \left|Y_{ij} - Md_j\right| \tag{ix}$$

Where *i* designates the i^{th} observation in group j, and where Z_{ij} is computed for each individual returns series by taking their score Y_{ij}, subtracting from it the group median Md_j, and then taking the absolute value. The test values and corresponding probabilities for the Bartlett, Levene and Brown-Forsythe tests reported in Table 4.5 show that the null hypothesis is strongly rejected. For example, the *F* statistic under the Brown-Forsythe test is equal to 5.989, which is statistically significant at the 1% level. Variances are not homogenous across the weekdays. The other two test statistics, i.e. Bartlett (64.78) and Levene (5.99) also tell the same story.

Table 4.5: Test of Equality of Variance of Daily Returns on the DSE

Method	df	Value
Bartlett	4	64.78261***
Levene	(4, 3042)	5.998342***
Brown-Forsythe	(4, 3042)	5.988929***

***, **, * denotes the significance at 1%, 5% and 10% levels.

In summary, equality of mean tests confirm heterogeneous mean returns for each weekday. We therefore reject the trading time hypothesis and accept the likely presence of the day-of-the-week effect on the DSE. If the trading time model is correct then the expected returns would be the same for each day of the week (French, 1980). Our rejection of homogenous variance across the trading days also leads us to discard the calender time hypothesis. In addition, the low returns on Sunday compared to other weekdays and their statistical significance suggest that the trading time model is not an accurate description of the returns generation process as suggested in French (1980). We therefore use a conditional variance approach to capture the dynamics of equity returns and their volatility after each weekend.

4.5.3 The Sunday effect on the DSE

To investigate the validity of information content theory and weekend effect on the DSE, we follow the procedure explained in existing literature, e.g. French (1980), Gibbons and Hess (1981), Jaffe and Westerfield (1985), Kiymaz and Berument (2001, 2003) and develop a regression model based on equation (i):

$$R_t = \alpha_0 + \alpha_1 Sun + \alpha_2 Mon + \alpha_3 Wed + \alpha_4 Thu + \sum_{i=1}^{n} \alpha_i R_{t-i} + \varepsilon_t \qquad \text{(x)}$$

The first results column of Table 4.6 shows the outcome of the OLS estimation in equation (x).

Table 4.6: Three Models of Daily Returns and Volatility on the DSE

	OLS	GJR-GARCH	Modified C-GARCH
Estimation of mean and volatility equation			
Returns Equation			
Sunday	-0.003302***	-0.001601***	-0.001640***
	[0.000754]	[0.000370]	[0.000397]
Monday	-0.003100***	-0.000847**	-0.000796**
	[0.000750]	[0.000375]	[0.000381]
Wednesday	-0.001215	-0.000394	-0.000389
	[0.000749]	[0.000384]	[0.000360]
Thursday	0.000622	0.000471	0.000481
	[0.000755]	[0.000397]	[0.000389]
Return(-1)	0.033184	0.126463***	0.128099***
	[0.017401]	[0.017773]	[0.018467]
C	0.001830***	0.000670***	0.000732***
	[0.000482]	[0.000238]	[0.000222]
Volatility Equation			
ω		1.89e-06***	0.000498
		[4.47e-07]	[0.000697]
α		0.193903***	0.119220***
		[0.019584]	[0.029708]
β		0.797802***	0.603141***
		[0.013425]	[0.105593]
γ		0.054173**	
		[0.026382]	
ρ			1.005117***
			[0.005822]
$\emptyset$			0.169507***
			[0.020744]
Sunday			1.56e-05***
			[4.87e-06]
Monday			6.59e-07
			[4.59e-06]
Wednesday			8.89e-08**
			[4.07e-06]
Thursday			7.76e-06
			[3.98e-06]
Log Likelihood	9357.655	10396.01	10407.93
Ljung-Box Q-Statistic			
1	0.0355(0.851)	1.8946(0.169)[a]	0.0036(0.952)[a]
5	7.0470(0.217)	5.2241(0.389)[a]	1.8385(0.871)[a]
10	13.627(0.191)	14.442(0.154)[a]	6.8862(0.736)[a]
Breusch-Godfrey Serial Correlation LM Test:			
	4.0646(0.1310)		
ARCH-LM Test:			
1	671.6923***(0.000)	1.892420(0.1689)	0.004014(0.9495)
5	736.8687***(0.000)	5.101897(0.4036)	1.828142(0.8723)
10	838.2274***(0.000)	13.97891(0.1740)	7.014894(0.72403)

[a] standardized squared residuals; ***, ** and * denote significance at the 1%, 5% and 10% levels respectively; standard error and probability are in [ ] and ( ) respectively.

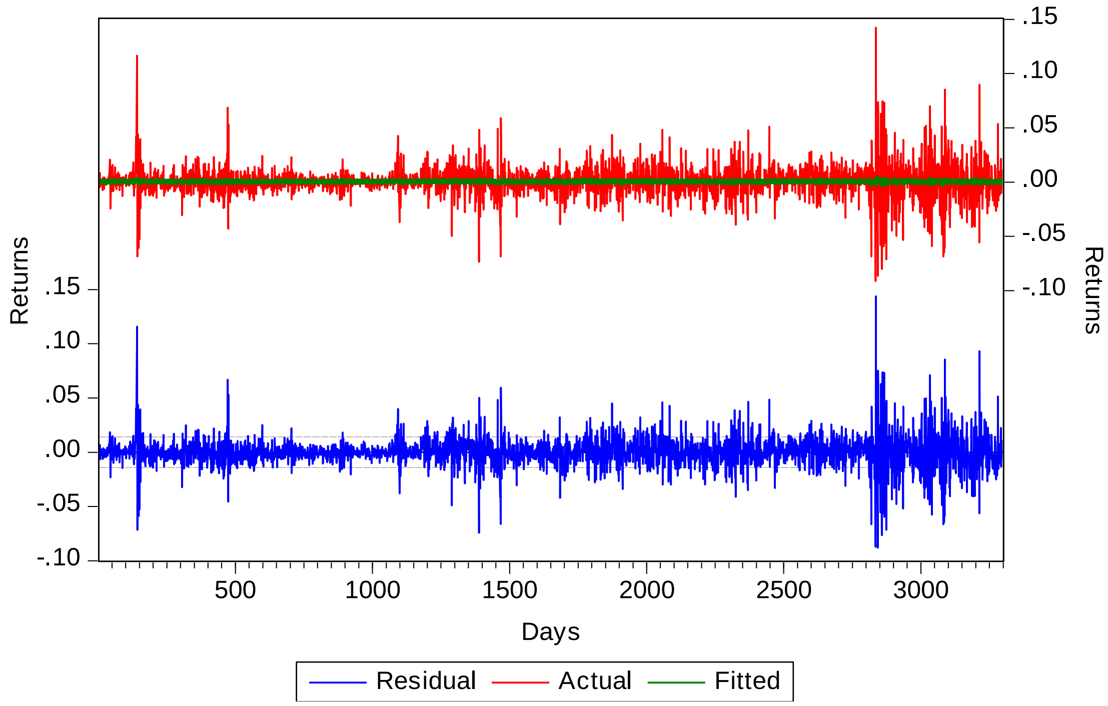
Results show that Sunday[18] has the most negative returns (-0.33%) which are statistically significant at the 1% level, while Thursday has the highest positive returns (0.06%). The findings are consistent with the results reported in Table 4.3. Indeed, significantly negative returns on the opening day are evident in most of the equity markets in previous studies (see French, 1980; Keim and Stambaugh, 1984; Jaffe and Westerfield, 1985; Wang et al., 1997; Chia et al., 2008). Using cross-sectional returns data Chowdhury and Sharmin (2012) report a similar outcome for the DSE. Our results therefore confirm the idea that the weekend effect is not just a feature of the stock markets of the United States and other developed countries but also of emerging markets, as stated by Choudhry (2000). The null hypothesis that the day of the week dummy variables are jointly equal to zero is rejected using the Wald test (not reported), in agreement with the tests in section 4.5.2.

The value of the *F* statistic is 8.69, with p-vlaue near to zero which implies overall significance of our model. We apply the Akaike Information Criterion (AIC) to determine the autoregressive order $[R_{t-i}]$ as included in equation (x) to minimize the possible autocorrelation between returns. The Ljung-Box Q test also supports that, using up to ten lags, the null hypothesis (i.e. the residuals are not autocorrelated) is not rejected. The value of the Breusch-Godfrey Serial Correlation LM Test is 4.06, which again is not statistically significant at the 10 percent level. We therefore conclude that there is no serial correlation in the model. Finally we perform the Lagrange Multiplier Autoregressive Conditional Heteroskedasticity test as suggested by Engle

[18] Being a Muslim country, we have performed a robustness check for Ramadan effect in DSE all-share price index. This Ramadan effect refers to significantly higher stock returns during the ninth month of the Islamic calendar (see Al-Khazali, 2014). Ramadan is the most venerated month of the lunar (Hijri) calendar during which Muslims fast from dawn until sunset and gifts are shared with the poor. The 12 months derived from the lunar cycle are separated by the appearance of the new moon and the number of days in a month average between 29 and 30 days, marking the Islamic year approximately 11 days shorter than the Gregorian year. Recently, researchers have examined this moving calendar anomaly for Muslim countries. There are mixed results available for different markets. For example, Seyyed et al. (2005) find no significant change in Ramadan mean returns in Saudi Market, but a noticeable decline in volatility. Contrary to other studies on Muslim countries, Almudhaf (2012) finds 4 out of 12 countries, Bialkowski et al. (2012) find 11 out of 14 countries and Al-Khazali (2014) find 15 countries stock markets are affected by the Ramadan period. In line of thought, this study has investigated whether the stock returns and volatilise of Sunday during Ramadan periods are significantly different than Sunday of non-Ramadan periods. Using ANOVA F-test, Welch (1951) F-test and Brown-Forsyth (1974a, 1974b) test, results confirm that over the sample periods from 2000 to 2012, there is no statistically significant difference between returns and volatilities of Sunday during Ramadan periods and returns and volatilities of Sunday during non-Ramadan periods (results are available on request). That implies Ramadan has minimum or no impact on Sunday seasonality in DSE. It is may be due to the fact that the larger populations of Bangladesh are Muslim but the traditional culture of this country is still different than other Muslim countries.

(1982) using up to ten lags. The result indicates the presence of an ARCH effect, i.e. variances are not homoscedastic. Figure 4.1 similarly indicates the presence of volatility clustering.

Figure 4.1: Volatility Clustering of the OLS Model of Daily Returns on the DSE



Given that both an ARCH effect (Table 4.6) and volatility clustering (Figure 4.1) are indicated, we apply two separate specifications for the returns and volatility equations to capture the weekend effect. First, we model the conditional variance of the returns equation as a GARCH (1,1) process (Equation ii) and re-estimate the returns equation with the conditional variance to see the weekend effect in returns only. Second, we use a modified GARCH (1,1) process to investigate the weekend effect on both the returns and volatility equations by including daily dummies as exogenous variables (equation iii).

One disadvantage of modelling the conditional variance as a GARCH (1,1) with the day of the week dummies is the possibility of being too restrictive (Kiymaz and Berument, 2003). On the other hand, the GARCH (1,1) specification requires that $|\alpha + \beta| < 1$, in order to prevent the equation variance from exploding (Bollerslev, 1986). Furthermore, each of ω, α, and β has to be positive in order to satisfy the non-negativity of conditional variances for each given time *t* (Bollerslev, 1986).

To capture the volatility clustering and conditional variance under the restrictions of being non-negative and non-explosive, we applied various GARCH models by including additional terms in the conditional variance equation, e.g. GARCH (1,1), GARCH (2,1), GARCH (2,2), TGARCH, EGARCH, CGARCH, and PARCH for both equations (ii) and (iii). The results are not reported here but we identified the Threshold GARCH (TGARCH or GJR-GARCH) and the Component GARCH (1,1) (or CGARCH) as being the most appropriate under these restrictions. The rest of the models are either explosive, i.e. $|\alpha + \beta| > 1$, or fail to satisfy non-negativity or fail to capture the volatility clustering. Nevertheless, it is important to mention that the findings about the weekend effect on the returns and volatility equations remain robust under each of the GARCH processes.

The GJR model is a simple extension of GARCH with an additional term added to account for possible asymmetries (see Glosten et al., 1993). The leveraging effect allows us to differentiate between good news (increased stock prices) and bad news (decreased stock prices). The conditional variance under the first specification, to see the weekend effect in returns, is now given by

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \gamma\varepsilon_{t-1}^2 I_{t-1} \qquad \text{(xi)}$$

Where $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$ or $I_{t-1} = 0$ otherwise

For a leveraging effect, $\gamma > 0$, and the condition for non-negativity is $\omega > 0,\ \alpha > 0$, and $\beta \geq 0$, and $\alpha + \gamma \geq 0$.

To examine the weekend effect on both returns and volatility we identified a modified GARCH process following the Component GARCH (1,1) model. This model was developed by Engle and Lee (1999), in which the conditional variance is decomposed into permanent and transitory components and is designed to better account for long-run volatility dependencies. The GARCH (1,1) model shows mean reversion to ω, which is constant for all time. By contrast, the Component GARCH (1,1) model allows mean reversion to a varying level m_t. Therefore, the modified Component GARCH (1,1) model is

$$\left.\begin{aligned} h_t &= m_t + \alpha(\varepsilon_{t-1}^2 - m_{t-1}) + \beta(h_{t-1}^2 - m_{t-1}) \\ m_t &= \omega + \rho(m_{t-1} - \omega) + \emptyset(\varepsilon_{t-1}^2 - h_{t-1}^2) + Sun\,\pi_1 + Mon\,\pi_2 + Wed\,\pi_3 + Thu\,\pi_4 \end{aligned}\right\} \text{(xii)}$$

Here, h_t is still the conditional variance, while m_t takes the place of ω and is the time varying long-run volatility. The first part of equation (xii) describes the transitory component of volatility, $h_t - m_t$, which converges to zero with a power of $(\alpha + \beta)$. The second part describes the long-run component of volatility m_t, which converges to ω with a power of ρ. ρ is typically between 0.99 and 1 so that m_t approaches ω very slowly. From both of the above specifications (equations xi and xii), Tuesday is dropped to avoid the dummy variable trap. Finally, we assume that the conditional distribution of the error term follows the Generalized Error Distribution as suggested by Nelson (1991).

The second results column of Table 4.6 reports the results of our GJR-GARCH estimation. The time-varying conditional variance is allowed to follow a TGARCH specification to see the possible weekend effect on returns. The lowest returns are observed on Sunday (-0.16%) and the highest returns on Thursday (0.047%). The negative returns on Sunday are also statistically significant. This finding is similar to our previous OLS estimation and is in line with existing literature. In the variance part, the estimated coefficients of the constant term, the coefficient of the lagged value of the square residual (0.194) and the lagged value of the conditional variance (0.798) are all statistically significant at the 5% level. The sum of α (ARCH term) and β (GARCH term) is close to one, which implies persistent effect of shocks to the conditional variance. The asymmetry term γ is positive (0.054) and significant, suggesting that bad news increases volatility. The negative shocks imply a higher next period conditional variance than positive shocks of the same sign.

Looking at the Ljung-Box Q statistics towards the bottom of the column, for standardized squared residuals we accept the null hypothesis that the residuals are not autocorrelated up to ten lags (Engle, 2001). Engle's (1982) ARCH-LM test implies that there is no ARCH effect on the residuals. Indeed, allowing time varying variance in the estimation process provides more efficient estimates for the returns equation, which is in line with previous expectations (Enders, 1995; Berument and Kiymaz, 2001). The low standard errors for the estimated parameters of the returns equation (except the autoregressive term) clearly explain that efficiency (Berument and Kiymaz, 2001). Overall the presence of the weekend effect is strongly evident on the DSE under this conditional variance structure.

Finally, in our CGARCH (1,1) model we allow the conditional variance of the returns to change for each day of the week. The objective is to see whether any weekday has an impact on volatility. Table 4.6 reports the results of CGARCH (1,1) in the rightmost column. The returns and variance equations give similar outcomes. Sunday has the lowest returns of -0.16%, which is statistically significant at the 1% level. Monday has the second lowest returns (-0.077%) and Thursday has the highest positive returns (0.48%), but Monday's returns are only statistically significant at the 5% level. The standard errors are very low for each of the estimated coefficients and all of these results are in line with our previous findings, i.e. our OLS estimation, TGARCH estimation and Table 4.3.

We present the results for conditional variance in the middle of the rightmost column in Table 4.6. The volatility is statistically significant on Sunday and Wednesday in CGARH (1,1) approach but only at a 10% level of significance. However, the highest volatility occurs on Sunday. A similar finding for the first day of trading is also reported in several earlier papers, e.g. for the US (Gibbons and Hess, 1981), for Indonesia, Malaysia, South Korea, Philippines, Taiwan and Thailand (Choudhry, 2000), for the S&P 500 (Berument and Kiymaz, 2001), and for Germany and Japan (Kiymaz and Berument, 2003). To explain the possible reason for the highest variance being on the opening day French and Roll (1986), Barclay et al. (1990) and Foster and Viswanathan (1990) claim that stock returns variance should be highest on Mondays because the informed trader has his maximum information advantage then. This supports the argument of information content theory.

We also see in the rightmost column that the autoregressive coefficient ρ and the coefficients of the ARCH and GARCH terms are statistically significant. The permanent component exhibits a high degree of persistence, as the autoregressive coefficient ρ is one which means that the persistence of volatility is very high in the long run. On the other hand, the sum of α and β is relatively small (0.1192 and 0.6031 respectively), meaning weaker persistence of the transitory component. The standard squared residual shows no autocorrelation between returns as the Ljung-Box Q statistics are insignificant, as is reported at the bottom of the rightmost column. Further, there is no remaining ARCH effect in residuals up to ten lags, which implies that the CGARCH model successfully captures volatility clustering.

In summary all three of the models that appear plausible (OLS, TGARCH and CGARCH) clearly suggest the presence of a Sunday effect on both equity returns and volatility.

4.5.4 Investors' trading behaviour on Sunday

As suggested by Rystrom and Benson (1989), investors are influenced by moods, perceptions and emotions that are systematically different on the first day of trading. This assertion is at least as plausible as suggesting such ultra-rationality as, for example, investors being acutely sensitive to settlement procedures. Rystrom and Benson (1989) further assert that the moods of fundamental and technical analysts may be influenced by a pall of Monday depression and a beautiful stock in the glow of optimism on Friday may look more like an overvalued sell candidate in the gloom of Monday morning. Following this behavioural finance line of thought, our objective is to find out the trading patterns of investors or who moves the marekt on the opening day of the DSE, which is Sunday. In particular we use firm size and dividend yield as proxies to determine which group of investors (i.e. individuals and institutionals) is influencing the returns and volatility on Sunday.

As stated in Section 4.4, in order to investigate the relationship between the weekend effect and firm size, we create ten portfolios using all DSE listed firms according to the ranking of their daily average market value. We then calculate value weighted daily mean returns for each of the ten portfolios. We also determine the standard deviation of the equity returns to see the volatility for each day. The results are in Table 4.7.

Table 4.7: Daily Returns and Standard Deviations on the DSE Grouping by Market Value Deciles

Deciles		Sunday	Monday	Tuesday	Wednesday	Thursday	F [a]
Small	Mean	-0.1815***	-0.00054	0.00068	0.0203	-0.0177	4.706
1	Std. Dev.	1.8592	0.5771	0.5930	0.4804	0.7349	(0.000)
2	Mean	-0.0540	-0.0230	0.0511	0.1008**	0.0469	1.925
	Std. Dev.	1.3274	1.0396	1.0341	1.3696	1.0073	(0.104)
3	Mean	0.1167***	0.0443	-0.0534	0.0611	-0.0381	2.499
	Std. Dev.	1.0792	1.3997	1.1831	1.0853	1.0732	(0.041)
4	Mean	0.0662	0.0280	-0.0379	0.1097***	-0.00563	1.377
	Std. Dev.	1.3158	1.6018	1.1373	1.0928	1.2397	(0.239)
5	Mean	0.0890**	0.00102	-0.0699	0.1990***	-0.0239	4.332
	Std. Dev.	1.1100	1.6580	1.2881	1.1957	1.3422	(0.002)
6	Mean	0.0870**	0.0532	-0.0723	0.1588***	-0.0297	3.503
	Std. Dev.	1.1477	1.5361	1.1781	1.2081	1.2993	(0.007)
7	Mean	-0.0731	0.1033	-0.1043	0.1780**	0.1292***	2.827
	Std. Dev.	1.6243	2.4858	1.7575	1.9815	1.8628	(0.024)
8	Mean	-0.00574	0.0227	-0.0462	0.2199*	-0.0202	2.473
	Std. Dev.	1.0384	1.4527	1.0827	3.0777	1.3441	(0.043)
9	Mean	0.0302	0.0481	-0.0604	0.1877***	0.0854	1.641
	Std. Dev.	1.1271	1.3904	1.3636	1.1814	1.6611	(0.161)
Large	Mean	0.1192**	0.1570***	0.00375	0.1373**	0.00057	2.985
10	Std. Dev.	1.3973	1.7323	1.3662	1.5844	1.4218	(0.018)

All data are in percentage form.
***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.
[a] Anova F-test with probability in ( ) that shows the results of a test for equality of means between the returns series of the five weekdays.
Note: The standard deviations for each day in each decile are also found statistically significant at 1 percent level.

The average returns on Sunday show an interesting pattern across firm sizes. Mean returns on Sunday are negative for small firms (-0.18% and -0.05% respectively for decile 1 and 2) and two of the mid-sized firms (deciles 7 and 8), but positive for the other deciles. Furthermore the standard deviations for the smallest decile is highest on Sunday (1.86%). The returns and standard deviation are also both statistically significant at the 1% level for this smallest decile. The negative mean returns and larger variance for small firms on Sunday is an indication of their importance in the weekend effect.

For other weekdays, mean returns are negative for most of the deciles on Tuesday and Thursday, e.g. from 3 through 6 and 8. Indeed, the returns pattern on Thursday strongly supports the information processing hypothesis. This hypothesis suggests that individuals will, in general, be more aggressive sellers of shares early in the trading week, particularly on Monday following declines in the market on the prior Friday (Abraham and Ikenberry, 1994). Hence a different returns pattern on Sunday may be following bad news released in the prior week, and this is particularly strong for smaller firms.

Surprisingly, on the other hand, the mean returns on Wednesday from the smallest to the largest portfolios are all positive and statistically significant except for deciles 1 and 3, which are positive but not significant. The positive returns on Wednesday indicate a possible "reverse mid-week effect" on the DSE regardless of the size of the firms. For the US equity market, Brusa et al. (2000 and 2005) find a "reverse weekend effect" on Monday, particularly for large firms. They report mean returns being negative for smaller firms on Sunday but these transform into significantly positive returns for larger firms. However, on the DSE equity returns on Wednesday are positive across all sizes of firms. Maybe this "reverse mid-week effect" is related to the trading volume. Table 4.8 shows that the average trading volume on the DSE is highest on Wednesday. This characteristic is also documented by Chordia and Subrahmanyan (2001), who report that trading activity tends to be higher in mid-week.

Table 4.8: Average Daily Trading Volume on the DSE

	Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**
Mean	25,405,472	24,630,401	25,152,884	25,471,850	25,029,184
Median	6,471,656	6,766,035	6,752,659	6,448,353	6,405,050
Std. Dev.	37677288	35844260	37867307	39074996	38109428

To further examine the extent to which firm size is related to the weekend effect, we categorize our observed firms into three sub-portfolios based on the smallest 20%, mid-sized 60% and largest 20%. We then apply a time-varying conditional variance model to assess the significance of each portfolio on Sunday returns and volatility. The first half of Table 4.9 summarizes the mean returns and standard deviation for these sub-portfolios.

Table 4.9: DSE Mean Returns and Standard Deviations for Portfolios Grouped by Size and Dividend Yield

Portfolio(s)		**Sunday**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**
Based on the size of firms						
Small	Mean	-0.1197***	-0.0042	0.0126	0.0440**	-0.00018
	Std. Dev.	1.3759	0.5787	0.5731	0.5899	0.6420
Mid-size	Mean	0.0126	0.0632	-0.0665*	0.1531***	0.0105
	Std. Dev.	0.8805	1.4438	0.9421	1.1840	1.0306
Large	Mean	0.0889**	0.1353***	-0.0185	0.1521***	0.0264
	Std. Dev.	1.0988	1.3616	1.1848	1.2670	1.3107
Based on Dividend Yield						
Low	Mean	-0.0462*	0.0295	-0.0222	0.1373***	0.0185
	Std. Dev.	1.1870	1.0679	0.7555	0.9693	0.7882
High	Mean	0.0219	0.1151***	0.00282	0.1300***	-0.00198
	Std. Dev.	0.9122	1.1778	0.85867	0.8539	0.9984

All data are in percent.
***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.
Note: The standard deviations for each portfolio are found statistically significant at 1 percent level.

For the smallest 20 percent the returns are negative (-0.1197%) and statistically significant at the 1% level. However, for the mid-sized and largest portfolios mean returns are positive (0.0126 and 0.0889 percent respectively) but only the coefficient of the largest 20 percent of firms is statistically significant. This result lends weight to our hypothesis that substantial trading of smaller firms is what influences the Sunday returns to be negative. For the US equity market Abraham and Ikenberry (1994) and Brusa et al. (2000, 2005) also report that mean returns of smaller portfolios are negative on Monday and claim this is due to the trading pattern of individual investors. The mean returns of the smallest 20 percent of firms are also negative on Monday (-0.0042%) and Thursday (-0.00018%) although they are not statistically significant. For the mid-sized and largest portfolios, mean returns are only negative on Tuesday (-0.0665% and -0.0185% respectively). They are positive for other weekdays. The results on Wednesday for the three sub-portfolios are similar to those reported in Table 4.7, i.e. mean returns are all positive and significant at the 1% level. The standard deviation of the smallest portfolio is the highest (1.2759%) on Sunday compared to the other portfolios on that day; it is even higher than the standard deviations on any other weekdays for that sub-portfolio except on Monday for mid-sized portfolios. This further indicates that the weekend effect is probably caused by trading in smaller firms.

The second half of Table 4.9 shows the mean returns and standard deviations of portfolios based on dividend yield. We divide all the listed firms on DSE into two groups based on their median value of daily dividend yield over the observed sample period. Each group – low DY and high DY - include 50% of all listed firms. Then we calculate value weighted mean returns and standard deviations and apply the conditional variance approach to capture the association between investors' trading behaviour and weekend effect. Like the firm size, we document some interesting patterns in mean returns when grouping stocks by dividend yield. First, it is negative (-0.0462%) and significant at the 10% level for low DY companies on Sunday. Second, the mean returns of the high DY portfolio on Sunday are positive, yet not significant. Third, the mean returns on Wednesday are significantly positive for both groups. Finally, standard deviation is higher on Monday for both portfolios.

We report the results of the conditional variance models, designed to capture the influence of investors' trading behaviour on the weekend effect, in Table 4.10. The first and second results columns present the outcome for portfolios based on firm size; the results for portfolios based on dividend yields are in the third and fourth results columns. We use the GARCH (1,1) and modified GARCH (1,1) models as stated in equation (ii) and (vi) for firm size. However due to non-negativity and non-explosive restrictions we apply a modified TGARCH (1,1) or GJR-GARCH (1,1) model as stated in equation (xi) for dividend yield. The modified GARCH (1,1) and TGARCH (1,1) approach allow us to include exogenous variables in the variance equation to check the significance of each portfolio's effect on volatility. Indeed, they help to substantiate our conjecture that the trading activities of individual investors determine the weekend effect on both returns and volatility.

Table 4.10: Alternate Models of Returns and Volatility on the DSE, Grouping Portfolios by Size and Dividend Yield

	Firm Size (Portfolios)		Dividend Yield (Portfolio)	
	GARCH (1,1)	GARCH (1,1)	GARCH (1, 1)	GJR-GARCH (1,1)
Estimation of mean and volatility equation				
Returns Equation				
Small	-0.048950***	-0.012931		
	[0.010318]	[0.028916]		
Mid-size	0.023207	-0.014814		
	[0.022267]	[0.025090]		
Large	0.002382	0.003188		
	[0.015872]	[0.019957]		
Low yield			-0.112171***	-0.100039
			[0.007999]	[0.015404]
High yield			-0.009239***	0.022391
			[0.013850]	[0.025183]
Return(-1)	0.029049***	0.025852	0.020846***	0.013772***
	0.009042]	[0.016109]	[0.005512]	[0.008586]
C	-0.000459***	-0.000419***	-0.000593***	-0.000566
	[0.000115]	[0.000153]	[0.000117]	[0.000141]
Volatility Equation				
ω	5.01e-05***	4.48e-05***	4.35e-05**	3.43e-05***
	[2.06e-05]	[9.51e-06]	[2.00e-05]	[1.15e-05]
α	0.111294*	0.148210***	0.075102*	0.000261
	[0.063561]	[0.060569]	[0.045212]	[0.005297]
β	0.713984***	0.657009***	0.768701***	0.797871***
	[0.106794]	[0.062402]	[0.097079]	[0.062804]
γ				0.155135**
				[0.078299]
Small		0.003528***		
		[0.000801]		
Mid-size		-0.001748		
		[0.001361]		
Large		0.001128		
		[0.001200]		
Low yield				0.002709***
				[0.000539]
High yield				-0.000844
				[0.001209]
Log Likelihood	2010.503	2013.543	2013.633	2025.742
Ljung-Box Q-Statistic				
LB (15)	3.8463 (0.996)	3.8991 (0.996)	3.9977 (0.995)	3.6335 (0.997)
LB^2 (15)	0.4499 (1.000)	0.4114 (1.000)	0.4632 (1.000)	0.3961 (1.000)
Wald statistics	242.84	870.61	551.91	1173.95
ARCH-LM Test:				
5	0.0355 (0.999)	0.0343 (0.999)	0.0348 (0.999)	0.0289 (0.999)

***, ** and * denote significance at the 1%, 5% and 10% levels respectively.
Standard errors and probabilities are in [ ] and ( ) respectively.

The first results column of Table 4.10 shows that the negative Sunday returns are driven by small firms (-4.895%, significant at 1%). The coefficients for the mid-sized 60 percent and largest 20 percent are positive but are not statistically significant. According to this model, the Sunday returns on the DSE are not only influenced largely by smaller firms but the negative returns are solely due to them. On the other hand, in the modified model (results column two) the returns are not significant for any portfolio. Nevertheless the highest volatility still belongs to the smallest portfolio (0.3528%) and is statistically significant. These findings are consistent with our previous results from Table 4.9: the trading activity in smaller firms causes the negative equity returns and increased volatility on Sunday. The estimated coefficients of the constant term, the lagged value of the square residuals and the lagged value of the conditional variance are all statistically significant in both models. However, the sum of the ARCH term and the GARCH term implies less persistence of shocks to the conditional variance (i.e. 0.8250 and 0.8052 respectively in the GARCH and modified GARCH models).

On the other hand both dividend yield portfolios are statistically significant in the returns equation presented in the third results column of Table 4.10. However, it is evident that Sunday returns are largely dragged down by the low DY firms, i.e. with returns of -11.27% and -10.00% respectively in the GARCH (1,1) and the modified GJR-GARCH (1,1) models. The high DY portfolio influences the Sunday returns negatively (-0.092%) in the GARCH (1,1) model and positively (+2.24%) in the modified TGARCH (1,1). In the variance equation (rightmost column of Table 4.10), we see the highest (and significant) volatility of 0.27% occuring with the low DY portfolio. The high yield firms have a negative effect on Sunday returns volatility (i.e. -0.084%) but this is not significant. This finding is also in line with our previous findings and implies that the weekend effect on returns and volatility is due to the trading behaviour of individual investors on the DSE, as displayed in low dividend yield firms. Nonetheless, the sum of α (ARCH term) and β (GARCH term) is 0.8438 and 0.7980 respectively in our time-varying models, which shows less persistent effect of shocks to conditional variance. Finally the asymmetric term γ is positive and insignificant, which means that bad news increases the volatility of the Bangladesh equity market on Sunday. Thus any negative shocks should increase the next period's conditional variance more than positive shocks of similar size.

We run several specification tests and report them at the end of Table 4.10. The Ljung-Box Q statistics check the adequacy of conditional returns and the validity of the conditional variance equation. For standardized residuals (LB) and squared residuals (LB^2) the null hypothesis that the residuals are not serially correlated (result is reported up to 15 lags). Engle's ARCH-LM test shows that there is no ARCH effect in the residuals, because the test result is close to zero. Finally, the Wald test confirms that the coefficients of the returns and variance equations for all four models are significantly different from zero.

Our findings strengthen the assertions of Kim and Stambaugh (1984), Gibbon and Hess (1981), and Brusa et al. (2000, 2005) that the weekend effect is stronger for small firms than large firms[19]. This is consistent with the conjecture of Osborne (1962), Ritter (1988), Lakonishok and Maberly (1990), Abraham and Ikenberry (1994) and Kamara (1997) that a weekly variation in trading activity by individuals is an important cause of the day-of-the-week effect. Lakonishok et al. (1992), Blume and Zeldes (1993) and Barber and Odean (2005) suggest that individual investors generally have greater holdings in small firms. Our results, therefore, suggests two different perspectives on the Bangladesh stock market. First, the information processing hypothesis is probably effective here: individual investors use their weekends to gather and process information and become active players on Sunday. Second, because this market is largely dominated by individual investors, the weekend effect strongly exhibits itself in smaller firms' stock prices. Individuals demonstrating this particular behaviour on Sunday may be due to several reasons, such as liquidity needs or rebalancing (Abraham and Ikenberry, 1994), an absence of brokerage firms (Miller, 1988; Lankonishok and Maberly, 1990), less participation by institutional investors as they set their strategic plans (Osborne, 1962), and a low-cost advantage over trading of smaller firms (Kamara, 1997).

4.5.5 Feedback effect and individual investors

It is empirically proven that first order serial correlation in daily returns is not equal across weekdays. For example, several early researchers document a higher correlation between Monday and the previous Friday (Keim and Stambaugh, 1984; Bessembinder and Hertzel, 1993; Abraham and Ikenberry, 1994; Brusa et al., 2000 and 2005). In an extensive study on returns autocorrelation, Bessembinder and Hertzel (1993) found an unusually high correlation for at least 100 years between Monday's returns and the prior Friday's return. Using the CRSP equally-weighted index of NYSE and ASE firms, Abraham and Ikenberry (1994) also report that the highest positive correlation is between Friday and subsequent Monday returns. Scholes and Williams (1977) claim that this first-order serial correlation in daily returns may be due to non-synchronous trading.

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[19] For robustness purposes this study has checked the weekend effect in DSE-20, which is a top cap index of this market. We do this investigation with an argument that if the weekend effect is due to small investors' trades and hence is observed in small cap stocks, then there should be no weekend effect in large cap index, i.e. DSE-20 (constructed with twenty blue-chip shares of the market). To examine the weekend effect and significance of Sunday on return and volatility, we have applied equations (x), (ii) and (iii) respectively for OLS, GARCH (1,1) and modified GARCH (1,1) models. Results from OLS estimation show that Sunday return is positive and not statistically significant. Similar results are also found in GARCH (1,1) approach, where Monday and Thursday are found significant at 5% level. Finally, Sunday is further not found significant up to 10% level in our modified volatility model (i.e. modified GARCH (1,1) model), whereas Monday and Thursday are found significant at 5% and 1% level respectively (detail results are available on request). Altogether, findings confirm that there is no Sunday seasonality in DSE-20 index and market is not moved on Sunday by the stocks trading of large cap firms.

However, Keim and Stambaugh (1984), Jaffe and Westerfield (1985) and Bessembinder and Hertzel (1993) contend that measurement errors in stock index returns that arise from non-synchronous trading cannot explain the high correlation observed in Friday-Monday returns. Abraham and Ikenberry (1994) provide a natural explanation for this returns correlation. They assert that it is a delayed response of individual investors to the information revealed on the previous trading day. Lakonishok et al. (1992), Brusa et al. (2005) and Venezia and Shapira (2007) also link this feedback relationship to the weekend behaviour of investors. They assert that the conditional weekend effect is the result of the differential trading patterns of institutional and individual investors.

In this section, following the influence of individual investors on the weekend effect, we analyse the correlation between Thursday-Sunday returns. Using firm-level evidence we explore whether the weekend effect is driven by the trading behaviour of individual investors. We conjecture that in Bangladesh the Thursday-Sunday returns autocorrelation should be higher for smaller firms, where individual investors have greater holdings.

To test this hypothesis, we calculate the contemporaneous correlations between Sunday returns and variance and the returns and variance of the previous Thursday. We divide all the listed firms into small, mid-sized and large groups similar to the previous section. We report the results in Table 4.11, where the first three results columns show the correlations between returns and results columns four to six show the correlations between variances.

Table 4.11: Thursday-Sunday Correlations between Returns and Volatility for Size Portfolios on the DSE

		Thursday					
		Correlation between returns			**Correlation between variance**		
		Smallest	Mid-size	Largest	Smallest	Mid-size	Largest
Sunday	Smallest	0.2037***	0.0979***	0.0801**	0.1997***	0.0957***	0.0777**
		[5.4099]	[2.5578]	[2.0886]	[5.2940]	[2.4986]	[2.0236]
	Mid-size	0.0727**	0.1931***	-0.0152	0.0735**	0.1982***	-0.0093
		[1.8947]	[5.1168]	[-0.3956]	[1.9145]	[5.2523]	[-0.2425]
	Largest	0.0502	0.0255	-0.0038	0.0514	0.0242	-0.0052
		[1.3074]	[0.6645]	[-0.0990]	[1.3362]	[0.6293]	[-0.1367]

***, ** and * indicate significance at the 1%, 5% and 10% levels respectively. t-statistics are in [ ]

As expected, the highest and significantly positive Thursday-Sunday contemporaneous correlation (0.2037) is between returns for the smallest firms. Surprisingly, the Sunday returns of the smallest group is also significantly correlated with the Thursday returns of the mid-sized (0.0979) and largest (0.0801) firms. There is a strong Thursday-Sunday positive returns correlation (0.1931) between mid-sized firms as well. The Sunday returns of mid-sized firms are also influenced by the smallest group (0.0727) and this is statistically significant at the 5% level. The Thursday-Sunday returns for the largest firms are barely correlated and it is not statistically significant.

Conversely, we use the residuals from the returns models of each firm-size portfolio to determine the contemporaneous correlation between the variances of Thursday-Sunday returns. The results are very much consistent with those from the returns: the highest and significant positive correlation is found in the smallest group (0.1997) and then between mid-sized firms (0.1982). The correlation between the variance of the largest firms is again very close to zero and not statistically significant. The variance of the smallest portfolio is positively influenced by the variance of both mid-sized (0.0957) and large firms (0.0777). Finally, the Sunday returns variance for mid-sized firms is positively correlated (0.0735) with the smallest firms and it is significant at the 5% level. These contemporaneous correlation results for the DSE are similar to those of Abraham and Ikenberry (1994). They report a positive correlation between Monday returns and the returns from the previous Friday, and it is particularly strong for small and mid-sized stocks.

We extend the analysis by dividing firms into ten deciles and focusing on the firm-level characteristics. We create unconditional and conditional Sunday proportions following the methodology suggested in Brusa et al. (2000). Here the unconditional proportion represents the total number of positive and negative returns on Sunday. These results are reported in columns three and four of Table 4.12. The results in column five and six show the conditional Sunday proportion. It is representing the proportion of Sunday returns are positive (negative) given that the preceding Thursday return was positive (negative). The statistics for unconditional and conditional independence are given in results column seven. To check the independence we split the Thursday-Sunday returns series into positive-positive, negative-negative, positive-negative and negative-positive categories and calculate Pearson's χ^2 and the Phi Coefficient. Pearson's χ^2 is used to measure overall unconditional independence and the Phi Coefficient is to measure conditional independence, i.e. the association between the Thursday and Sunday returns series. While the correlation coefficient only measures the linear association between series, the nonparametric Phi Coefficient measure is robust to departures from linearity. Finally, the *z*-statistics, at the bottom of each decile's cell in columns five and six, test whether the conditional positive (negative) proportions are significantly different from the unconditional positive (negative) proportion, given that the preceding Thursday returns were positive (negative).

Table 4.12: Conditional and Unconditional Proportions of Sunday Returns on the DSE

Decile		Unconditional Sunday proportions		Conditional Sunday proportions		Unconditional and conditional independence [a]
		Positive	**Negative**	**Positive**	**Negative**	
Smallest	No. of Obs.	369	309	220	160	[12.91]***
1	Proportion	54.42	45.58	58.51	51.66	(0.14)
	z-statistic			2.11**	1.95**	
2	Obs.	334	344	176	207	[12.80]***
	Proportion	49.26	50.74	56.23	56.71	(0.14)
	z-statistic			1.71*	2.24**	
3	Obs.	370	308	189	176	[80.42]***
	Proportion	54.57	45.43	58.88	49.30	(0.34)
	z-statistic			2.01**	1.98**	
4	Obs.	360	318	193	170	[5.04]
	Proportion	53.10	46.90	56.76	50.30	(0.09)
	z-statistic			1.19	1.55	
5	Obs.	375	303	197	168	[5.71]
	Proportion	55.31	44.69	59.52	49.27	(0.09)
	z-statistic			1.29	1.32	
6	Obs.	364	314	182	160	[681.39]***
	Proportion	53.69	46.31	54.17	46.78	(1.00)
	z-statistic			2.89***	3.64***	
7	Obs.	338	340	178	187	[684.99]***
	Proportion	49.85	50.15	53.78	53.89	(1.00)
	z-statistic			2.78***	3.84***	
8	Obs.	345	333	154	172	[228.98]***
	Proportion	50.88	49.12	48.89	47.38	(0.58)
	z-statistic			1.84*	2.05**	
9	Obs.	363	315	194	165	[10.84]
	Proportion	53.53	46.46	56.40	49.40	(0.12)
	z-statistic			0.89	1.41	
Largest	Obs.	362	316	191	164	[3.95]
10	Proportion	53.39	46.61	57.01	47.81	(0.05)
	z-statistic			1.82*	0.68	

[a] Unconditional and conditional independence respectively measure overall independence and association between Thursday and Sunday returns. We calculate Pearson's $\chi^2 = \sum_{i,j} \frac{(\hat{n}_{i,j} - n_{i,j})^2}{\hat{n}_{i,j}}$ to measure the overall independence (where, $\hat{n}_{i,j}$ and $n_{i,j}$ are overall and actual expected count in each cell) and the Phi coefficient $\sqrt{\chi^{-2}/N}$ to measure the association between the two returns series. The results of Pearson's χ^2 are reported in [ ] and the Phi coefficient in ( ). The *z*-statistics test whether the conditional proportions of positive (negative) Sunday returns are significantly different from the unconditional proportions of positive (negative) Sunday returns. The sample of returns includes 678 observations over the thirteen-year period 2000-2012. ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively. All proportions are in percentage form.

The results given in Table 4.12 are very interesting. We see that there are more positive returns than negative returns for most of the deciles except 2 and 7, where there are slightly more negative returns than positive. In particular the positive returns are substantially higher for some of the mid-sized (deciles 3 to 6) and larger firms (deciles 9 and 10). For the conditional Sunday proportion, a negative Sunday return following negative returns on the Thursday is more likely for deciles 2, 7 and 8. Consistent with the previous literature, the *z*-statistics show that strong autocorrelations exists between Sunday returns and preceding Thursday returns for some of the mid-sized firms, such as deciles 3, 6, 7 and 8. Autocorrelation also exists between Thursday-Sunday returns in smaller decile 1 and 2. These results are similar to those of Keim and Stambaugh (1984), Gibbon and Hess (1981) and Abraham and Ikenberry (1994), since they report higher autocorrelations for small and medium size firms.

However, Brusa et al. (2000) report no autocorrelation between Friday-Monday returns for small and large firms using the DJIA and NASDAQ stock indices, but strong autocorrelation for mid-sized firms. Thus, the autocorrelation characteristics for the DSE across firm size are similar but not identical to those of the US equity market. The significance of the *z*-statistics for both positive and negative returns in deciles 1 to 3 and 6 through 8 means that given a positive Thursday return, the following Sunday returns are more likely to be positive, and the same for negative returns. Thus positive (negative) Sunday returns follow positive (negative) returns on the Thursday. Similar to the US market (Brusa et al., 2000), we do not find any such correlation for large firms, except that for the largest decile positive returns in the conditional Sunday proportions are statistically significant at the 10% level. This implies that positive Sunday returns may follow positive returns on the previous Thursday for the largest stocks, but the same is not true for negative returns.

Pearson's χ^2 and the Phi Coefficient provide similar results to those of the *z*-statistics. Applying the unconditional independence test, Pearson's χ^2 is found statistically significant for deciles 1, 2, 3, 6, 7 and 8. We therefore reject the null hypothesis that the returns series of Thursday and Sunday are independent for these small and mid-sized firms. Furthermore we see a very strong unconditional association between the Thursday-Sunday returns series for firms in deciles 3, 6, 7 and 8. This is because the Phi Coefficient is 0.34 for decile 3, 1.00 for deciles 6 and 7 and 0.58 for decile 8. These findings are very much consistent with our previous results.

Overall we see a conditional returns pattern in our sample. This pattern depends on firm size, where small and mid-sized firms exhibit a stronger conditional effect between Thursday and Sunday. This finding is in line with the argument of Abraham and Ikenberry (1994). Using the CRSP value-weighted index of NYSE and ASE firms over the period 1963-1991 they find that institutional investors generally have a greater presence in large-cap stocks. Therefore positive autocorrelation is consistent with the notion that the trading behaviour of individuals has greater impact on small and mid-sized stocks and may be occured as a delayed reaction to negative information revealed in the previous trading session. In addition, the Thursday-Sunday returns and variance autocorrelation on the DSE may be the consequence of information revealed in the prior trading session. Altogether, the positive autocorrelation between Thursday-Sunday equity prices is strongly documented in small and mid-sized firms on the DSE. This supports our conjecture related to individual investors. Brusa et al. (2005) report that small stocks in the US market during the 1988-98 periods also exhibit a positive autocorrelation between Friday and Monday returns. In another study on the US equity market, Lakonishok et al. (1992) also find this positive feedback trading in small stocks, but they claim that institutional investors are responsible for this effect. In Venezia and Shapira (2007), the coefficient of the behavioural variables turns out to be significantly related to stock returns. They also agree, this is due to the behaviour of certain types of investors that may affect stock prices after the weekend.

4.6 Chapter Summary

We have applied conditional variance approaches to investigate the weekend effect and the influence of investors' trading behaviour on returns and volatility on the Dhaka Stock Exchange. This anomaly is extensively documented in previous studies for developed and many emerging equity and non-equity markets. Our results for our sample period January 2000 to December 2012 also identify the presence of the weekend anomaly on the DSE in both returns and volatility, although due to the exchange's opening days it is a Sunday effect, not a Monday effect. This suggests that investors might get an advantage by designing their investment strategies based on such a regular shift in the market. An active trading strategy may not have been profitable all the time due to transaction costs. Nevertheless investors could have increased their expected returns simply by changing the timing of trades that were planned anyway (French, 1980) with this market anomaly in mind.

There are several findings reported in this study. First, following the trading time hypothesis of French (1980), we find that the day-of-the-week pattern exists in returns following information content theory. Mean stock returns are not the same across the weekdays: Sunday's returns are significantly negative compared to the other trading days. Unlike most other markets the DSE operates from Sunday to Thursday; hence there is a "Sunday Effect".

Second, we have applied a conditional variance model using daily returns series and document a weekend effect on volatility. Sunday's price is statistically significant for both returns and variance equations under both GJR-GARCH and CGARCH (1, 1) specifications. These findings support the arguments of Clark (1973), Kyle (1985), and Schwert (1990) that stock market variance is positively linked to trading volume. On the Dhaka Stock Exchange the average trading volume is highest on Wednesday and the next highest volume is on Sunday. Hence heavy trading might be the reason for the "weekend effect" and the "reverse mid-week effect" we have found on Sunday and Wednesday respectively. Earnings and macroeconomic announcements are often disclosed on the DSE on Thursday and over the weekend. Most investors might therefore take long or short positions on Wednesday as they try to predict the announcement, then reshuffle their positions on Sunday based on the details of the announcement. As French and Roll (1986) and Barclay et al. (1990) observed, returns variance may be highest on the first day of the trading week because investors have their maximum information advantage to trade then.

Third, we find that the trading pattern of individual investors influences the weekend effect. Sunday returns tend to be negative for smaller firms and firms with a low dividend yield, where individuals tend to have greater holdings than institutions. The equity variance is also found to be significantly higher on Sunday. These results are consistent with previous studies, e.g. Gibbon and Hess (1981), Keim and Stambaugh (1984), Abraham and Ikenberry (1994), Kamara (1997), Brusa et al. (2000), and Chan et al. (2005) even though the DSE is dominated by individuals, as are the Shanghai and Shenzhen markets. In a market dominated by individual investors the weekend effect is stronger for smaller firms than larger companies. To explain the dynamics Abraham and Ikenberry (1994) assert that the weekend phenomenon is more complex than has been previously reported, and appears to be influenced by the trading behaviour of individual investors. In addition, this result validates the argument that regardless of the size of the economy and its firms, investors' preference towards small versus large stocks still influences the weekend effect.

Fourth, we have identified a positive feedback relationship between Sunday returns and the returns of previous Thursday. This pattern is also a function of firm size, where small and mid-sized firms show a stronger conditional effect between Thursday and Sunday. This conditional relationship adds weight to our argument about individual investors' behavior (Abraham and Ikenberry, 1994; Brusa et al. 2005). We also document the feedback effect between Thursday-Sunday returns residuals. This means that the Sunday returns variance is substantially influenced by the variance of previous Thursday. Finally, we find from our robustness test that returns and volatility of Sunday during Ramadan period is not significantly different than non-Ramadan periods. Moreover, ther is no weekend effect found in DSE 20 index, which confirms that negative returns and higher volatilities on Sunday are the results of trading of small firms.

In future, a similar approach could also be applied to other emerging markets to investigate the link between investors' trading behaviour and the weekend anomaly. Calendar regularities in stock market returns and volatility are a complex and interesting topic. Further investigation of investors' psychology and sentiment in other markets as they process equity market information, and understanding how they participate after the weekend, can doubtless shed more light on this area.

Chapter 5:
Volatility Spillovers: The Time Zone Effect

5.1 Introduction

Since the US stock market crash of October 1987 and its impact on other financial markets of the world researchers are interested to see how financial disturbances transmit from one market to others (see Lin et al. 1994; Gagnon and Karolyi, 2006). Studies extensively investigates the volatility transmission between stock markets (see Hamao et al., 1990; Koutmos and Booth 1995; Ng, 2000; Singh et al., 2010; Jiang et al., 2012; Balli et al., 2013), between foreign exchange markets (see Hong, 2001; Antonakakis, 2012), between future markets (see Gannon and Choi, 1998; Gannon, 2005), between bond markets (see Skintzi and Refenes, 2006; Duncan and Kabundi, 2013) and between swap markets (In, 2007)to name a few.

Surprisingly though, little attention has been given to the combined volatility spillovers from stock markets with synchronous and nonsynchronous trading hours. That means no evidence is available in earlier studies about how the volatility of a domestic stock market is simultaneously influenced by the transmission of information from markets in similar time-zone and markets from other time-zones. In other words, whether the domestic equity market has equally affected or there is any differences remain in their nature of transmission of information. Earlier studies only have documented the volatility spillovers effect between countries either by eliminating overlapping trading hours (see Hamao et al., 1990; Lin et al., 1994) or by including overlapping trading hours (see Susmel and Engle, 1994; Kohonen, 2013), but evidence is rarely found to see the combined influence. On the other hand, researchers have described how local, regional, and world market factors or information influence the volatility of emerging stock markets (e.g. Bekaert and Harvey, 1997; Ng, 2000), yet distinction is not been made between factors based on time-zone.

Nevertheless, there are some studies where equity markets have been separated based on time-zone, such as Engle and Susmel (1993), who group the data of 18 international stock markets according to time-zones and search for common regional news factor. Even in an earlier paper, Furstenberg and Jeon (1989) investigate the influence of time-zone stock price innovations on comovement in international stock prices, separated between before and after the stock market Crash of 1987. Loughran and Schultz (2004) use time-zone of companies headquarter as proxy to examine the evidence of weather effect on intra-day trading pattern. Some of the contemporary studies, e.g. Cai et al. (2009) and Singh et al. (2010) also mention about the time-zone effect on market integration and transmission of information. Cai et al. (2009) report strong correlation between the US and Asian equity markets with time-zone effect, yet they do not show the volatility spillovers from that perspective. Besides, Singh et al. (2010) include the same day effect between markets and propose the importance of a study of volatility transmission with overlapping trading time. Moreover, most of the existing literatures have documented this transmission among markets with similar trading days, which is from Monday to Friday. But when the domestic stock exchange operates other than Monday to Friday and located in a different time-zone then the dynamics of daily volatility spillovers will be different from usual. This study tries to fill the need of such a study by examining the daily flow of information between markets.

Transmission of information across countries is one of the prevalent themes in finance literature, yet theoretical works on the cause of interdependence are limited (see Hamao et al., 1990; Kohonen, 2013). Nevertheless, there are several possible reasons claimed in literatures about why volatility is being transferred across borders, e.g. globalization of financial markets, liberalization of capital markets regulations, free flow of capital investment, international trade, improvements in information technology, market cointegration and contagion. For example, Lin et al. (1994) explain that the growing financial market integration increases the correlation between stock markets and therefore, equity prices of one country may be affected by the changes in another country beyond what is credible by connections through fundamentals. According to the signal extraction model of King and Wadhwani (1990) price changes in one market depend on the price changes in other countries through structural contagion coefficients and further, mistakes or idiosyncratic changes in one market may be transmitted to other markets, thus increasing volatility. It is now fairly established that investors including the market-makers have access to different sets of information and they can infer valuable information from price changes in other markets and incorporate those into their buy and sell decisions. Koutmos and Booth (1995) explain such behaviour as consistent with the efficient markets hypothesis, provided that information generated by international stock markets is relevant for the pricing of domestic securities.

In this study, we consider the relationship between equity prices across eight international markets: Japan, Canada, China, Hong Kong, India, Bangladesh, the UK and US. Particularly, we are interested in (1) the extent to which security price changes in one market in similar and different time-zone influence the price volatility of domestic market, and (2) the causal relationship between volatilities of domestic capital market and markets from similar and different time-zones.

Our study differs from the previous literatures by several ways. First, we use stock market data from two different time-zones, where four markets open earlier than domestic market and three markets open later. Further, five of those markets have overlapping trading hours and two of them have distinctly separate operating hours. By doing this we combine the arguments of excluding overlapping trading by Hamao et al. (1990) and including simultaneous trading of Susmel and Engle (1994). In particular, the capital market of Japan, Hong Kong, China and India start earlier than the domestic country (i.e. Bangladesh) and have respectively three, four, three, and five hours of overlapping trading hours. On the other hand, Canada, the UK and US start their trading later of the day, yet the UK has two hours of simultaneous operation with Bangladesh. Therefore, we can examine the impact of news revealed in one market on return volatility in the other markets hours later (see Susmel and Engle, 1994).

Second difference of this study with existing papers is that the stock market of domestic country is operating from Sunday to Thursday and thus the dynamics of volatility spillovers effect are not same across the trading days of the week. Nevertheless, early researchers study the volatility spillover effects between markets with similar trading days, which are from Monday to Friday. Therefore, this study provides an opportunity to add to the evidence that within a week how domestic market is influenced by the other markets from similar and different time-zone. Third contribution of this research is that it provides new evidence of joint volatility spillovers from both developed and emerging stock markets to another emerging equity market which is different in economic and institutional characteristics. Specifically, this study is an evidence of volatility transmission from the capital markets of four G-8 and two BRIC countries to a NEXT-11 countries' equity market. There are contradictory findings reported in literatures about this influence. For example, weak transmission between developed and emerging markets is stated in Bekaert and Harvey (1997) and Ng (2000) but significant effect is reported in Wongswan (2006). Finally, as Bollerslev et al. (1992) claim, further work on volatility spillovers seems promising and might help in further understanding the transmission mechanism of stock return volatility.

The remainder of the study is organized as follows. Section 5.2 describes a brief review of literatures on the studies of volatility transmission across the markets. The data sources are presented in section 5.3. Methodology employed for the first and second moment (return and volatility) interdependence is discussed in section 5.4. Section 5.5 presents the main empirical results of the study. Section 5.6 concludes and discusses the direction for future research.

5.2 Literature Review

Financial market volatility is central to the theory and practice of asset pricing, asset allocation, and risk management (Andersen et al., 2001). For example, Sharpe (1964 and 1970) uses the stock return volatility to develop the capital asset pricing model, and Black and Scholes (1973) apply the variance in their option pricing model. Nevertheless, there is little theoretical work on volatility spillovers (Hamao et al., 1990) and most of the early researches have focused mainly on the return correlations between different international capital markets (see Agmon, 1974; Panton et al., 1976; Hilliard, 1979; Jaffe and Westerfiled, 1985a, 1985b; Eun and Shim, 1989; King and Wadhwani, 1990). For example, Hilliard (1979) examines the contemporaneous and lagged correlation in daily closing price changes across ten major stock markets. Jaffe and Westerfield (1985a, 1985b) investigate daily closing prices of Australia, Canada, Japan, the UK and US stock markets. They suggest that the correlations are positive and significant between those national markets.

Hamao et al. (1990) is the first study that uses ARCH family model to explore the volatility spillovers between stock markets. They use Nikkei 225, FTSE 100 and S&P 500 Composite index respectively for Japan, the UK and the US to see the short-run interdependence of price and price volatility. They find evidence of price volatility spillovers from New York to Tokyo, London to Tokyo, and New York to London, but no price volatility spillover effect in other direction. In a subsequent paper Hamao et al. (1991) use a GARCH based model and include the effect of the 1987 stock crash on the financial integration. They report volatility transmission does not occur evenly around the world; rather, there are spillover effects of disproportionate size from one market to the next and effects have been found relatively stable both prior to and after the crash. Using a weekly data set from 1980 to 1991, Theodossiou and Lee (1993) later examine the volatility spillovers between the US, UK, Japan and include Canada and Germany into this model. They report that significant volatility spillovers radiates from the US market to all four stock markets, from the UK to Canadian markets, and from Germany to Japanese markets. The volatility spillovers between the US and the UK market are extensively examined in Susmel and Engle (1994). Using several new ARCH approaches and high frequency hourly data, they find no evidence of mean spillovers during non-overlapping trading periods but identify a weak evidence of volatility spillovers between both markets. Further, they claim that inclusion of the October 1987 crash period does not reinforce the spillovers between New York and London.

In a seminal paper of international equity return correlations, King and Wadhwani (1990) document a contagion effect around the 1987 stock market crash, where a mistake in one market is transmitted to other market. All their empirical evidence suggests that an increase in volatility in turn leads to an increase in the size of the contagion effects. Later, Lin et al. (1994) improve the signal-extraction approach as suggested in King and Wadhwani (1990). Lin et al. (1994) decompose close-to-close returns of New York and Tokyo into daytime and overnight returns and allow time-varying volatility in performing the signal-extraction. Their results of GARCH-in-mean model show that cross-market interdependence in returns and volatilities is generally bi-directional rather than from New York to Tokyo markets only as reported in earlier literatures. In lagged spillovers model, however, they find little evidence of the lagged returns spillovers from New York daytime to Tokyo daytime or vice versa.

Unlike the linkages and interactions of stock markets, Koutmos and Booth (1995) consider the potential asymmetries that may exist in volatility transmission mechanisms. That means bad news in a given market has a greater impact on the volatility of the returns in the next markets to trade. They use exponential GARCH (or EGARCH) model on daily data set of price indices from September 1986 to December 1993 of New York, London and Tokyo. They document significant volatility spillovers between each other and in all instance the negative innovations in a given market increase volatility in the next market to trade considerably more than positive innovations. Finally, their pre and post October 1987 analysis reveals substantial interdependence in the post-crash era. A similar EGARCH approach is also applied in Booth et al. (1997) and Kanas (1998) to investigate the volatility spillovers across major European stock markets. For example, Booth et al. (1997) provide evidence of price and volatility spillovers among four Scandinavian stock markets – Denmark, Norway, Sweden and Finland. The results indicate that returns and volatilities are strongly dependent on their own past values from 1988 to 1994. They further report a weak spillover effect among four markets, except a small bilateral volatility transmission between Sweden and Finland. On the other hand, Kanas (1998) explores the volatility transmission between three major equity markets of Europe – London, Frankfurt and Paris. From 1984 till 1993, reciprocal spillovers are found between London and Paris, and between Paris and Frankfurt. Further, unidirectional spillovers are reported for the same period from London to Frankfurt as well. In line of thought, Koutmos (1996) uses VAR-EGARCH approach to investigate the volatility interactions among the UK, France, Germany and Italy. He finds significant second moment interactions among these countries and reports the volatility transmission mechanism is asymmetric. That means European stock markets are integrated in the sense that they react not only to local news but also to news originating in other markets, especially when the news is adverse.

From the European context Baele (2005) investigates the effect of globalization and regional integration to local equity markets. Specifically, he quantifies the magnitude and time-varying nature of volatility spillovers from the aggregate European (EU) and US market to 13 stock markets from Western Europe. He takes weekly data from 1980 till 2000 to cover the period of economic, financial and monetary integration. He uses a regime-switching model to allow the shock sensitivities to change over time and reports that the shock spillovers intensity from the EU and the US increased substantially over the second half of the 1980s and first half of the 1990s, though it is more pronounced for EU spillovers. He further provides evidence that higher trade integration, equity market development, and low inflation contribute to the increased intensity of EU shock spillovers. The volatility spillovers across the US and European stock markets is further explored in Savva (2009), who applies a multivariate GARCH approach to examine the transmission of price and volatility across the US and European stock markets. His daily data consist of S&P 500 (US), FTSE 100 (UK), DAX 30 (Germany), CAC 40 (France), MIBTEL 30 (Italy), and IBEX 35 (Spain) indices from 1990 till 2005. Regarding the volatility spillover effect, he finds bidirectional influence that means from US to Europe and from Europe to US. Further to assess the impact of shocks in each market on the conditional variance he uses News Impact Surfaces and reports that the patterns of conditional volatilities vary with the combination of markets.

Recently in an interesting study Jiang et al. (2012) examine the effect of several scheduled and unscheduled macroeconomic information announcements on the transmission of implied volatilities across the US and European markets. Based on some major US and European implied volatility indices they report strong volatility spillovers between the US and European markets and also across European markets. Further to support the information uncertainty theory their results show that volatility increases on days with unscheduled news announcement and decreases on days with scheduled news events. Surprisingly, Jiang et al. (2012) conclude that while news announcements affect the magnitude of implied volatility spillovers, they can't fully explain the volatility spillovers.

Over the last twenty years due to the financial market liberalization and development, researchers become interested to see the transmission of information across emerging equity markets and with developed markets. Bekart and Harvey (2000) note that evidence on changes in emerging capital markets' returns, volatilities, and correlations after the financial liberalization may help the effort to incorporate emerging markets into global asset allocation models. In this line of thought, Hu et al. (1997) examine the spillover effect of volatility among two developed markets (the US and Japan) and four emerging markets in the South China Growth Triangular (SCGT) - Hong Kong, Taiwan, Shanghai and Shenzhen, using causality-in-variance and GARCH model. Based on contemporaneous correlation, results indicate that markets of the SCGT are mainly correlated with the return volatility of the US market. It is also found in their study that the return volatility of the foreign equity markets as a proxy for information arrival can explain the excess kurtosis of a stock return series, especially for the less open emerging market. Aggarwal et al. (1999) examined the transmission of information between ten of the largest emerging markets in Asia and Latin America, Germany, Japan, the UK and US. They find evidences that the stock market volatility of emerging economies is significantly influenced by both local and global social, political and economic events. However, the periods with high volatility are found to be associated with important events in each country rather than global events.

Ng (2000) splits the sources of information into three categories – local, regional and world factors and examines the magnitude of volatility spillovers from the US and Japan stock markets on six Pacific-Basin countries. The methodology conducted by Ng (2000) involves two basic steps. First, she uses a bivariate GARCH (1,1) model for the joint dynamics of Japanese and US returns and volatility. In the second step, she develops a univariate volatility spillovers model for each Pacific-Basin country and allows innovations in Japan and the US to influence the equity return through that country's error term. The results show that both regional (Japanese) and world (US) factors are important for market volatility in the Pacific-Basin region, however, world factors have greater impact. She also reports that volatility captured by the regional and world factors is generally small only account for less than 10% of the weekly variance in returns. Similarly, In et al. (2001) examine the dynamic interdependence, volatility transmission and market integration among some of the largest Asian financial markets during the Asian crisis in 1997 and 1998. They use VAR based EGARCH model and find reciprocal volatility spillovers between Hong Kong and Korea, and unidirectional spillovers from Korea to Thailand. Overall, results suggest a strong influence of Hong Kong and a weak influence of Korea within Asian financial markets. With regard to correlation between markets, they report that Thailand demonstrated a greater linkage with Hong Kong and Korea, particularly during the crisis period.

For investigating the information flow between dually listed stocks traded in Australia and the US, Alaganar and Bhar (2002) use a bivariate GARCH model. They find evidence supporting information flow predominantly from the US equity market to the Australian market. The US influence is more pervasive and it occurs at both the mean and volatility levels of stocks with American depository receipts (ADR) as well as on aggregate indices. In the subsequent year, Miyakoshi (2003) analysed the return and volatility spillovers from the US and Japan to seven Asian equity markets. He finds that the US market is significant for Asian market returns but volatility is influenced more by Japanese market. He also reports an adverse influence of volatility from the Asian market to Japanese market. Following the deregulation policy of Turkish government, Darrat and Benkato (2003) examine to what extent the Istanbul stock exchange (ISE) is integrated with major markets in the US, Japan and Europe. Using GARCH process on monthly data from January 1986 to March 2000, they report that ISE become significantly linked to volatilities in the four matured markets only at post-liberalization periods. Their results further identify the US and UK equity markets as the main source of volatility spillovers for Istanbul stock exchange even in the aftermath of the Asian-Russian crisis.

To analyse the volatility transmission between developed and emerging equity markets, Wang and Firth (2004) use intra-day data from 1994 to 2012 of four Greater China stock indices, Japan, the UK and US indices. They propose that the volatilities of most of the sample stock market indices have significant asymmetric coefficients and after the Asian financial crisis of 1997, the volatility spillovers have been bidirectional between the Greater China markets and the developed markets. The investigation of same day effects along with dynamic information spillover is limited and that motivates Singh et al. (2010) to see the return and volatility transmission among 15 countries from Asia, Europe and North America. The return and volatility spillovers are modelled through VAR (15) and AR-GARCH respectively. In both return and volatility, it is found that a particular index is mostly affected by the indices which open/close just before it. The results also report a greater regional influence among Asian and European stock markets.

In a recent study, Kohonen (2013) asserts that studies trying to estimate a theoretical model that would explain both volatility and its transmission are rare, and to fill this gap he combines a theoretical explanation for volatility spillovers with a statistical model and also develops a spillover test for fully overlapping stock markets. His approach basically augments the King and Wadhwani's (1990) rational expectations model with a distributional assumption about the reduced form error distribution. The model is estimated for five Eurozone stock markets data around the beginning of the sovereign debt crisis of 2010-11 and found the evidence of volatility spillovers. Kohonen (2013) further reveals that the large countries in the sample (e.g. Italy and Germany) have greater impact on all countries; however, small countries (e.g. Ireland and Greece) mostly have effects on each other.

For the Gulf region, Balli et al. (2013) examine the spillover effects of local and global shocks on Gulf Cooperation Council (GCC)-wide sector equity returns. Empirically, they model the returns with a GARCH and a time-varying spillover model. Their initial finding reports that GCC-wide sectoral returns are highly dependent on their own volatility rather than on local or global shocks and even the magnitudes of the responses to those shocks are heterogeneous. Applying a time-varying model, they further identify that the effect of global shocks on the volatility of GCC sector returns has been decreasing, whereas regional shocks have been affecting the sector indices with a positive and significant manner.

Based on the above discussions it is documented that early researchers, therefore, have extensively investigated the volatility spillovers among financial markets across developed and emerging countries. Nevertheless, no evidence is documented in literatures about how information transmitted to an equity market on daily basis from other international markets located in similar and different time-zones. Gap also exists to examine the volatility spillover dynamics between stock markets which are not operating simultaneously from Monday to Friday. In this study, we try to fill these gaps by providing empirical evidence.

5.3 Data

This study selects seven international markets to cover primarily the world financial markets and time-zones: Canada, the US and the UK to represent the developed western markets from different time-zones, and Japan, Hong Kong, China and India to cover the similar time-zones, because Cai et al. (2009) claim they play irreplaceable role as Asian financial markets and the world. Bangladesh, one of Asia's new emerging economies is considered as the domestic market in this study to examine daily spillover effects. Figure 5.1 shows the opening to closing times of each market with respect to domestic country and also explain the amount of synchronous and non-synchronous trading hours between markets for every trading day. Table 5.1 gives both local and GMT timings for all these eight international equity markets to present the time-zone differences. The dataset we use covers daily closing prices over the period from 3rd January 1992 to 31st December 2012. During this 21 years period domestic market, Bangladesh has adopted different liberalization policies such as removal of the barriers to the international equity investment, adoption of international quality trading and settlement mechanism and reduction of transaction cost. Indeed, the financial sector reform agenda was formarly launched in 1984 with the appointment of the National Commission on Money, Banking and Credit (NCMBC). The commission submitted its report in 1986 and in response to this report the Bangladesh government launched the Financial Sector Reforms Programme (FSRP) in 1990 under a financial sector adjustment credit of the International Development Agency (see Chowdhury, 2000 for details). That indicates since early 1990s Bangladesh equity market has become more exposed to the transmission of world factors and associated to global financial markets. It is reported in Bekaert and Harvey (1997, 2000) that the capital market liberalization often leads to a higher correlation between local and international markets. Therefore, it is possible that the volatility of domestic equity market could be receiving spillovers effect from major international capital markets as stated in Ng (2000). From each market, we choose the most comprehensive and diversified stock index to meet our requirements. The indices used are the S&P 500 (US), FTSE 100 (UK), S&P/TSX Composite (Canada), TOPIX (Japan), SSE Composite (China), Hang Seng (Hong Kong), BSE 100 (India), and DSI all-share Index (Bangladesh). The dataset is obtained from Datastream and the main board of the Dhaka Stock Exchange (DSE hereafter).

Figure 5.1: Exchange Trading hours

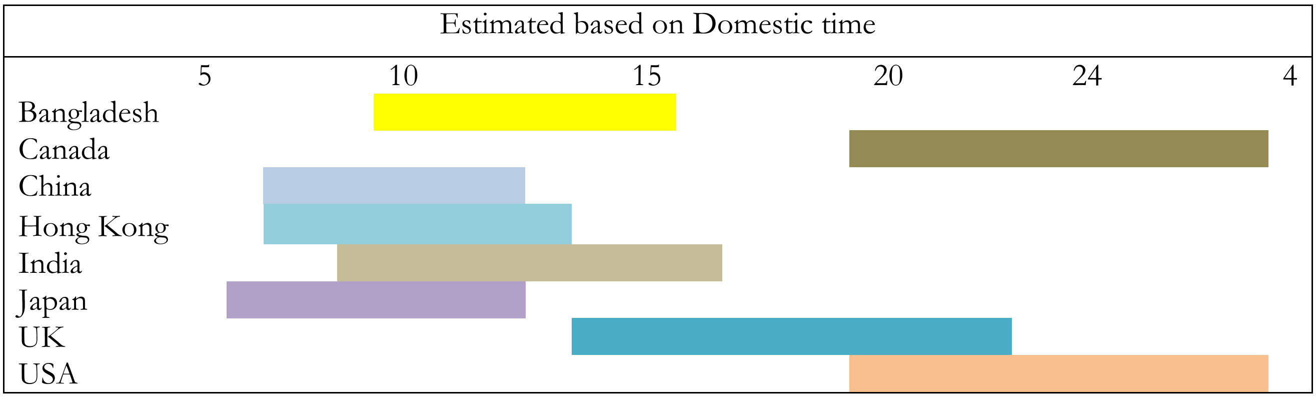

Table 5.1: Indices, their country and opening to closing timings

Index	Country	Local time		Time-zone
		Open	*Close*	
DSI all-share	Bangladesh	10:30	14:30[a]	GMT + 6
S&P/TSX Composite	Canada	9:30	16:00	GMT – 5
SSE Composite	China	9:30	15:00	GMT + 8:00
Hang Seng	Hong Kong	10:00	16:00	GMT + 8
BSE 100	India	9:15	15:30	GMT + 5.5
TOPIX	Japan	9:00	15:00	GMT + 9:00
S&P 500	United States	9:30	16:00	GMT – 5
FTSE 100	United Kingdom	7:50	16:20	GMT + 0

[a] before 3 June of 2012 it was operating till 15:00

All the countries considered in this study are important partners to Bangladesh in international trade. It is claimed in earlier literature that bilateral trade relationship could be a possible reason for market integration and volatility transmission. For example, Hamao et al. (1990) argue that volatility spillovers on to the conditional variance of the domestic market represent a casual phenomenon across markets that trade sequentially; alternatively, they could reflect global economic changes that concurrently alter stock-return volatility across international markets. Chambet and Gibson (2008) further added that increasing trade openness positively contribute to financial market integration among countries. Similarly, Lin et al., (1994) claim that volatility and returns of two equity markets may be related due to close trade and investment link. Table 5.2 represents the bilateral trade statistics between selected countries and Bangladesh. It is evident in the statistics that the US and the UK are the major export partners to Bangladesh in international trade, however, Bangladesh mostly imports from China, India and Hong Kong. On the other hand, from Table 5.3 it is found that Canada, China and the US have causal association in international trade with the domestic country. That means we could expect higher level of integration and effect of volatility spillovers from equity markets outside the domestic market's time-zone compare to similar time-zone.

Table 5.2: International trade, 2000 – 2012

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bangladesh's Export to											
Canada	5424	4869	5979	12104	16688	20666	24237	26336	33706	34076	49941
China	417	521	684	1283	2780	3417	5158	6149	5771	10467	17466
Hong Kong	5456	5393	5339	5492	5938	8352	10858	10406	7374	9121	14955
India	3071	2503	2742	3216	5975	10024	14214	19296	18333	20634	33212
Japan	3900	3129	3030	3515	3882	4765	4801	5290	6234	10064	15810
UK	26044	28413	32490	41430	54386	55535	68741	74800	82403	83632	113952
USA	100183	89154	88609	88473	114581	148030	189157	183745	206343	196746	268289
Bangladesh's Import from											
Canada	5282	3372	4527	4337	3771	5375	10802	24869	19727	31352	40969
China	38254	50451	54325	70615	100823	139458	177587	215178	237461	264217	421664
Hong Kong	25772	25321	25090	25513	34689	41960	51611	56328	585316	54467	551125
India	63887	58515	78616	94438	124646	125330	156642	232738	196987	222386	325469
Japan	45651	37620	35038	32514	34334	43637	47653	57102	69857	72450	93459
UK	14702	11120	11820	12534	17633	21933	18981	22170	22700	23149	23725
USA	13387	14982	12920	13297	20183	231629	26304	33627	31723	32479	48403

Source: Bangladesh Central Bank Statistics
Note: All figures are in million Taka (local currency), the current exchange rate is US$1=Tk.79.83, as of December, 2012

Table 5.3: Bilateral causal relationship in trade, 2001 – 2011

	F – Statistics [a]						
Bangladesh trade with ⟶	Canada	China	Hong Kong	India	Japan	UK	US
Import does not cause Export	5.543**	0.727	0.632	0.846	0.050	0.081	0.200
Export does not cause Import	0.784	9.872***	0.566	0.172	1.128	1.502	4.386*

[a] in order to test for Granger's causality we consider export (x_t) and import (y_t), then estimate the following equations: $\Delta x_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta x_{t-i} + \sum_{i=1}^{m} \beta_{2i} \Delta y_{t-i} + \varepsilon_{1t}$ and $\Delta y_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta y_{t-i} + \sum_{i=1}^{m} \delta_{2i} \Delta x_{t-i} + \eta_{1t}$, where ε and η are random disturbances, which are serially uncorrelated with zero mean and unit variance, and β and δ are the parameters to be estimated. We run an F-test for joint significance of the coefficient assuming null hypothesis that x_t does not Granger cause y_t and vice versa, a rejection of the null hypothesis shows a presence of Granger causality. ***, ** and * indicates significant at 1%, 5% and 10% level.

The eight exchanges are linked together because of economic and business ties but they are quite different in terms of size and the degree of market openness, transparency and maturity. In addition, the domestic equity market, DSE has some particular characteristics which are not common in many other emerging stock markets, such as, ease of manipulation by a few large traders, weaker disclosuer and accounting requirements, settlement delays, and a generally less than smooth transmission of financial information (see Islam and Khan, 2005). These features make Bangladesh capital market distinctly different from other equity markets of BRIC and

NEXT-11 countries. Therefore, information transmission to/from Bangladesh stock market is provided an opportunity to add to the evidence of volatility spillovers.

Table 5.4 shows the size and development of each capital market in our study. The ratio of market capitalization to GDP explains how big the capital market is with respect to their economy. For example, Hong Kong has the largest equity market compare to its gross domestic product in our sample. The next largest markets are the UK, the US and Canada relative to their own economic size. On the other hand, the stock to GDP ratio measures the development of the equity market (Gupta and Guidi, 2012). Hong Kong has the highest ratio among the selected markets, which is 374.89% on average since 2001 and 624.11% in 2011. The US, UK and China are next three developed stock markets in this cohort and domestic market is the smallest. The size of the domestic market is 21.04 percent to GDP and the development indicator is 16.23 percent for Bangladesh in 2011, however, they were only 2.3% and 1.57% respectively in 2001. These indicate the growth and momentum of the DSE over last decade. Hence, this study allows examining the volatility spillovers from seven largest equity markets of the world to a small but a new emerging stock market. In an earlier study, Wongswan (2006) reports that information is transmitted from the world's major economies to smaller ones and that there is a short-lived volatility effect in the target countries' stock market. He also claims that information regarding macroeconomic fundamentals of developed economies should significantly influence emerging-market fundamentals and thus equity market returns and volatility. Findings from this study will contribute to the theoretical development in this area as we are empirically investigating that influences.

Table 5.4: Features of sample stock markets

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
MCap/GDP											
Bangladesh	2.43	2.50	3.12	5.86	5.03	5.83	9.92	8.38	7.90	15.62	21.04
Canada	97.94	78.31	103.24	118.67	130.61	133.01	153.54	66.69	125.67	136.97	109.82
China	39.54	31.85	41.51	33.12	34.59	89.43	178.19	61.78	100.32	80.31	46.30
Hong Kong	298.73	278.38	341.56	393.40	381.93	462.57	549.42	606.00	427.86	471.83	357.82
India	22.42	25.05	45.19	53.74	66.29	86.27	146.85	52.73	86.36	94.44	54.21
Japan	54.13	53.40	70.66	79.00	103.60	108.48	102.22	66.41	67.08	74.69	60.34
UK	147.45	116.39	132.57	128.17	133.20	154.68	136.55	69.91	128.05	137.70	118.71
USA	135.37	104.79	128.64	138.36	135.07	145.89	142.87	82.54	108.48	118.86	104.33
Stock/GDP											
Bangladesh	1.57	1.39	0.63	1.57	1.65	1.52	7.01	11.61	16.33	14.64	16.23
Canada	64.50	55.27	54.03	65.90	74.53	100.91	115.54	117.83	92.67	86.59	87.55
China	33.88	22.93	29.05	38.73	25.97	60.27	222.99	120.98	179.43	135.40	104.82
Hong Kong	115.91	126.63	150.96	166.50	161.97	208.68	433.31	741.58	695.94	698.17	624.11
India	50.63	37.70	46.11	52.53	52.012	67.27	89.41	85.75	79.75	61.76	39.52
Japan	43.90	39.52	52.82	73.68	109.30	143.51	149.14	121.24	83.26	77.99	70.91
UK	126.77	119.23	119.17	168.74	181.50	172.93	365.40	244.88	155.80	133.25	121.52
USA	283.77	239.57	140.20	164.05	171.19	249.86	305.21	450.19	336.27	211.20	205.12

Source: World Development Indicators
Note: MCap/GDP is the market capitalization of listed companies as a percentage of GDP and Stock/GDP is the total values of shares traded as percentage of GDP.

5.4 Methodology

One of the significant differences between equity market of developed and emerging economies is that emerging capital markets generally exhibit higher volatility (Bekaert and Harvey, 1997) and this dynamic characteristic of emerging stock markets is also prominently claimed in other studies, e.g. Aggarwal et al. (1999), and Santis and Imrohoroglu (1997). Here, a time-varying volatility approach is applied to capture this dynamics of an emerging market's volatility and to measure the influence from other equity markets. Indeed, since the development of autoregressive conditional heteroskedasticity (ARCH) model by Engle (1982) and later generalized by Bollerslev (1986) as GARCH, we now have a model for returns which allows for time-varying conditional variance. In their study, Lin et al., (1994) have explained several benefits of using time-varying stock return volatility. For example, since the volatility of stock prices is clustered, volatility is related to the rate of information flow, and correlations in absolute price changes are associated with the dispersion of investors' beliefs which leads to price changes.

For investigating the volatility transmission this research uses asymmetric threshold GARCH (TGARCH or GJR GARCH) model of Glosten et al., (1993), which can successfully capture three basic characteristics of time series – leptokurtosis, volatility clustering and leverage effect. Hence, the model not only explains the magnitudes of the error that affects volatility, but also their signs. In a seminal paper, Black (1976a) provides a persuasive explanation about the 'leverage effect' that volatility tends to increase in response to lower than expected excess returns and to a decrease in response to higher than expected excess returns. However, the conventional GARCH model does not capture this asymmetric effect, since the sign of returns does not affect volatility (Nelson, 1991). Koutmos and Booth (1995) have documented the asymmetric innovations in the volatility transmission between the US, UK and Japanese stock markets. Booth (1997) and Kanas (1998) also report the evidence of asymmetry in volatility transmission. In this line, we use this approach to explain the volatility behaviour of each national stock return series.

There are various asymmetric GARCH models proposed in the literature, yet for daily observations the best model is proposed by Glosten, Jagannathan and Runkle (see Engle and Ng, 1993). Engle and Ng (1993) measure how new information is incorporated into volatility estimates using various ARCH models including a partially nonparametric model on daily Japanese stock index returns. Their results report that GJR is the best at parsimoniously capturing the asymmetric effect and the variability of the conditional variance implied by the EGARCH is too high. However, using monthly US stock returns, Pagan and Schwert (1990) claim EGARCH model has better explanatory power. In this study we use daily price data and therefore, TGARCH model is applied.

The TGARCH (p, q) model of this study consists of equation (i) and (ii):

$$R_t = a_0 + a_1 R_{t-1} + \varepsilon_t, \qquad \varepsilon^2 | I_{t-1} \sim GED(0, h_t) \tag{i}$$

and

$$h_t = \omega + \sum_{i=1}^{p} \beta_i \, h^2{}_{t-i} + \sum_{j=1}^{q} \alpha_j \, \varepsilon_{t-j}^2 + \sum_{j=1}^{q} \gamma_j \, S_{t-j}^{-} \varepsilon_{t-j}^2 \tag{ii}$$

Here, R_t represents the log return of each price index, I_{t-1} is the set of information available at the beginning of time t, and the conditional density function is modelled as a generalized error distribution (GED hereafter). In the Sign Bias Test, the squared standardized residuals (ε_{t-j}^2) are regressed on a constant and a dummy variable, denoted S_t^-, that takes a value of one if $\varepsilon_{t-1} < 0$ and zero otherwise. For a leverage effect, $\gamma_j > 0$, and the condition for non-negativity is $\omega > 0,\ \alpha_j > 0$, and $\beta_i \geq 0$, and $\alpha_j + \gamma_j \geq 0$. The AR terms are included in the return equation to account for the autocorrelation potentially induced by nonsynchronous trading of investors. This problem is reported as particularly severe in emerging markets given their low level of liquidity (see Lee and Rui, 2001; and Santis and Imrohoroglu, 1997).

The choice of GED is because the error term from a regression using stock returns is almost certainly not normally distributed (Connolly, 1989); rather stock returns often exhibit large skewness and kurtosis (Chen et al., 2008). Mittnik et al. (2002) argue that when fitting GARCH type models to return series, it is often found that GARCH residuals still tend to be heavy tailed and to accommodate this, model the GARCH process with heavier conditional innovation distributions than those of the normal. The GED includes the normal as a special case, along with many other distributions, some more fat tailed than normal and some thin tailed like uniform (Nelson, 1991). Therefore, GED is applied in this study to model the GARCH process.

For the GED errors, the contribution to the log-likelihood function is:

$$\mathrm{l_t} = -\ \frac{1}{2}\log\left(\frac{\Gamma\left(\frac{1}{\gamma}\right)^3}{\Gamma\left(\frac{3}{\gamma}\right)\left(\frac{\gamma}{2}\right)^2}\right) - \frac{1}{2}\log h_t - \left(\frac{\Gamma\left(\frac{3}{\gamma}\right)\left(R_t - \acute{X}_t\theta\right)^2}{h_t\Gamma\left(\frac{1}{\gamma}\right)}\right) \quad \text{(iii)}$$

Where, R_t is the endogenous variable, $\acute{X}_t$ is a vector of exogenous variables and γ is a tail-thickness parameter. The GED is a normal distribution if $\gamma = 2$, fat-tailed if $\gamma < 2$ and thin-tailed if $\gamma > 2$. The Marquardt technique is used to maximize the log likelihood function of the GED.

In performing the daily volatility spillovers analysis, we change equation (ii) and incorporate time-zone effects. The stock exchanges of China, Hong Kong and Japan open and close earlier than Bangladesh equity market, however, Indian exchange open earlier and close almost sequentially to Bangladesh exchange. On the other hand, the capital market of the US, the UK and Canada open and close the latest in the day compared to the domestic market. That means, we consider same day effects from markets in similar time-zones and one day lag effects from markets in different time-zone. Nevertheless, the domestic market is operating from Sunday to Thursday, and therefore, we can expect this flow of information from Tuesday to Thursday. For Monday, the domestic market is only influenced by the same day information of markets in similar time-zones not by the US, the UK and Canadian equity markets as they open and close later in the day after closing the DSE. Finally, for Sunday no international markets are operating and on Friday the domestic market is closed, thus on the opening day (which is Sunday for Bangladesh) we could expect the spillovers effect from Friday of all seven international markets. As, it is documented in Susmel and Engle (1994) that news affecting equity values in one market may also change the fundamentals in distant markets simultaneously around the globe with markets closed at that hour exhibiting the change upon opening.

Therefore, the representation of equation (2) is now:

$$h_t = \omega + \sum_{i=1}^{p}\beta_i\, h_{t-i} + \sum_{j=1}^{q}\alpha_j\, \varepsilon_{t-j}^2 + \sum_{j=1}^{q}\gamma_j\, S_{t-j}^{-}\varepsilon_{t-j}^2 + \sum_{1}^{k}\varphi_{kt}\varepsilon_{kt}^2 + \sum_{1}^{l}\varphi_{lt}\varepsilon_{lt-1}^2 \quad \text{(iv)}$$

$$h_t = \omega + \sum_{i=1}^{p}\beta_i\, h_{t-i} + \sum_{j=1}^{q}\alpha_j\, \varepsilon_{t-j}^2 + \sum_{j=1}^{q}\gamma_j\, S_{t-j}^{-}\varepsilon_{t-j}^2 + \sum_{1}^{k}\varphi_{kt}\varepsilon_{kt}^2 \quad \text{(v)}$$

$$h_t = \omega + \sum_{i=1}^{p} \beta_i \, h_{t-i} + \sum_{j=1}^{q} \alpha_j \, \varepsilon_{t-j}^2 + \sum_{j=1}^{q} \gamma_j \, S_{t-j}^{-} \varepsilon_{t-j}^2 + \sum_{1}^{k} \varphi_{kt} \varepsilon_{kt-1}^2 + \sum_{1}^{l} \varphi_{lt} \varepsilon_{lt-1}^2 \qquad \text{(vi)}$$

Where, k is the number of indices open and close before and along with the domestic market, e.g. China, Hong Kong, Japan and India; and l is the number of indices open and close after the domestic market, e.g. the US, the UK and Canada. Here, equation (4) is for modelling Tuesday to Thursday returns' volatility of domestic market, equation (5) and (6) are for Monday and Sunday respectively.

The existence of volatility spillovers offers direct evidence of whether equity markets within and across regions are integrated (Bekaert et al. 2005). We can therefore investigate whether the domestic stock market is cointegrated with equity markets within time-zone or outside time-zone based on the extent of volatility spillover effects. If Bangladesh capital market is significantly influenced by the markets from similar time-zone then they should be integrated. Otherwise, spillovers should be taking place from the US, the UK and Canada as well as be integrated with domestic market. We estimate the long-run comovement between eight stock indices using Johansen's methodology (Johansen, 1988 and 1991).

Johansen (1988 and 1991) uses vector autoregressive model and formulate the hypothesis of cointegration as the hypothesis of a reduced rank of a long-run impact matrix $\Pi = \alpha\acute{\beta}$, where β is the cointegration vector and α is the weight. In this model inferences on α and β under linear restriction are conducted using the usual χ^2 distribution as an approximation to the distribution of the likelihood ratio test. A vector autoregression (VAR) with k lags for stock prices is described as:

$$y_t = \phi + \sum_{i=1}^{k} \beta_i y_{t-i} + \varepsilon_t \qquad \text{(vii)}$$

Where, y_t is an $n \times 1$ vector of $I(1)$ stock price indices and ε_t is a zero mean white noise, which may be contemporaneously correlated. The VAR can be re-written into a vector error correction model:

$$\Delta y_t = \phi + \Pi y_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \, \Delta \mathrm{y_{t-i}} + \mathrm{\varepsilon_t} \qquad \text{(viii)}$$

Where,

$\Pi = \sum_{i=1}^{k} \beta_i - I,$

and, $\Gamma_\mathrm{i} = \sum_{\mathrm{i=1}}^{\mathrm{m}} \beta_\mathrm{i} - \mathrm{I}$

Johansen test is centred around an examination of the long-run coefficient matrix Π and indicates whether the vector of stock indices y_t has a long-run dynamic relationship or not. For $0 < \Pi = r < n$, there are r possible cointegration vectors exist among the n series and Π can be decomposed into α and β such that $\Pi = \alpha\acute{\beta}$, each with $n \times r$ matrices. In this representation the cointegration vectors β have the property that $\acute{\beta} y_t \sim I(0)$, even though y_t itself is non-stationary and refered to as a long-run equilibrium relationship. It can be shown that for a given r, the maximum likelihood estimator of β defines the combination of y_{t-1} that yields the r largest canonical correlation of y_t with y_{t-1} after correcting for lagged difference and deterministic variables when present. Johansen (1988, 1991) proposes two likelihood ratio tests for estimating the number of cointegrating vector: the trace test $(\lambda_{trace})$and the maximum eigenvalue test (λ_{max}):

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

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

where, r is the number of cointegrating vectors under the null hypothesis, T is the sample size, $\hat{\lambda}_i$ is the estimated values for the *i*th order Eigenvalue for the Π matrix. Intuitively, the larger is $\hat{\lambda}_i$, the more large and negative will be $\ln(1 - \hat{\lambda}_i)$ and hence the larger will be the test statistics. The first tests the null that the number of distinct cointegration vector is equal to or less than r, against an unspecified or general alternative that there are more than r(see, Brooks, 2014). It starts with p eigenvalues, and then successively the largest is removed. $\lambda_{trace} = 0$ when all the $\lambda_i = 0$, for $i = 1, \ldots., n.$ On the other hand, the maximum eigenvalue test conducts separate tests on each Eigenvalue, and has as its null hypothesis that the number of cointegrated vectors r against an alternative of $r + 1$ (see Brooks, 2014). Both the tests have a non-standard asymptotic distribution and the critical values for the test statistics are given in Johansen and Juselius (1990). Before applying Johansen methodology we check each of the eight stock indices for stationarity using the following ADF unit root test.

$$\Delta y_t = \alpha_0 + \pi y_{t-1} + \sum_{j=1}^{k} \psi_j \, \Delta y_{t-j} + \varepsilon_t \tag{xi}$$

Where, ψ are the estimated parameters and ε_t is the error term.

Finally, to examine the causal relationship between conditional variance across eight equity markets from different time-zones, we apply vector autoregression model (VAR) of Sims (1980). The VAR model allows us to analyse the contemporaneous and intertemporal linear relationship between conditional volatility among eight countries. The VAR model used in this study can be expressed in its standard form as,

$$h_{it} = \delta + \sum_{s=1}^{m} \zeta_s h_{it-s} + \varepsilon_{it} \qquad \text{(xii)}$$

Where, h_{it} is a 8×8 column vector of conditional variance of the eight stock markets, δ and ζ_s are respectively, 8×1 and 8×8 matrices of coefficient, m is the lag length, and ε_{it} is the 8×1 column vector of forecast errors of the best linear predictor of h_{it} using all the past h_{is}. We can infer the intertemporal linear movements between conditional volatility of equity markets by the sign and significance of ζ_s.

5.5 Empirical Findings

This section presents empirical findings related to our analysis based on the methodologies described in the previous section. Section 5.5.1 provides a description of the data. Modelling the volatility for each of the stock series and contemporaneous correlation among residuals are given in section 5.5.2. The impact of time-zone on volatility transmission is presented in section 5.5.3. Following the volatility spillover effect, the possible presence of cointegration among the price series is tested in section 5.5.4. Section 5.5.5 describes the causality between conditional variance among markets across different time-zone.

5.5.1 Description of Data

Table 5.5 reports several summary statistics for the daily returns of the eight equity markets from the period of January 1992 till December 2012. The mean returns are significantly different from zero for all markets and positive for seven markets except Japan[20]. It is found that emerging markets have higher average returns than developed stock markets. Within this whole sample, the domestic country Bangladesh has the highest mean return of 0.05%, followed by China (0.03%), Hong Kong (0.03%) and India (0.03%). On the other hand, the average return of Canada is 0.026% followed by the US (0.02%), UK (0.01%) and Japan with negative return of -0.0006%. Yet the higher return for emerging equity markets is accompanied by higher volatility, for example, China has the highest standard deviation of 2.53%, then India (1.79%), Hong Kong (1.68%), and Bangladesh (1.67%). The US capital market has the lowest return variance of 1.17% within the developed markets and then the Canada (1.27%), UK (1.30%) and Japan (1.42%). All these results clearly describe the characteristics of emerging stock markets; higher risk is rewarded

[20] The burst of the Japanese bubble in 1990s may be a possible reason for this observed value of mean returns in Japan. With the first failure in 1992, as many as 180 banks up to 2003 failed according to the statistics by Deposit Insurance Corporation, Japan.

with higher return; which is also consistent with previous literatures, e.g. Harvey (1995), Bekaert and Harvey (1995) and Ng (2000).

The measures for skewness and excess kurtosis show that six out of the eight return series are positively skewed; however, the US and the UK returns are negatively skewed. The return series are highly leptokurtic with respect to the normal distribution. Similarly, Jarque-Bera (JB) statistic rejects the normality for each of the return series at the 1% level. The Ljung-Box (LB) statistic for up to 36 lags is calculated respectively for both return and squared return series of eight equity markets (which are not reported except up to five lags). The results indicate the presence of linear and non-linear interdependencies in each of the return series. The LB statistics report linear dependency of market returns in Bangladesh, Canada, China, India, and the US at one lag. Further, strong non-linear dependency is evident in returns of all markets other than China at one lag. Linear dependency could be a result of non-synchronous trading[21] of the stocks that make up each index or market imperfections or some fundamental forces while non-linear dependency could be due to autoregressive conditional heteroskedastic (see Koutmos and Booth, 1995; and Ng, 2000).

Table 5.5: Descriptive statistics of index returns

	Bangladesh	Canada	China	Hong Kong	India	Japan	UK	USA
Mean	0.0455***	0.0259***	0.0347***	0.0305***	0.0304***	-0.00059***	0.0132***	0.0224***
Maximum	28.0308	9.9252	71.2299	17.2702	18.5511	11.3659	12.2189	10.9572
Minimum	-26.2939	-13.7894	-38.9573	-14.7132	-13.5066	-9.0972	-10.5381	-9.4695
Std. Dev.	1.6703***	1.2791***	2.5337***	1.6809***	1.7953***	1.4270***	1.3026***	1.1705***
Skewness	0.3992	-0.8385	4.1960	0.0462	0.0026	0.0571	-0.1254	-0.2369
Kurtosis	53.6485	14.1287	139.1939	12.0196	10.7812	7.2299	11.6996	12.0203
JB Test	585563.1***	28905.08***	4249060***	18567.46***	13817.54***	4086.20***	17285.93***	18619.59***
$LB\ (1)$	39.011	38.179	4.1039	0.0316	36.656	0.0143	0.5970	25.543
$LB\ (5)$	64.451	92.581	26.193	14.370	49.038	16.797	69.542	38.251
$LB^2\ (1)$	12.36	425.12	2.16	733.48	155.86	137.18	227.47	244.18
$LB^2\ (5)$	51.288	2146.7	25.229	1961.6	439.82	928.68	2295.90	2015.50

***, **, * denotes significant at 1%, 5% and 10% level. All returns are expressed as percentages. $LB(n)$ and $LB^2(n)$ are the Ljung-Box statistics for returns and squared returns respectively distributed as χ^2 with n degrees of freedom. The critical value at the 5% level is 3.841 for 1 lag and 11.070 for 5 lags.

Figure 5.2 plots the log values of the eight daily indices in US dollar. Each of the indices shows several fluctuations at different times during the period but from 2003 to 2007 an upward trend is common across all markets. In addition, timing for some of the market fluxes is also found

[21] Other than the thin trading or market frictions, feedback trading is another possible reason for linear dependencies of market returns (see Antoniou et al., 2005 for further discussion on this relationship).

identical across these equity markets. For example, from the second half of 2007 there is a dramatic fall of stock price across all eight markets, which further starts to recover from early 2008. This indicates possible integration and transmission of information between international capital markets. Finally, Table 5.6 reports the unit root test results for each of the indices and confirms that according to MacKinnon's critical values stock indices are stationary as first difference and non-stationary as levels.

Figure 5.2: Stock market price index (Jan. 3, 1992 – Dec 31. 2012), daily closing values in US$

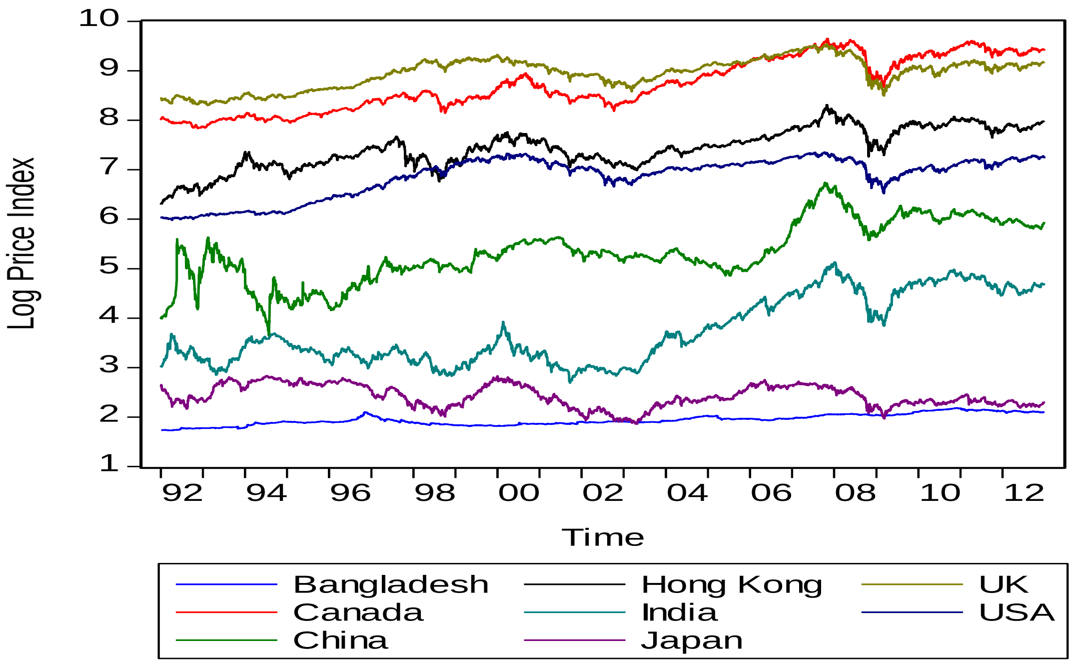

Table 5.6: Augmented Dickey Fuller (ADF) test results

Country and Price Series		Level	First Difference [a]
		Test equation include Trend and Intercept	
Bangladesh	DSE all share	-1.739995	-67.95773
Canada	S&P/TSX Composite	-2.562537	-32.51210
China	SSE Composite	-2.152164	-73.4882
Hong Kong	Hang Seng	-3.106956	-74.93604
India	BSE 100	-2.289603	-19.13672
Japan	TOPIX	-2.509377	-73.84298
UK	FTSE 100	-1.790429	-34.09779
USA	S&P 500	-1.988820	-79.18829
MacKinnon Critical Value at:			
1%		-3.959713	
5%		-3.410625	
10%		-3.127091	

[a] According to MacKinnon's critical values, all values are significant at the 1% level

5.5.2 Volatility and the residuals

The key objective of this study is to investigate the effect of volatility spillovers from seven international stock markets across similar and different time-zone on a domestic country. It is, therefore, important to correctly specify the volatility models for each of these equity markets. Table 5.7 reports the time-varying volatility models for stock returns of those eight national stock markets. Except or the US, we model the asymmetric volatility for each of the seven markets in Table 5.7 using AR (1)-TGARCH (1,1) specification of equation (1) and (2). Yet, due to the non-negativity restriction of parameters in the threshold GARCH we fit US returns data with AR (1)-exponential GARCH (1,1) (or EGARCH) process. Nelson (1991) proposes the EGARCH specification for the conditional variance which does not require the non-negativity of coefficients but also captures the leverage effect.

$$logh_t = \omega + \sum_{i=1}^{p} \beta_i \, logh_{t-i} + \sum_{j=1}^{q} \alpha_j \left| \frac{\varepsilon_{t-j}}{\sigma_{t-j}} \right| + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sigma_{t-k}} \quad \text{(xiii)}$$

The $logh_t$ on the left-hand side implies that the leverage effect is exponential, rather than quadratic and that forecasts of the conditional variance are guaranteed to be non-negative. The presence of leverage effect is tested by the hypothesis that $\gamma_i < 0$ and the impact is asymmetric if $\gamma_i \neq 0$. We assume, as Nelson (1991) proposed, that the ε_t follows a Generalized Error Distribution (GED). Table 5.7 reports the AR (1) – EGARCH (1,1) results for the US daily returns data at the last row.

Table 5.7: Volatility modelling for each stock returns series

Market	Return Equation		Variance Equation			
	α_0	θ	ω	α	β	γ
Bangladesh	2.93e-07	0.056765***	3.65e-06***	0.201269***	0.771888***	0.124364***
	[4.65e-05]	[0.009632]	[4.02e-07]	[0.017362]	[0.012443]	[0.027459]
Canada	0.000579***	0.117628***	1.07e-06***	0.036310***	0.919977***	0.068674***
	[0.000126]	[0.013657]	[2.01e-07]	[0.010029]	[0.006805]	[0.011899]
China	1.41e-06	0.000502	6.08e-06***	0.066175***	0.889261***	0.074469***
	[0.000116]	[0.009574]	[1.09e-06]	[0.006212]	[0.007473]	[0.014463]
Hong Kong	0.000255*	0.007029	2.27e-06***	0.030609***	0.926629***	0.071703***
	[0.000144]	[0.012583]	[4.92e-07]	[0.007890]	[0.007817]	[0.011110]
India	0.000461***	0.108560***	7.85e-06***	0.065906***	0.864030***	0.096722***
	[0.000178]	[0.012693]	[1.25e-06]	[0.010867]	[0.011469]	[0.016249]
Japan	-5.73e-05	-0.000921	4.15e-06***	0.042724***	0.896686***	0.081369***
	[0.000154]	[0.014119]	[7.08e-07]	[0.008424]	[0.009227]	[0.011705]
UK	0.000271**	-0.001481	1.74e-06***	0.011831*	0.927213***	0.092801***
	[0.000127]	[0.013817]	[2.75e-07]	[0.007009]	[0.006884]	[0.010546]
USA	0.000340***	-0.024104*	-0.218288***	0.116065***	0.986137***	-0.107405***
	[9.10e-05]	[0.013165]	[0.022761]	[0.012354]	[0.001982]	[0.008887]

***, ** and * are significant at 1%, 5% and 10% level. Standard errors are in [ ].

All indices of eight equity markets in Table 5.7 are showing the presence of asymmetric innovations or leverage effect and the results are consistent with earlier studies (see Koutmos and Booth, 1995; Booth, 1997; Kanas, 1998). The effect is very strong in the domestic country (0.124364) and the US (-0.107405) equity market and least in Canada (0.068674). We use asymmetric GARCH models because equity market volatility increases are more pronounced following a large negative return than they are following a positive return of the same size (see Alexander, 2010). Other than the US market our results are consistent with this argument. The signs of asymmetric innovations are positive and significant at the 1% level for seven markets, which means negative shocks imply a higher next period conditional variance than positive shocks of the same sign. On the contrary, a positive shock increases next period's conditional variance in the US stock market more than negative shocks of the same sign. The sum of α (ARCH term) and β (GARCH term) shows the persistence effect of shocks to the conditional variance in each of the stock markets. It is evident that volatility is highly persistent in Bangladesh and less persistent in India out of the eight sample countries.

We run several specification tests, i.e. the Ljung-Box (LB) Q statistics, ARCH-LM test and BDS independent test and their results for each of the volatility models are reported in Table 5.8. For standardized square residuals the null hypothesis that the residuals are not autocorrelated is accepted up to 10 lags (see Engle, 2001). Further, Engle's (1982) ARCH-LM test implies there is no ARCH effect in the residuals up to 5 lags. Finally, we use BDS independent test to check whether ε_t of the return equation (i) is independent and identically distributed (i.i.d.). The results confirm that the values of *z*-statistics are significantly larger than critical values up to 5 embedding dimensions and thus reject the null hypothesis of linearity of the residuals of the AR(1) return model for all eight return series. This finding supports our assumption of using GED for the volatility modelling. Altogether, therefore, our non-linear asymmetric GARCH models are appropriately capturing volatility clustering in each of the equity markets.

Table 5.8: Diagnostic check for volatility models

	Bangladesh	Canada	China	Hong Kong	India	Japan	UK	USA
LB^2 – Q statistics								
2	0.0597	0.4646	0.0778	1.9893	1.5557	0.7842	0.9182	5.0236
	(0.807)	(0.495)	(0.780)	(0.158)	(0.212)	(0.376)	(0.338)	(0.025)
5	0.1236	0.6322	0.2383	2.9071	2.3680	1.7499	2.8869	6.2095
	(0.998)	(0.959)	(0.993)	(0.573)	(0.668)	(0.782)	(0.577)	(0.148)
10	0.2117	1.0456	0.4643	5.0811	7.5949	4.5392	8.5949	14.274
	(1.000)	(0.999)	(1.000)	(0.827)	(0.575)	(0.872)	(0.475)	(0.113)
ARCH – LM test statistics								
1	0.0383	0.3257	0.000	1.8496	0.0455	0.1069	0.1129	3.9717
	(0.844)	(0.568)	(0.996)	(0.174)	(0.831)	(0.744)	(0.737)	(0.046)
5	0.1244	0.6083	0.2379	2.9206	2.3505	1.7201	2.9436	6.5774
	(0.999)	(0.988)	(0.999)	(0.712)	(0.799)	(0.886)	(0.709)	(0.254)
BDS test [a]								
m				z - statistics				
2	25.413	16.905	22.586	12.682	16.955	10.594	16.528	12.643
3	31.618	23.241	27.636	16.982	21.013	14.784	20.869	19.103
4	35.207	27.446	31.575	20.763	23.879	17.562	24.424	23.297
5	38.451	31.357	34.764	23.982	26.409	19.676	27.532	27.366

[a] the BDS test statistics can be stated as $BDS_{\varepsilon,m} = \sqrt{T}\frac{C_{\varepsilon,m}-(C_{\varepsilon,1})^m}{V_{\varepsilon,m}}$ where $V_{\varepsilon,m}$ is a consistent estimator of the asymptotic standard deviation of $\sqrt{T}(C_{\varepsilon,m} - (C_{\varepsilon,1})^m)$ and can be estimated consistently; The test it is a two-tailed test, we can reject the null hypothesis of i.i.d. if the BDS test statistics is greater than or less than critical values (e.g. if $\alpha = 0.05$, the critical value $= \pm 1.96$). The first brackets in LB and LM test show the *p*-values.

Table 5.9 represents the contemporaneous correlations of the residuals (error terms) among the eight equity markets. As stated in Eun and Shin (1989), the residuals or innovations represent abnormal stock market returns that are not predicted on the basis of all the information reflected in past returns. Rather, they state, contemporaneous correlations on the residual returns reflect the degree to which new information producing an abnormal return in one market is shared by the other markets in the same calendar day. The results in Table 5.9 report some interesting outcomes. The pairwise correlations between intra-time-zone markets tend to be higher than inter-time-zone correlations, which is consistent with the argument of Eun and Shin (1989). For example, strong correlation is found between the US/Canada, the UK/Canada and the US/UK. Similar correlation is evident between Japan/Hong Kong, India/Hong Kong, Japan/India, and Hong Kong/China. This result of contemporaneous correlation is consistent with the structure of time-zone difference between pairs of markets and therefore, we could expect higher level of market integration and spillovers effect between markets in the same time-zone than different time-zone. The highest correlation between the US and Canada may be due to their synchronous trading hours. Both of these markets also share simultaneous operating hours with the UK and it is clearly reflected into their contemporaneous correlation. On the other hand, Japan, Hong Kong, India and China are located in similar time-zones and share concurrent trading hours all through their trading week. Surprisingly, the domestic market, Bangladesh shows significant correlation with the UK and India, yet they are situated in two different time-zones. In addition, results are also statistically significant at the 10% level. This may be due to their synchronous trading (i.e. two and five hours for the UK and India respectively) through Monday till Thursday in every operating week. Eun and Shin (1989) also document similar results in their study and claim to the structure of time-zone difference as possible reason for contemporaneous correlation between return residuals of national stock exchanges. Finally, beyond the similar time-zone, equity markets of Hong Kong and India are found correlated with the markets of UK and Canada.

Table 5.9: Correlation between residuals

	Bangladesh	Canada	China	Hong Kong	India	Japan	UK	USA
		0.0168	0.0080	0.0062	0.0216*	0.0059	0.0218*	0.0084
Bangladesh	1.0000	(1.2457)	(0.5903)	(0.4617)	(1.6006)	(0.4331)	(1.6140)	(0.6190)
			0.0322***	0.2551***	0.2195***	0.1405***	0.5776***	0.6828***
Canada		1.0000	(2.3817)	(19.5210)	(16.6479)	(10.5009)	(52.3571)	(69.1409)
				0.1365***	0.0997***	0.0760***	0.0712***	0.0087
China			1.0000	(10.1911)	(7.4143)	(5.6398)	(5.2778)	(0.6474)
					0.3095***	0.3888***	0.3496***	0.1760***
Hong Kong				1.0000	(24.0807)	(31.2203)	(27.6118)	(13.2278)
						0.1565***	0.2626***	0.1560***
India					1.0000	(11.7241)	(20.1344)	(11.6858)
							0.2036***	0.0461***
Japan						1.0000	(15.3859)	(3.4153)
								0.4758***
UK							1.0000	(40.0184)
USA								1.0000

Note: each entry in the table represents the contemporaneous correlation coefficient of the residual returns between a pair of countries, net of expected returns that are estimated from the seven markets TGARCH and one market EGARCH system using daily return from 1992 till 2012. ***, ** and * are significant at 1%, 5% and 10% level. t-statistics are in ( ).

5.5.3 Impact of the Time-Zone on Volatility Transmission

It is often argued that the information flow across markets through returns might not be significant and visible; however, they may have strong effect through volatility (see Singh et al., 2010). This study, consequently, examine the daily dynamics of volatility spillovers from equity markets located in similar and different time-zones to a domestic market. We divide the presentation of the results into two other Tables – 5.10 and 5.11. In Table 5.10 we report the daily volatility model of DSI using same day effect of SSE composite, Hang Seng, BSE 100, TOPIX and one day lagged residuals effect of S&P/TSX composite, S&P 500, FTSE 100. The equity markets of Japan, China and Hong Kong close before DSI and India close with DSI from Monday to Thursday. Therefore, as mentioned earlier, we consider same day volatility spillovers effect from these markets and model the volatility of DSI applying AR(1)-TGARCH(1,1) approach. However, Canada, the US and the UK markets open and close later in the day and thus we consider one day lag effect of their residuals on DSI from Tuesday till Thursday following the argument of Susmel and Engle (1994) and expect no effect on Monday. In their paper, Susmel and Engle (1994) claim that news affecting equity values in one market may also change the fundamentals of distant markets and such changes should occur simultaneously around the globe with market closed at that hour exhibiting the changes upon opening. Finally, we take Friday's residuals of all seven markets on Sunday's volatility model of DSI.

We re-estimate the AR(1)-TGARCH(1,1) model using one day lagged residuals of all seven international equity markets, where Monday of DSI represents the remaining volatility spillovers from Friday and results are reported in Table 5.11. By doing this we allow time for the domestic markets to react to the different macroeconomic announcements of other markets. Sometimes investors need time to differentiate between various scheduled and unscheduled macroeconomic news transmission from other international markets. One day delay might also lead the domestic market to adjust the feedback effect of Asian markets (Japan, China, Hong Kong and India) to information disclosures in far western markets (Canada, the US and UK) and vice versa. However, for example, Wogswan (2006) control for this time difference effect between the US and Asia while examining the net effect of macroeconomic announcements particularly from the US market to Korea and Thailand. This study, on the contrary, considers the combined effect of information from most of the major equity markets of the world, thus one day lag allows the information to influence each other and provide time for investors to make their decisions[22]. It is

[22] However, this study has checked the volatility transmission to domestic equity market from seven international stock markets by controlling several financial crises. We also have investigated whether the observed volatility inter-dependence grow over the period. Among many Choudhry and Jayasekera (2014) assert that most financial markets (both in developed and developing countries) have now liberalized capital movements, facilitated by advances in computer technology and information processing, thus the isolation of domestic markets is reduced and made them more vulnerable to react promptly to news and shocks originating from the rest of the world. Moreover, financial crisis are capable of fomenting volatility transmission internationally (see Alter and Beyer, 2014; Bekiros, 2014; Jung and Maderitsch, 2014). In this study we consider and control three financial crises – Asian crisis, Dot Com crisis and crisis of 2008-09, as the domestic market is located in Asia and time scale is 1992-2012. And for checking whether the observed volatility interdependence grow over time, we split the sample in two periods: pre and post 2000, since DSE had undergone several market reforms programme including market liberalization policies during 1990s. Therefore, it is expected that nature of spillover effect to domestic market from other global equity markets during pre and post 2000 would be different. We use Ordinary Least Square (OLS) model, $R_t = \alpha_0 + \theta_1 R_{t-1} + b_0 A_t + b_1 D_t + b_2 W_t + \varepsilon_t$ for controlling the financial crises. Here, R_t is the daily returns of DSE all-share price index; *A*, *D* and *W* are the dummy variables for Asian crisis, Dot Com crisis and crisis 2008-09 respectively. Then, we take the residuals (i.e. ε_t) from this model and apply

mentioned in earlier studies that some announcement are expected by an average market participant but when the announcements are made, uncertainty is resolved and individuals may rebalance portfolios (see Karpoff, 1986; Kim and Verrecchia, 1991, Wongswan, 2006).

In Table 5.10 results of model one indicate substantial spillovers effect from markets both with synchronous and non-synchronous operating hours on domestic market volatility. Four out of five days' volatility of DSE is found mostly influenced by equity markets from similar time-zones. Results indicate significant volatility spillover takes place from Japan, then from Hong Kong, India and China. In particular, Monday and Thursday's return volatilities are negatively (-0.24% and -0.15% respectively) and Tuesday's volatility is positively (0.14%) influenced by the residuals of Japan. Hong Kong is also negatively affecting the volatility of DSI, on Monday with -0.14% and Tuesday with -0.12%. India is the closest market to Bangladesh and shares maximum hours of simultaneous trading each day among all the sample countries. However, the spillover effect is documented to Bangladesh from India only on Monday and Wednesday, where coefficients are negative (-0.13%) and positive (0.046%) respectively. Surprisingly, no other market is found to have a statistically significant volatility spillover on Wednesday except India. Finally, the influence of Chinese equity market is reported to be minimal among similar time-zone markets and it is only significant on Thursday and its impact is negative (-0.019%).

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equation (iv), (v) and (vi) for investigating the daily transmission of volatility from India, China, Hong Kong, Japan, Canada, the UK and the US. One the other hand, for investigating the changing nature of spillover effect during pre and post 2000, we apply equation AR(1)-GJR GARCH models following equation (iv), (v) and (vi). Our results (not reported but available upon request) show that only Asian crisis of 1997 is statistically significant impact on returns series of DSE. Similarly, it is reported in earlier studies that Asian crisis has significant influence on the equity markets of Asian countries, e.g. Baig and Goldfajn (1998) and Yang et al. (2003). Further, we find almost similar results of daily transmission of volatility as reported in Table 5.10 and 5.11 after controlling these financial crises. Our AR(1)-GJR GARCH results indicate strong influence of volatility from the US, the UK and Canada on the opening (Sunday) and closing (Thursday) days. For rest of the weekdays volatilities are significantly transmitted from markets from similar time zones (i.e. India, China, Hong Kong and Japan). For pre- and post-2000 volatility spillover models, it is found that the nature of volatility transmission remains same over the periods as our earlier models but there is difference in sources of volatility. That means investors of DSE consider global factors (from the US, the UK and Canada) at the beginning and end of every week during both the pre- and post-2000 periods. But volatilities were transmitted from fewer countries in pre-2000 period and more countries become significant in post 2000 period. For example, in pre 2000 period DSE was mostly influenced by the US, Japan and China. However, in post 2000 periods Canada, the UK, Hong Kong and India also become determinant of volatility for this market. All these implies that various market reform and liberalization polices put DSE more exposed to global factors than that of early 1990s; but still not like other emerging markets, such as China, India, Brazil which are exposed to global financial crises as well.

Table 5.10: Volatility spillovers to domestic country (Model one)

	Sunday	Monday	Tuesday	Wednesday	Thursday
Return equation					
α_0	-2.94e-10	0.000710	0.000160	2.70e-08	-9.49e-05
	[4.79e-07]	[0.000669]	[0.000233]	[8.05e-06	[0.000369]
θ	-5.48e-07	0.004667	-0.057919**	7.75e-06	0.047617
	[0.000129]	[0.051474]	[0.029498]	[0.001556]	[0.032646]
Volatility equation					
ω	0.000100***	0.000134***	4.70e-05***	1.72e-05***	9.83e-05***
	[1.76e-05]	[2.47e-05]	[6.45e-06]	[4.51e-06]	[1.25e-05]
α	0.387919***	0.131984***	0.217586***	0.376877***	0.240422***
	[0.148240]	[0.052741]	[0.052346]	[0.098111]	[0.067584]
β	0.438361**	0.464989***	0.430397***	0.589000***	0.291411***
	[0.074596]	[0.089757]	[0.053481]	[0.061673]	[0.061016]
γ	0.386853	0.064609	0.066951	0.109148	0.157839
	[0.273625]	[0.073085]	[0.071724]	[0.182360]	[0.104452]
		Equity markets from similar time-zone			
China	-0.000361	-0.000245	0.000119	-9.77e-05	-0.000187***
	[0.000603]	[0.000344]	[0.000115]	[0.000144]	[3.29e-05]
Hong Kong	-0.001101	-0.001378***	-0.001233***	-0.000281	-0.000457
	[0.000891]	[0.000506]	[0.000280]	[0.000280]	[0.000669]
India	-0.000298	-0.001281***	0.000357	0.000462**	1.82e-05
	[0.000855]	[0.000102]	[0.000234]	[0.000219]	[0.000597]
Japan	-0.000158	-0.002390***	0.001378***	0.000124	-0.001450***
	[0.001280]	[0.000549]	[0.000361]	[0.000327]	[0.000583]
		Equity markets from different time-zone			
Canada	-0.004018***		0.000291	0.000528	0.000694
	[0.001180]		[0.000514]	[0.000543]	[0.001081]
UK	0.001541*		-0.000766*	0.000415	0.001247
	[0.000812]		[0.000406]	[0.000410]	[0.000866]
USA	0.004797***		0.000751	-0.000871	-0.002222***
	[0.001365]		[0.000622]	[0.000585]	[0.000657]
Log Likelihood	3232.115	3170.808	3450.122	3696.934	3264.000
Wald Test	8.272896	50.30539	5.635364	9.043442	23.19264
$LB^2(15)$	0.4532	35.195	46.731	5.6276	2.4727
ARCH-LM(3)	0.246722	4.539663	3.345911	1.222365	0.034577

***, ** and * are significant at 1%, 5% and 10% level, standard errors are in [ ]. LB^2 (n) is the Ljung-Box statistics for the squared standardized residuals. LM (n) is for the Lagrange – Multiplier test.

A large volatility spillover effect is evident on DSI's variance from outside the time-zone region, particularly, from the US and Canadian capital markets. The results are not only significant at the 1 percent level but also substantial in values. Interestingly, Bangladesh capital market reacts to the information from the US market on every opening and closing days of the week. Particularly, on Sunday equity markets beyond the similar time-zone are found influential to the investors, i.e. a positive effect of the US residuals (0.48%) and a negative effect of Canadian market (-0.40%) are reported. Other than the US and Canada, a positive volatility spillover from the UK market (0.15%) is also statistically significant at the 10% level on the opening day and it is negatively influencing (-0.077) the return volatility of Bangladesh on Tuesday as well. However, on the closing day of each week a large negative volatility spillover takes place from the US equity market (-0.22%) only. Including the Japan and China, influence of the US market is significantly larger on Thursday.

Turning to our second model of one day lag volatility spillovers from all seven markets on DSE, it can be reported from Table 5.11 that the extent of influence remains almost identical. Sunday and Thursday's return volatilities of DSI are still significantly influenced by the US and Canada, however, for rest of the week days volatilties are affected by the information transmitted from markets within similar time-zones.

Table 5.11: Volatility spillovers to domestic country (Model Two)

	Sunday	Monday	Tuesday	Wednesday	Thursday
Return equation					
α_0	-2.94e-10	0.001559**	7.47e-05	0.002618***	-0.000279
	[4.79e-07]	[0.00079]	[0.000297]	[0.000647]	[0.000737]
θ	-5.48e-07	0.003944	-0.053435	0.015635	0.037951
	[0.000129]	[0.056979]	[0.034698]	[0.051965]	[0.043359]
Volatility equation					
ω	0.000100***	0.000141***	5.48e-05***	9.35e-05***	0.000172***
	[1.76e-05]	[1.93e-05]	[8.71e-06]	[1.96e-05]	[3.40e-05]
α	0.387919***	0.131564***	0.213191***	0.136111***	0.111985**
	[0.148240]	[0.055160]	[0.056734]	[0.030877]	[0.048977]
β	0.438361**	0.494878***	0.405652***	0.483697***	0.478201***
	[0.074596]	[0.078564]	[0.066933]	[0.098746]	[0.096071]
γ	0.386853	0.057445	0.028881	0.033416	0.048827
	[0.273625]	[0.070529]	[0.074639]	[0.065945]	[0.068838]
		Equity markets from similar time-zone			
China	-0.000361	-0.001040*	-4.86e-05	0.000903***	-0.000578*
	[0.000603]	[0.000541]	[0.000180]	[0.000224]	[0.000324]
Hong Kong	-0.001101	-0.002137***	0.001418***	-0.000408	0.000598
	[0.000891]	[0.000696]	[0.000151]	[0.000465]	[0.000681]
India	-0.000298	-0.001260*	-0.000471***	-0.000254	-0.001895**
	[0.000855]	[0.000679]	[6.65e05]	[0.000363]	[0.001007]
Japan	-0.000158	0.001729*	-0.000379*	0.001402***	-0.003187***
	[0.001280]	[0.001050]	[0.000226]	[0.000560]	[0.000895]
		Equity markets from different time-zone			
Canada	-0.004018***	-0.000711	-0.000377	-0.000403	0.004493***
	[0.001180]	[0.001579]	[0.000565]	[0.00102]	[0.000503]
UK	0.001541*	0.000489	-0.000423	0.001402	0.001601
	[0.000812]	[0.001209]	[0.000406]	[0.000864]	[0.001187]
USA	0.004797***	0.001730	0.000815	-0.000672	-0.004565***
	[0.001365]	[0.001676]	[0.000588]	[0.000971]	[0.000783]
Sunday		-0.000960***			
		[0.000110]			
Log Likelihood	3232.115	3134.259	3460.933	3327.687	3054.885
Wald Test	8.272896	3.449421	21.07295	44.39396	52.21407
$LB^2(15)$	0.4532	3.9080	49.014	36.926	16.648
ARCH-LM(3)	0.246722	0.564530	4.254179	1.080317	4.045306

***, ** and * are significant at 1%, 5% and 10% level, standard errors are in [ ]. LB^2 (n) is the Ljung-Box statistics for the squared standardized residuals. LM (n) is for Lagrange – Multiplier test.

On Sunday we have similar results reported in Tables 5.10 and 5.11, because in both cases Friday's residuals from seven international markets are regressed and substantial volatility spillover takes place from the US and Canada. Next, Monday's volatility of the domestic market is largely influenced by Hong Kong, which is negative (-0.21%) and significant at the 1 percent level. In addition, Japan, India and China also affect the volatility of Monday with 0.17%, -0.13% and -0.14% respectively and they are significant at the 10 percent level. As it is mentioned earlier, we use spillover of one period lag residuals for this re-estimation model and no international markets out of seven countries are operating on Sunday, therefore, we apply Friday's residuals again as exogenous variables to see any left-over effect on Monday. Here we also include Sunday's residuals from DSI to examine whether information adjusted in last day's price is still relevant for DSI's volatility on Monday and a small coefficient (-0.096%) is found significant at the 1 percent level.

For the rest of the week, volatility spillovers significantly take place from Japan and Hong Kong. For example, Hong Kong and Japan influence the DSI positively, 0.14% and 0.14% respectively on Tuesday and Wednesday. Other than Japan and Hong Kong, India affects the volatility of DSI negatively (-0.047%) on Tuesday and China positively (0.090%) on Wednesday. Finally, DSI's volatility is largely influenced by the US (-0.46%), Canada (0.45%) and Japan (-0.32%) on Thursday. That implies, in both our models (as reported in Tables 5.10 and 5.11) Bangladesh stock market is intensively influenced by the volatility of the US and Canadian equity markets on opening and closing day of every trading week. Which implies, investors of the domestic market, therefore, make their investment decision initially based on information transmitted from far western markets and then it is further adjusted the information transmitted from equity markets located in similar time-zones. Finally, positive asymmetric innovations are documented in both of our models (Tables 5.10 and 5.11) for daily volatility spillovers, yet they are not found statistically significant at the 1 to 10 percent levels.

Residual based diagnostic tests are reported at the end of each Table (5.10 and 5.11). Results show that the non-linear TGARCH model satisfactorily explains the volatility spillover effect from seven international markets to domestic equity market. Wald test statistics significantly reject the null hypothesis that coefficients are equal to zero. The Ljung-Box Q statistics show no evidence of linear and non-linear dependence in the standardized squared residuals up to 15 lags, except Monday and Tuesday in model one (Table 5.10) and Tuesday and Wednesday for model two (Table 5.11). However, Engle's (1992) ARCH-LM test implies there is no ARCH effect left in the residuals for any model. The low standard error for the estimated parameters of the return and variance equation clearly explains the efficiency of the model.

Altogether, it is documented that other than Sunday and Thursday the volatility of DSI is significantly influenced by the equity markets located in similar time-zones. We see substantial volatility spillovers from Japan, Hong Kong, India and China to Bangladesh capital market on Monday, Tuesday and Wednesday. This result is very much consistent with existing literature. For example, Singh et al. (2010) found greater regional influence in Asia. In this line of thought, Masih and Masih (1999) provide strong support for the view that the Asian stock markets' fluctuations are explained mostly by regional markets rather than by the advanced markets.

Further, Janakiraman and Lamba (1998) conclude that geographically and economically interrelated markets exert significant impact on each other. In their study, Carrieri et al. (2007) also provide evidence that local risks are important factors in explaining time variation of emerging market returns. However, the behaviour of the domestic country in this study is very much similar to the finding of Ng (2000). Investors of Bangladesh equity market may extract regional information from Japan and global factors from the US as explained in Ng (2000). Importance of the US and Japanese stock market information on the emerging economy is also documented in many other literatures, e.g. Hu et al. (1997), Miyakoshi (2003), Wongswan (2006) and Singh et al. (2010). Particularly, Miyakoshi (2003) report significant spillovers from Japan to other Asian equity markets' volatility than the US market. Recently, in their paper, Balli et al. (2013) also find strong influence of regional shocks rather than global on the volatility of GCC-wide sector equity returns.

Importance of other markets like Hong Kong is also reported in earlier studies, for example, In et al. (2001) state that Hong Kong is playing a notable role in volatility transmission to other Asian markets. Nevertheless, the volatility spillovers from Canada and China may be due to trade linkage with Bangladesh as reported in Table 5.2 and Table 5.3. International trade as a reason for transmission of information between markets is also evident in Hamao et al. (1990), Koutmos and Booth (1995) and Gagnon and Karolyi (2006) to name a few. The strong influence of Canadian equity market on DSI could be for substantial positive contemporaneous correlation between the residuals of the US and Canada (see Table 5.7). Any information, therefore, adjusted into the price of the US stocks is simultaneously reflected in stocks of the Canadian market and transmited to a third market. Finally, India is one of the top ten capital markets in the world, has solid bilateral trade relationship with Bangladesh (see Table 5.2) and shares almost entire hours of trading every day from Monday to Thursday (see Figure 5.1), thus exerting volatility spillovers on to the domestic country.

5.5.4 Testing the integration with domestic market

Since the volatility spillover significantly takes place from equity markets within similar time-zone then we could expect that the domestic market should be integrated with Japan, Hong Kong, China and India. It is claimed in earlier studies that the existence of volatility spillovers offers direct evidence of whether markets within and across regions are integrated (see Bekaert et al. 2005). We therefore investigate the bivariate and multivariate cointegration of domestic stock market with seven international equity markets; although the link between stronger market integration and volatility remains a controversial subject in the literature (Darrat and Benkato, 2003). Testing for cointegration as a measure of assessing the degree of market integration or segmentation across international capital markets is also documented in several literatures, e.g. Chan et al. (1997), Darrat and Benkato (2003) and Gupta and Guidi (2012).

Stock markets are completely integrated if assets with the same risk have identical expected returns irrespective of the market (Bekaert and Harvey, 1995). However, cointegration test allows us to address whether stock prices of different national markets move closely together over the long-term, while accepting the possibility of short-run divergences among them. In this study we use Johansen's methodology (Johansen, 1988, 1991) to examine the degree of market linkage between domestic market and markets from similar and different time-zones. Given the sensitivity of Johansen's test to the lag structure, we use Schwarz Criterion (SC) to estimate the optimal number of lags. Table 5.12 reports the bivariate Johansen cointegration between domestic market and seven international markets. The null hypothesis is that, for example, DSI and TSX composite indicies are cointegrated $(r=0)$ against the alternative of one cointegration $(r\leq1)$. The null hypothesis is not rejected for any pair of markets since both the λ_{trace} and λ_{max} statistics do not exceed critical values at the 5% level of significance. Therefore, we found no evidence of cointegration on a bivariate basis between the DSI and other seven international markets (see Table 5.12). That means Bangladesh capital market is not independently integrated with any of the global financial markets in our sample, however, with some them the domestic country has strong trade relationship.

Table 5.12: Bivariate Johansen cointegration results

	λ_{trace}	Critical value 5%	λ_{max}	Critical value 5%
DSI and TSX Composite				
r=0	5.774	15.495	4.897	14.265
r≤1	0.877	3.841	0.877	3.841
DSI and SSE				
r=0	10.324	15.495	7.557	14.265
r≤1	2.767	2.767	2.767	3.841
DSI and Hang Seng				
r=0	14.224	15.495	11.308	14.265
r≤1	2.916	3.841	2.916	3.841
DSI and BSE 100				
r=0	13.474	15.495	12.821	14.265
r≤1	0.653	3.841	0.653	3.841
DSI and TOPIX				
r=0	10.553	15.495	8.783	14.265
r≤1	1.769	3.841	1.769	3.841
DSI and FTSE 100				
r=0	6.362	15.495	4.944	14.265
r≤1	1.418	3.841	1.418	3.841
DSI and S&P 500				
r=0	6.476	15.495	5.237	14.265
r≤1	1.239	3.841	1.239	3.841

Results from the multivariate Johansen test are reported in Table 5.13. The first model is between the domestic country and capital markets from similar time-zone (Japan, Hong Kong, China and India), while the second model is for testing integration with equity markets from different time-zone (Canada, the US and the UK). Our first model indicates that there is a robust cointegrating (equilibrium) relationship, binding the DSI within the similar time-zones markets. We can make this inference supported by both the trace and the maximal eigenvalue statistics of the Johansen test. Both the statistics are significantly large to reject the null hypothesis of no-cointegration among the five equity markets (Japan, Hong Kong, China, India and Bangladesh) at the 1% level of significance. On the other hand, there is no cointegration evident in our second model. That implies between the domestic market and three stock markets from outside the time-zone (i.e. the US, the UK and Canada) have no long-run relationship. The estimated trace and maximal eigenvalue both are substantially lower (38.42 and 20.62 respectively) than critical values, which are 47.86 and 27.58 respectively. The absence of a long-run relationship shows evidence of limited financial integration among these markets.

Table 5.13: Multivariate Johansen cointegration results

	λ_{trace}	Critical value 5%	λ_{max}	Critical value 5%
Model one: DSI , SSE, Hang Seng, BSE 100 and TOPIX				
r=0	71.858***	69.819	37.455***	33.877
r≤1	34.403	47.856	16.937	27.584
r≤2	17.466	29.797	11.037	21.132
r≤3	6.429	15.495	5.538	14.265
r≤4	0.892	3.841	0.892	3.841
Model two: DSI , TSX Composite, FTSE 100 and S&P 500				
r=0	38.419	47.857	20.623	27.584
r≤1	17.796	29.797	11.189	21.132
r≤2	6.608	15.494	6.406	14.265
r≤3	0.201	3.841	0.201	3.841

***, ** and * are significant at 1%, 5% and 10% levels

Our results clearly support the argument of Bekaert et al. (2005); the domestic market is integrated and has got significant volatility spillovers from equity markets within similar time-zones during the sample period 1990-2012. In their study, Darrat and Benkato (2003) also report that Istanbul Stock Exchange is cointegrated with four major developed capital markets (the US, the UK, Japan and Germany), and receive volatility spillovers from the US and the UK. Strong cointegration and regional influence among Asian markets is also documented in previous literature, e.g. Hung and Cheung (1995), Johnson and Soenen (2002) and Jong and Roon (2005). Particularly, Johnson and Soenen (2002) find that six major Asian stock markets have become more integrated with the Japanese market over time. On the other hand, interdependence among developed equity markets and emerging markets is also reported in Manning (2002), Syriopoulos (2007), Syriopoulos and Roumpis (2009) etc.

The finding of domestic market integration with equity markets in similar time-zone may be due to their synchronous trading, strong bilateral trade relationships and adoption of liberalization policies. Japan, Hong Kong, China and Indian equity markets interact on the same day with the domestic market throughout this 21-year sample period. Therefore, possibly we document integration among these markets as suggested in Bracker et al. (1999). For macroeconomic determinants, Table 5.14 shows the percentage export and import of Bangladesh with all seven international markets separated into time-zones for the period 2001- 2012. We can infer three major conclusions based on this table; first, the value of import is significantly larger than that's of export. Second, Bangladesh is importing more from economies within time-zone and their percentage of exports is also increasing (e.g. only China and India contribute more than 33% of total imports in 2012) with these countries. Third, both the exports and imports from outside the time-zone economy are decreasing since early 2000s (e.g. in 2001 the US and the UK contributes to 42% of total exports and this figure decreased to 25.1% in 2012). Altogether, business linkages within time-zone economies are growing over the days and that may be pursuing equity markets to be integrated and spur the volatility spillovers. For example, Bracker et al. (1999), Johnson and Soenen (2002), Kearney and Lucey (2004) and Forbes and Chinn (2004) claim that markets become increasingly integrated due to the rapid expansion of international trade in commodities, services and financial assets. Moreover, Forbes and Chinn (2004) claim that bilateral trade flows are the most important determinant of cross-country linkages in stock markets. Finally, Darrat and Benkato (2003) mention the liberalization policy and link it with market integration and volatility spillovers. They assert that the equity market of Turkey has become integrated and started to receive spillover effects from major international markets since the liberalization policy adopted in 1989. Similarly, Bangladesh has undergone market liberalization since early 1990 and has also started to be influenced by international information.

Table 5.14: Trade Relationship with countries from different time-zone

Year	Total Export [a]	Total Import [a]	Within Time-zone Economy [b]		Outside Time-zone Economy [c]	
			% Export	% Import	% Export	% Import
2001	144,495.00	206,935.00	8.89	83.87	91.11	16.13
2002	133,982.00	201,381.00	8.62	85.36	91.38	14.64
2003	138,873.00	222,336.00	8.49	86.84	91.51	13.16
2004	155,513.00	253,248.00	8.68	88.09	91.32	11.91
2005	204,230.00	336,079.00	9.10	87.63	90.90	12.37
2006	250,789.00	609,322.00	10.59	57.50	89.41	42.50
2007	317,166.00	489,580.00	11.05	88.54	88.95	11.46
2008	326,022.00	642,012.00	12.62	87.44	87.38	12.56
2009	360,164.00	1,163,771.00	10.47	93.63	89.53	6.37
2010	364,740.00	700,500.00	13.79	87.58	86.21	12.42
2011	513,625.00	1,504,814.00	15.86	92.48	84.14	7.52
2012	627,804.00	1,120,236.00	17.40	94.29	82.60	5.71

[a] values are in million taka (local currency), where the exchange rate is US$1=Tk.79.83 as of December, 2012

[b] economy includes – Japan, Hong Kong, China and India; [c] economy includes – Canada, the US and the UK.

5.5.5 Causality between conditional variance of markets across different time-zone

In this final section, we investigate the interdependence between eight international stock markets across various time-zones through causality in conditional variance and also the role of domestic market in this causation. We do this with an objective to see whether equity markets are segmented or they have causal associations. Many of the previous studies have adopted the causal approach for investigating the interrelationship as well as spillovers effects between different capital markets. For example, Eun and Shim (1989) investigate the international transmission mechanism of stock market movements using a nine-market vector autoregression (or VAR) system. Hu et al. (1997) explore the causality relationship and volatility spillovers between the US, Japan and four markets in the South China Growth Triangular using Chueng and Ng's causality-in-variance test. Similarly, In et al. (2001) apply VAR-EGARCH approach to examine the dynamic interdependence and volatility transmission between six Asian stock markets. By applying vector autoregression model, Janakiramanan and Lamba (1998) determine the possible linkages between the Pacific-Basin stock markets. Brandt and Kang (2004) use latent VAR approach for examining the relationship between conditional mean and volatility of value-weighted CRSP index. For investigating the interdependence of fifteen world indices including India, Singh et al. (2010) use a VAR and AR-GARCH framework. In a recent study, Jiang et al. (2012) employ vector autoregression specifications to study the effect of news releases on volatility transmissions.

Following these existing literatures, we apply vector autoregressive (VAR) system of Sims (1980) to model the casual relationship between conditional variance of our sample equity markets. It is explained in Brandt and Kang (2004) that time-varying volatility is typically modelled in an ARCH or stochastic volatility (SV) framework, yet this study use ARCH approach to determine the conditional variance series[23]. We know in ARCH family model, the conditional variance of return depends both on lagged squared returns and lagged variance (see Bollerslev et al., 1992). The ARCH approach is quite popular in use because the fact that in this models all randomness is ex-post observable (through returns) thus necessitating that volatility realizations can be recovered from the data (see Brandt and Kang, 2004 for further discussion). On the other hand, the vector autoregressive analysis of Sims (1980) estimates unrestricted reduced form equations that have uniform sets of the lagged dependent variables of every equation as regressors. Eun and Shim (1989) describe several advantages of the VAR model. First, VAR estimates a dynamic simultaneous equation, free from a prior restriction on the structure of relationships. Second, since no restrictions are imposed on the structural relationships among variables, the VAR can be viewed as a flexible approximation to the reduced form of the correctly specified but unknown model of the actual economic structure. Finally, the large-scale structural models are very often

[23] In contrast, in SV models the conditional variance is a stochastic process. In these models the innovations to the volatility process are random and the volatility realizations are therefore unobservable. In addition, estimating an SV model involves integrating out the latent volatilities. The computation of this high-dimensional integral is analytically difficult and computationally intensive, causing SV models to be less popular than ARCH models despite their statistical and economic appeal.

misspecified and therefore, it is appealing to use the VAR for the purpose of stylizing empirical regularities among time-series data.

The estimated VAR model and the results are presented in Table 5.15 and the following causal relations are observed: the conditional variance of each market is influenced by its own lag and the lag of other markets. The dependency on past variance is highest for the Hong Kong, US and UK equity markets. Japan, Hong Kong, Canada and the US equity markets are also significantly affected by the lag values of other equity markets. However, the laged conditional variance of Indian stock market is affecting the highest number of other markets in our sample. For example, the variance up to three days of Indian equity market is linearly related to Hong Kong and the UK, then to Japan and the US for two days, and finally to Canada and China up to lag one. We see significant causal association of the Canada and US equity markets with the Hong Kong, India, Japan and UK capital markets. Examining the Japan and the US markets, Cheung and Ng (1996) report that the Nikkei 225 index affected the S&P 500 index. Although we use different market indices and examine different relationship, however, our results are in line to those reported in Cheung and Ng (1996). A similar finding is also reported in Hu et al. (1997) using causality-in-variance between return series.

There are several feedback relationships existing between conditional variances from different stock markets. For example, there between Hong Kong and Canada, Japan and the US, and Hong Kong and the US are the most substantial among those causations. However, between Hang Seng and the S&P 500 index, the impact from US to Hong Kong is stronger than from Hong Kong to the US. This finding is consistent with the bilateral relationship reported in Hu et al. (1997) and Wei et al. (1995). On the other hand we see equal influence from Canada to Hong Kong and Hong Kong to Canada. But between Japan and the US, S&P 500 index affects TOPIX up to four lag periods and there is a bidirectional influence from Japan to the US up to two days and the fourth lag is also significant. The Japanese index (TOPIX) is also significantly influenced by the UK conditional variance. The robust influence of the US and UK markets on Japan is also strongly evident in previous literatures, e.g. Hamao et al. (1990). They report volatility spillovers from New York and London to Japan but not in the other direction. From Table 5.15 we notice several other reciprocal causalities, such as, Canada with Japan, the UK and the US; Hong Kong with India, Japan, and the UK; India with the UK, the US and Canada; and between Japan and the UK.

In Table 5.15, a low level of correlation is reported for the conditional variance of China and Bangladesh equity markets with other international markets in our sample period from 1992 till 2012. The SSE composite index of China is only affected by its own first lag and four lags of the

Indian market. Nevertheless, the first and second lag of China is significantly correlated with the Hong Kong market. The domestic equity market is influenced by its own first and fourth lags. No other of the seven international markets is correlated with this market. Surprisingly, though, the first lag coefficient of conditional variance of Bangladesh stock market is significantly related to the equity variance of Japan.

The findings related to causal associations between conditional variances of eight international equity markets across time-zones profoundly support our earlier results and results from previous literatures. For example, the domestic market is only found cointegrated with markets from similar time-zones (i.e. Japan, China, Hong Kong and India) and significant volatility spillovers takes place from Japan, Hong Kong, Canada and the US. Further, the importance of Japan, Hong Kong and the US equity markets for transmission of volatility and causal effect are extensively documented in Eun and Shim (1989), Hu et al. (1997), In et al. (2001) and Singh et al. (2010) to name a few. Finally, it is evident that markets from different time-zones are not strictly segmented, rather strong comovements exist among major international equity markets around the world, thus confirming information is transmited across borders.

Table 5.15: Causality between conditional variance

	Horizon (in days)	Bangladesh	Canada	China	Hong Kong	India	Japan	UK	USA
Bangladesh	1	0.804584***	-0.000262	-0.003682	8.84E-05	0.001021	0.001734*	-0.000335	3.65E-06
	2	0.002819	0.000256	0.000886	0.001729	-0.002038	-0.000376	-1.58E-05	0.000475
	3	-0.011426	0.000650	-0.000808	-0.002089	0.000826	6.71E-05	0.000311	-0.000103
	4	0.027225**	-0.000500	-0.002544	0.000469	-0.000871	-0.000208	-0.000188	-0.000370
Canada	1	0.007470	0.957185***	0.004226	0.105109***	0.145696***	0.028694*	0.101233***	0.151945***
	2	0.006360	-0.090301***	0.035151	-0.141528***	-0.099813**	-0.084405***	-0.045970***	-0.149920***
	3	0.151147	0.025719	-0.110502	0.097648***	0.062253	0.040271**	-0.112290***	-0.054255***
	4	-0.141778	0.051401***	0.010965	-0.053032**	-0.091436**	0.017444	0.053373***	0.053510***
China	1	-0.001644	-4.99E-05	0.903278***	0.004451***	0.003333	-0.000857	-3.13E-05	-7.31E-05
	2	-0.000306	0.000159	0.018756	-0.004140**	-0.004736	0.000450	0.000200	-0.000234
	3	-0.001838	-0.000746	0.009428	-0.000292	0.004055	0.000122	-0.000616	-1.57E-05
	4	0.001001	0.000450	-0.011410	0.000742	-0.002733	0.000109	0.000676	8.23E-05
Hong Kong	1	-0.003135	-0.010355	-0.040266	1.138878***	-0.094117***	-0.030480***	-0.051587***	0.039026***
	2	0.011900	0.068067***	0.001860	-0.193218***	0.135097***	0.010197	0.071114***	-0.027324***
	3	-0.003024	-0.092342***	0.016375	0.193899***	-0.024024	0.036774**	-0.030800**	0.006647
	4	0.022530	0.035393***	0.012252	-0.169434***	-0.022429	-0.010983	0.005432	-0.016499***
India	1	-0.002868	0.023641***	0.079267	0.037898***	0.995121***	0.027735***	0.012981***	-0.000215
	2	-0.014209	-0.013126	-0.007622	-0.020429**	-0.092830***	-0.012550*	-0.020292***	0.009384**
	3	-0.002708	-0.001322	-0.128516	-0.027218***	-0.005404	-0.011963	0.013993**	-0.010384**
	4	0.003858	-0.005224	0.220508***	0.009512	0.038246*	0.000893	-0.006492	0.001517
Japan	1	-0.031716	-0.003421	-0.073427	-0.067795***	0.057823	0.973486***	0.004711	0.023020***
	2	0.031203	-0.047163**	-0.068192	-0.013461	0.029886	-0.010744	0.016702	-0.032745***
	3	-0.058384	0.053031**	0.038212	0.083329***	-0.019639	-0.027352	-0.030254*	-0.007934
	4	-0.024354	-0.008132	0.071608	0.002431	-0.040965	0.002785	0.008406	0.016993**
UK	1	-0.010757	-0.017897	-0.008292	0.052448**	-0.113226**	0.149507***	0.845330***	0.075622***
	2	-0.010135	0.011934	0.026195	0.091883***	0.289966***	-0.051636**	0.145263***	-0.044853***
	3	0.065508	0.315811***	0.141209	-0.038706	-0.102215	-0.123210***	0.029138	0.160694***
	4	0.010486	-0.265691***	-0.138710	-0.079159***	-0.030854	0.047929***	-0.040427**	-0.156035***
USA	1	0.041930	0.032399	-0.032341	0.272911***	-0.215228***	0.280725***	0.033530	0.749579***
	2	-0.201505	-0.004731	-0.029588	-0.341996***	0.157209*	-0.335891***	-0.011898	0.263683***
	3	-0.135587	-0.102688***	0.080088	-0.089916**	-0.163067**	0.233912***	-0.027244	-0.130915***
	4	0.203041	0.094487***	-0.097367	0.147287***	0.183585***	-0.182987***	0.029685	0.069325***
δ		7.13E-05***	-9.85E-07	2.69E-05***	3.06E-06**	1.30E-05***	5.87E-06***	2.32E-06***	3.01E-07
Adjusted R^2		0.6651	0.9784	0.8600	0.9764	0.9097	0.9498	0.9782	0.9865

Note: Each entry in the table denotes the coefficient of conditional variance of the left-hand side market explained by the market at the top. The optimal lag is selected based on Schwarz information criterion (SIC). ***, ** and * are significant at 1%, 5% and 10% level.

5.6 Chapter Summary

In this study we analyse the daily dynamics of volatility spillovers to a domestic equity market from seven other financial markets. We divide these major international markets (i.e. Japan, Hong Kong, China, India, Canada, the US and the UK) based on time-zones to see the transmission of information and in each time-zone markets share synchronous trading hours with each other. The domestic market (i.e. DSE) is located in one particular time-zone in Asia and operates from Sunday to Thursday instead of usual Monday to Friday. We apply non-linear asymmetric, AR(1)-TGARCH(1,1) process that allows us to investigate the time-varying behaviour of return variance. Further, we obtain from the Johansen test of multivariate cointegration that there is first-moment (market return) interdependence between markets during the sample period January 1992 - December 2012. Finally, we apply vector autoregression system to examine the causal relationship between conditional variance to see whether markets are segmented or have interdependencies.

Several conclusions appear from our empirical analysis. First, in between markets from similar and different time-zones, the domestic market is significantly affected by the volatility transmission from Japan, Hong Kong, Canada and the US. Particularly, from Monday to Wednesday the volatility spillovers take place substantially from Japan and Hong Kong, yet partial influence is documented from India and China as well. The US and Canada exert major influence over DSE on opening (Sunday) and closing (Thursday) days. Our finding is very much in line with Ng (2000), and we can assert that investors of Bangladesh capital market may be taking the regional information from markets in similar time-zones but adjust from world factors from the US and Canada at the beginning and end of each week. The results are also consistent with Hu et al. (1997), Janakiraman and Lamba (1998), Wongswan (2006), Carrieri et al. (2007), Singh et al. (2010), and Balli et al. (2013).

Second, we find evidence that Bangladesh stock market is become integrated with the markets in similar time-zones. There is no bivariate cointegration reported in this study. However, under the multivariate Johansen cointegration test, DSE is found integrated with Japan, China, Hong Kong and India, some of the major markets of Asia and the world. Therefore, our results support the argument of Bekaert et al. (2005) that the existence of volatility spillovers offers direct evidence of whether markets within and across regions are integrated. Strong regional influence and integration within Asian equity markets is also documented in Hung and Cheung (1995), Johnson and Soenen (2002) and De Jong and De Roon (2005). The volatility spillovers and integration also provide direct evidence of bilateral trade relationship between Bangladesh and seven other international economies in our sample. For example, China, India, Japan, the US and the UK are the major trade partners of Bangladesh and contribute more than 25 percent (average) of total imports and exports every fiscal year since 1990. This robust trade association is clearly visible in Johansen's cointegration and non-linear asymmetric GARCH model. In this line of thought, earlier researchers, such as, Bracker et al. (1999), Kearney and Lucey (2004) and Forbes and Chinn (2004) claim that stock markets become increasingly integrated due to rapid expansion of international trade.

Our third major finding is causal associations between conditional variances of international capital markets across time-zones. Following the findings of existing studies (e.g. Eun and Shim, 1989; Hamao et al., 1990; In et al., 2001; Singh et al., 2010), we find strong correlations between the conditional variances of Japan, Hong Kong, India, Canada, the US and the UK. Here, financial markets from Asia are significantly affected by the Canada and the US. On the contrary, the US, the UK and Canada are highly influenced by Hong Kong, Japan and India. Other than these unidirectional correlations across time-zones we also document strong feedback effects between Hong Kong, Canada, Japan and the US. All these suggest comovement among world financial markets regardless of the timing of a market's opening and closing hours. That implies, international equity market are not segmented, rather a strong interdependence exist between them. However, emerging markets are yet to have association with international markets and remain segmented, thus investors could take benefits by investing into this markets.

This study has documented several other empirical evidences, such as, using Granger causality we find causation in international trade between the domestic country and Canada, China and the US. Each of the financial markets has asymmetric innovations in their volatility modelling. Other than the US equity market all the seven international markets report positive leverage effect, which means any negative shocks entail a higher next period conditional variance than positive shocks of the same sign. However, the sign is negative for the US market and thus positive shocks are followed by higher volatility in this market. Based on the contemporaneous correlations between pairwise residuals of eight international equity markets, the correlation is found to be higher between intra-time-zone markets rather than inter-time-zone markets. For example, strong correlation is found between the US/Canada, the UK/Canada and the US/UK. Similarly, significant correlations are evident between Japan/Hong Kong, India/Hong Kong, Japan/India, and Hong Kong/China. Our sample results suggest that there is a small but significant positive correlation between the time-varying conditional variance of Bangladesh and

Japan's. That implies equity market variance of an emerging market sometime can influence the volatility behaviour of a developed market and this supports the argument of Miyakoshi (2003). He reports an adverse influence of volatility from the Asian market to the Japanese market.

Finally, our robustness test confirms that financial crises have little impact on the dynamics of volatility transmission to DSE from other seven international equity markets. We have controlled three financial crises – the Asian crisis, Dot Com crisis and crisis of 2008-09 and found that only Asian crisis is statistically significant impact on daily returns of DSE. However, using the residuals, we find no significant changes in the nature of spillover effects. Results indicate strong influence of volatility from the US, the UK and Canadian stock markets on the opening (Sunday) and closing (Thursday) days of DSE. For rest of the weekdays markets from similar time zones are significant. In addition, to check whether the volatility inter-dependence grow over the periods, we split over all sample in to pre and post 2000. The results show similar pattern in volatility transmission but more countries become significant in post 2000 compare to pre 2000 periods. That indicates integration is slowly growing between DSE and international markets in recent years.

In future, this research can be extended by including more domestic countries from various time-zones, which will give robust results about volatility spillovers from markets with synchronous and nonsynchronous trading hours on a daily basis. Possible existence of unidirectional transmission of information from emerging markets to developed markets may also draw attention of researchers.

Chapter 6:
Timing of Macro and Non-macroeconomic News and Market Breaks

6.1 Introduction

Due to the macroeconomic variables, such as, monetary and fiscal policy instruments, the behaviour of equity price series could change over time in terms of its mean value and volatility. The behaviour may change once or it may change for a period of time before reverting back to its original behaviour or switching to yet another style of behaviour (Brooks, 2008). There are many studies which discuss this behavioural interdependence and studies of this kind are increasing over time (e.g. Castanias, 1979; Chen et al., 1986; Schwert, 1989; Beltratti and Morana, 2006; Challe and Giannitsarou, 2014). For example, Morana and Beltratti, (2002) assert that both first and second moments of equity returns should be affected by structural changes in economic events to the extent that they affect price fundamentals. Similarly, Rangel (2011) mentions that there is a close connection among jumps in the returns process, large changes in market volatility, and the arrival of macroeconomic releases. Flannery and Protopapadakis (2002), Marquering and Verbeek (2004) and Avramov and Chordia (2006) also report that macro variables can predict the conditional variance of stock returns. Schwert (1989) claims that the macro variables which can affect the stock returns can also be used to predict the conditional volatility. In another study Beltratti and Morana (2006) further report that the break process in stock market volatility can be related to the break process in the volatility of macroeconomic factors - federal funds rate and money supply growth in particular. Wasserfallen (1989) also mentions that the structural breaks happen in equity market due to changes in monetary regimes.

Earlier researchers, such as Schwert (1981), Pearch and Roley (1985), Fari (2002) also find large immediate price changes in the stock market following monetary announcement. Supporting this idea, Lastrapes (1998) and Jensen et al. (1996, 2002) argue that the stock market is influenced by the monetary environment and monetary policy shocks. In an interesting paper, Ehrmann and Fratzscher (2004) claim that contractionary monetary policy shocks have immediate significant effects on stock prices in the US economy. There are, of course, numerous studies available those explaining the effect of ‘tight’ money – and occasionally ‘easy’ money – on financial markets (Fisher, 1976; Homa and Jaffee, 1971). For example, interest rate is considered an indicator for the monetary authority to execute tight or loose policies (Chang, 2009) and execution of monetary policy affects stock price through the credit channel (see Bernanke and Gertler, 1995; Kiyotaki and Moore, 1997).

Changes in interest rates can also affect the variance of the stock market (Glosten et al., 1993). Bernanke and Kuttner (2005) argue that the most direct and immediate effects of monetary policy actions, such as changes in the Federal funds rate, are on financial markets. Later, Laopodis (2006) reported that a change in any of the monetary policy instruments, such as the money supply or central bank rate (e.g. the federal funds rate) leads to changes in market interest rates and this in turn, forces investors to revalue their equity holdings. Recently, in their general equilibrium model, Challe and Giannitsarou (2014) find the impact of unexpected monetary policy on stock prices through real interest rate channel is larger than others, such as dividends and ex-ante excess returns. Among many, McQueen and Roley (1993) find inflation surprises are sometime significant and similarly, Jain (1988) asserts, surprise monetary and CPI announcement are significant for changes in stock prices. The interrelationship between exchange rates and financial markets is also evident in many previous literatures, e.g. Kanas (2002), Hau and Rey (2006), Moore and Wang (2007), Katechos (2011).

On the other hand, macro variables related to fiscal policy shocks can also influence the stock market. According to Keynesian approach fiscal policy can support aggregate demand, boosting the economy and thus positively contributing to the financial market. Further, it is explained in classical economic theory that fiscal policy could potentially drive stock prices down through the crowding out of the private sector. Many of the existing literatures also have provided evidence related to interdependencies between fiscal policy and the stock market. For example, in his general equilibrium model Tobin (1969) shows both monetary and fiscal policies can have important impact on the stock market. Darrat (1988, 1990) in his two papers empirically tested stock market efficiency with respect to both monetary and fiscal policy variables. He asserts that fiscal policy stance plays a significant role in determining stock returns even when the path through interest rates is excluded. In a separate study, Darrat and Brocato (1994) claim that the federal budget deficit exerts a significant lagged impact on current US stock returns.

In many recent studies, researchers have linked the stock market with fiscal and/or governmental policy, e.g. Belo and Yu (2013), Belo et al. (2013), Chatziantoniou et al. (2013), Pastor and Veronesi (2012), Croce et al. (2012), Afonso and Sousa (2011) to name a few. They argue that contractionary and expansionary fiscal policy shocks related to government spending, deficit financing, public sector investment and tax policy could directly influence equity markets. For example, Ardagna (2009) provides evidence from 16 OECD countries that stock market prices surge around times of substantial fiscal tightening and plunge in periods of very loose fiscal policy. Belo and Yu (2013) link the stock market with the government investment in the public sector. Adjustment of tax policy shocks to the stock price is documented in Agnello et al. (2013) and Croce et al. (2012). However, besides all there evidence, the transmission of fiscal policy innovations to asset markets is far from complete (Afonso and Sousa, 2011).

This study analyzes the stock market response to both monetary and fiscal policy news along with other macro and non-macroeconomic information. Particularly, in a first step, we investigate whether stock prices behavior of an emerging market changes over time or switches over states with respect to timing of monetary policy, fiscal policy and some of the non-macroeconomic (henceforth, non-macro) announcement or surprises, such as political events, national election, changes in government policies, and changes in capital markets regulations etc. In line with our thought, Aggarwal et al. (1999) find that most of the volatility breaks in the emerging markets coincide with country specific economic crises, idiosyncratic political events, as well as worldwide financial crises. Nonetheless, this study does not include any worldwide factor following the argument of Wasserfallen (1989), who states that the macroeconomic effects on the stock market are generally of a purely domestic nature; Wang and Theobald (2008) also support this argument. In this vein, prior researchers have shown that investors who hold predominantly domestic assets and unable to diversify internationally exhibit a significant home bias (see French and Poterba, 1991; Baxter and Jermann, 1997; Bailkowski et al. 2008). Second, we extend our analysis to provide firm-level evidence related to this interdependence. We examine whether any of the macro and non-macroeconomic news has specific effect on portfolios with different characteristics, i.e. size, dividend yield and sectors. Our motivation is Cenesizoglu (2011), who claims that little is known about the reactions of daily returns on portfolios with different characteristics to unexpected changes in macroeconomic conditions.

Given the huge empirical substantiations in existing literatures, this study has several unique importances. First, there is growing evidence that the standard valuation model has failed to capture stock market movements (see Shiller, 1981; Mei and Gou, 2004; Coakley and Fuertes, 2006; Bailkowski et al., 2008; Chau et al., 2014). For example, Shiller (1981) argues that the observed stock market volatility is inconsistent with the predictions of the present value model. Therefore, we need to identify and evaluate drivers of volatility other than conventional dividends and earnings, such as, national elections (see Leblang and Mukherjee, 2005; Bailkowski et al., 2008), political uncertainty (see Mei and Guo, 2004; Nguyen and Bellalah, 2008; Chou et al., 2014), government policy (see Pastor and Veronesi, 2012), regulatory changes (see Schwert, 1981; Bengtsson et al., 2014) besides monetary and fiscal policy. In this study, we include most of these macro and non-macroeconomic variables to analyse their timing of disclosure and timing of structural breaks and regime shifts simultaneously in the conditional returns and variance. There is little empirical evidence available in existing literatures, particularly for emerging markets.

Second, we examine time-varying reaction of portfolios based on different characteristics to macroeconomic news, such as, size, dividend yield and industry. Many of the previous studies have documented how macro and non-macroeconomic information influences the price behaviour across firm size and industry, e.g. Ehrmann and Fratzscher (2004), Dedola and Lippi (2005), Basistha and Kurov (2008), Chen and Wu (2014). However, Cenesizoglu (2011) mentions that there might be important asymmetries in the reactions of daily volatilities of portfolios to macroeconomic news and portfolios based on other characteristics, such as dividend yield might provide further evidence on the relation between stock prices and the aggregate economy. Further, dividend yields exhibit less variability and hence are more likely to represent permanent, rather than transitory changes (Bekaert and Harvey, 2000). Hence, we categorize the firms based on dividend yield and examine their price fluctuations within GARCH-based analytical framework.

Finally, the emerging market that we examine in this study i.e. Bangladesh, has some interesting characteristics, which are distinctly different than most other developed and emerging economies, such as, the US, the UK, China, India or Brazil, which make it a good candidate for this kind of research. For example, from 1990-2011, it has had a system of interim non-political governments (commonly known as Caretaker Government) between politically elected governments. Initially, it was a consensus between major political parties but later was adopted into the constitution in 1996. The objective of this special kind of small scale government system is to ensure smooth transition and holding free and fair election without any influence of outgoing government. A similar mechanism is only found in Australia and the Netherlands (a Caretaker Cabinet though).

Over the sample period from January 1990 to December 2012, all together the country has been run by a Caretaker Government for about three years; this government has presented three national budgets and conducted four national elections. Therefore, the dynamics of macroeconomic news and stock market reaction of this economy should be a new evidence for existing literatures. Since the application of fiscal policy largely depends upon the environment of political economy in which it is made (see Chatziantoniou et al., 2013). Further, Cooray (2011) provide evidence from 71 economies that size and quality of government positively influence the size and efficiency of financial sector. Thus this research possibly could document differential reaction of equity market to political versus non-political government and interdependence between economic information and market.

In addition, the political government of this country is very powerful (see Shakhawat, 2012, 2013 and Sayeed, 2014) and thus can influence the economic structure as a whole. Such as to increase the liquidity government allow the black money (undisclosed) in the stock market despite strong oppoition from various organizations, such as, National Board of Revenue (NBR), Financial Action Task Force (FATF) and Transparency International Bangladesh (TIB) (see Showkat, 2011; The Financial Express, 2011). In addition, Ministry of Finance, through central bank, urged commercial banks to invest 50 percent of their profit (which is equivalent to BDT 45 billion) to stocks, against the fundamentals of monetary management. It is, therefore, expected that share prices should reflect this information, simultaneously changing returns and volatility. Pastor and Veronesi (2012) nicely explain the scenario by saying that governments set the rules of the game and governments change these rules from time to time, eliciting price reaction in financial markets.

The next characteristic of this market is political uncertainty that affects entire economy and thus the financial market as well. It is reported in Diamonte, Liew and Stevens (1996) that political risk represents a more important determinant of stock market returns in emerging than in developed markets. From economists to laymen, only few could deny that political events can have an important, sometimes even overwhelming, impact on economic decisions in general, and investment decisions in particular (see Stevens, 2000). In Bangladesh one form of political risk is national shutdown or strike (known as Hartal) and that has become commonplace in politics over the decades (Prokopp, 2013). Since 1990 there have been more than 1100 days (equal to about 4 working years) of hartal called by political parties till 2012 (UNDP, 2005; Khan, 2013). This culture is also found in other part of the world but the phenomenon is not as severe in other emerging economies like, China, Brazil or India (see UNDP, 2005). From an economic perspective, if it is a one-off event, it could be easily ignored, but these recurrent nationwide strikes certainly have some impact on the production and business activities of firms and their overall performance which must be reflected in stock price. It is documented in earlier literature that labour strikes have significant negative relationship with stock prices (see Nelson et al., 1994; Dinardo and Hallock, 2002). For example, Nelson et al. (1994) find a loss in stock prices of about 1% for the 5-day window around the strike. Nonetheless, we have to admit that the socio-economic extent of nationwide hartal or strike may be larger than labour strikes only. Such an action, similar to the labour strike, will reduce production, sales, cash flows, and also limit the investment opportunities. In the long run the value of the firm will be affected and stock price must be adjusted with this new information. On the other hand, sometime, due to long lasting hartal (e.g. about 10 days or more) individuals as well as institutions could face cash-crisis and therefore, sell pressure suddenly can rise in the equity market and that might surge the volatility.

The ICC (International Chamber of Commerce) of Bangladesh has estimated that the country loses around $200 million every hartal day (Khan, 2013). According to UNDP (2005), the loss is 4.5 percent of GDP per day and it was highest at 9.5 percent in 1995-96. Surprisingly, despite these political bottlenecks the economy has been maintaining growth rate of more than 6% since 2004 (see World Bank Data 2014). Prokopp (2013) asserts without these hartal, the GNI of Bangladesh could be 5.5 times greater than today at $4358 per person per year in 2011. Similarly, Ward (2012) includes this country in their fast growing list and estimate that the GDP will reach $673 billion by 2050 from only $78 billion as of 2010. Indeed, the economic developments of Bangladesh have been broadly as envisaged - exports are picking up, remittances remain strong, reserves continue to rise, and inflationary pressures have eased, supported by restrained fiscal and monetary policies (Cowen, 2013). The stock market, which is Dhaka Stock Exchange (DSE), has been recorded as Asia's best and second best performing market in 2010 and 2008 respectively. Therefore, the outcome of this study related to influence of political shocks on capital market, will be a good learning for other emerging and developing countries as well as help policymakers to formulate macroeconomic decisions and political leaders to rethink about their activities.

The other two attractive features of this country to finance researcher are its culture and investors. As a Muslim country, Bangladesh has stocks of different sets of industries or firms listed other than conventional operation, e.g. banks with Islamic banking norms. Chau et al., (2014) identify that conventional and Islamic financial market indices react heterogeneously to the political turmoil. They find a significant increase in the volatility of Islamic indices during the period of political unrests whereas the uprisings have had little or no significant effect on the volatility of conventional markets. Thus any similar evidence from Bangladesh should add to the literature. On the other hand, there are more than 99 percent retail equity investors are individuals in Dhaka Stock Exchange (DSE), who usually have less opening to diversify their portfolios may be due to small scale of investment and lack of knowledge about the capital market. Limited opportunity of portfolio diversification by the individual investors, however, is also documented in, e.g. Bialkowski (2008) and Giofre (2013). Hence, they are very sensitive to any shocks or surprise, particularly to any form of negative information. Besides, due to lack of knowledge and asymmetric information they sometime make their investment decisions based on market-rumours rather than fundamentals (see Haque, 2011). Barber and Odean (2013) also mention the informational disadvantage that individual investors face while trading. Therefore, where markets are dominated by individual investors, they might not get contemporaneous response to the changes in macroeconomic fundamentals. Altogether, this study is giving a new perspective to the existing finance and economic literature.

Finally, the relationship between macroeconomic variables and asset returns has revived the interest on the topic by academics (Sousa, 2010). Earlier, Fisher (1988) made an statement that there is an always obvious place to do research on capital market to see the effect of unexpected economic shocks.

The remainder of this study is structured as follows. The next section briefly reviews the related literatures. Research methodology related to structural breaks, switching GARCH and GARCH family model to investigate the influence of macroeconomic and non-macro information on stock market is given in section 6.3. Data employed in this study is also included in this section. Section 6.4 presents the empirical results of different tests on DSE and links them with timing of various country-specific news and events. Finally, we conclude the paper with a summary of main findings and their policy implication in section 6.5.

6.2 Literature Review

Asset pricing theory argues that variables that affect the level of consumption or the investment opportunity set should affect asset price (see Merton, 1973; Breeden, 1979). Birz and Lott (2011) assert macroeconomic factors are an example of such variables and therefore, news or announcement about macroeconomic variables should also affect stock prices. In the following section (section 6.2.1), we present the literature related to the influence of monetary policy shocks on equity markets. Section 6.2.2 discusses the interdependence between fiscal policy shocks and the stock market. How non-macroeconomic factors, such as political uncertainty and regulatory changes affect stock market behaviour is discussed in section 6.2.3. Finally, evidence of various macro and non-macroeconomic events on firm level characteristics is described in section 6.2.4.

6.2.1 Monetary Policy shocks and the capital market

In financial markets, where information is readily available and prices are sensitive to agents' expectations about the future, the interdependence between monetary policy and financial market should be simultaneous. Bjørnland and Leitemo (2009) propose a solution to the simultaneity problem of identifying monetary and stock price shocks by using a combination of short-run and long-run restrictions. Results indicate real stock prices immediately fall by seven to nine percent due to a monetary policy shock that raises the federal funds rate by 100 basis points. Then again, a stock price shock increases real stock prices by one percent to an increase in the interest rate of close to 4 basis points.

Some of the earlier studies have reported the announcement effect of economic news on stock price changes in the US markets. For example, Waud (1970) investigates the 'announcement effect' of discount rate changes, one of the major tools of monetary policy on equity price. He finds a significant and immediate negative response of stock prices to discount rate changes. Even on days preceding discount rate decreases, there seems to be some evidence of anticipation of the change, he further adds. For similar markets, Castanias (1979) argues that the variability of daily market factors is an increasing function of the rate of arrival of information of broad economic impact. He finds that the variance of stock prices rises around the days of most economic news events which he interprets as a reflection of new information appearing. Many specific macro-event types, for example, the release of Federal Reserve Board policy and news statements, have significant information content. Along these lines, Pearce and Roley (1983) examine the short-run reaction of stock prices in the US to weekly money supply announcements. Their study identifies that stock prices respond only to the unanticipated changes in the money supply. Later, they (Pearce and Roley, 1985) include several other macroeconomic announcements along with anticipated money announcements (i.e. the inflation, industrial production, unemployment rate and the Federal Reserve's discount rate) to see the influence on stock prices. Their empirical investigation reports significant effects of new information released related to monetary policy and limited evidence for inflation and real activities during the sample period 1977-1982.

Following a GARCH type approach, Flannery and Protopapadakis (2002) extensively investigate the impact of 17 macroeconomic announcements on the level and conditional volatility of daily US equity returns from January 1980 through year-end 1996. They divide the sample into three economic regimes defined according to the level of economic activity and estimate simultaneously the model for three contiguous subperiods. They report stock market returns are significantly correlated with inflation and money growth. In an interesting study, Fair (2002) examine tick data on the S&P 500 futures contract and use newswire searches to match events to 1- to 5-minute stock price changes. Sixty-nine events are identified between 1982 and 1999 that lead to large stock price changes, 53 of which are directly or indirectly related to monetary announcements. He states, however, many large changes correspond to no obvious events, and so many large changes appear to have no easy explanation.

The pre-announcement and news effects on the stock market in the context of public disclosure of monetary policy decisions are extensively studied in Bomfim (2003). His paper provides new statistical evidence, from the daily sample between June 1989 to December 1998, that the US stock price do respond reliably to macroeconomic news conveyed by monetary policy decisions regarding the target federal funds rate. The study also emphasizes the potential impact of unanticipated monetary policy on the volatility of stock returns. His results suggest that unexpected monetary policy decisions tend to boost significantly stock market volatility in the short run. Further, as expected, positive sign surprise tend to have a larger effect on volatility than negative sign surprises. Similarly, Bernanke and Kuttner (2005) also show that the stock market reaction to monetary policy is driven primarily by the effect of the unexpected changes of monetary policy, particularly in the Fed funds target rate on the equity risk premium. They claim policy surprises directly and immediately influence the financial market by affecting the expectations of future interest rates, dividends, and expected returns.

To provide evidence on the economic causes of volatility persistence for stock market returns, Beltratti and Morana (2006) study the relationship between S&P 500 returns volatility and the volatility of some macroeconomic factors, Federal funds and M1 growth in particular, over the period 1970-2001. They tested for structural breaks and long memory, using the Markov switching model to obtain a candidate break process in identification of the sources of volatility persistence. The results indicate macroeconomic volatility contributes to both persistent and nonpersistent stock market volatility fluctuations and the causality linkages are stronger from macroeconomic volatility to stock market volatility than the other way round.

Using various regime switching GJR-GARCH models, Chang (2009) analyses the effect of macroeconomic variables, such as interest rate, dividend yield and default premium, on stock return dynamics which include conditional mean, conditional volatility and transition probability. He applies S&P 500 composite index over a sample period starting from January 1965 to July 2007. The data is then divided between in-sample and out-of-sample respectively from January 1965 to March 1999 and April 1999 to July 2007 to compare the predictive validity of stable and volatile states, as well as sample performance of regime switching models. There are several important findings reported in his study; first, macro factors can affect the stock return dynamics through two different channels – the stable and volatile regime. Second, the effects of these three economic variables on returns are not time-invariant, but closely related to stock market fluctuations and the strength of predictability is stronger in the volatile regime than the stable one. Third, interest rate and dividend yield seem to play an important role in predicting conditional variance. Finally, however, none of these macro factors play any role in predicting transition probabilities.

In an interesting study, Kurov (2010) argue that the effect of monetary policy news on stocks is driven, at least in part, by the influence of Fed policy on investor sentiment. His empirical methodology accounts for possible asymmetries in the effects of Fed policy in different market regimes (bull versus bear market) and find that monetary policy changes in bear markets have similar directional effects on the aggregate stock returns, investor sentiment and expectations of credit market conditions. He also documents that the unexpected changes in the timing of target rate decisions have a larger effect on stock returns in bear markets. Previously, Chen (2007) also finds that monetary policy has larger effect on Standard & Poor's 500 price index returns in bear markets. In addition, a contractionary monetary policy leads to a higher probability of switching to the bear-market regime.

Rangel (2011) proposes an alternative approach to analyse the effect of public regularly-scheduled announcements in the US related to fundamental variables, such as, CPI, PPI, employment and federal funds rate on the conditional jump intensity and volatility of equity returns. Based on a mixture of a GARCH model with a Poisson jump process, he suggests that the day of the announcement, has little impact on conditional volatility for most of the announcements, except unemployment. However, when macroeconomic surprises are considered, inflation shocks show persistent effects while monetary policy and employment shocks reveal only short lived effects. In addition, the jump intensity responds asymmetrically to macroeconomic shocks.

Lee and Son (2013) investigate whether both nonlinearity and structural breaks are present in monetary policy rules with stock prices over a period between 1979: QI - 2011: QI. Particularly, they examine two objectives related to monetary policy; first, the Fed's response to stock prices as well as inflation using the US forward-looking interest rate rule. Second, whether and how the federal funds target rate has moved in accord with the movement of stock prices. The test results strongly support nonlinearity in the Fed's response to inflation pressures. They report that the time-varying dynamics of the expected inflation coefficient support the asymmetric response of the Fed. The Fed usually responds with aggressive monetary policy under high inflationary pressure and a moderate response when inflation is low. The stock price coefficient stays positive since 1991; however, its time-varying pattern does not show active responses in the early periods of stock price hike. Stock market responses to federal funds rate (FFR) surprises are also examined in Kontonikas, MacDonald and Saggu (2013) between 1989 and 2012, focusing specially on the recent financial crisis. They find that outside the financial crisis (i.e. 2007-2008) stock prices increase as a response to expansionary monetary policy shocks: an unexpected 1% cut in the FFR was associated with an almost 4% increase in the S&P 500 index. They show an important structural shift occurred during the financial crisis, changing the stocks' response to FFR shocks and the nature of state dependence.

Besides the US market, the impact of monetary surprises on capital markets is also documented in other economies. For example, Wasserfallen (1989) analyse the effect of a large number of macroeconomic announcements on aggregate stock price indices in Great Britain, West Germany and Switzerland. He takes quarterly data over the years 1977 to 1985. The overall results indicate very small effect of macroeconomic news on the stock market; however, unexpected changes in interest rates and price levels apparently have a predominantly negative influence on equity returns.

Economic integration, such as entering into a single monetary union may have considerable impact on the stock markets of member states. In this line of thought, Moore and Wang (2007) investigate the changes in volatility dynamics of five (i.e. the Czech Republic, Hungary, Poland, Slovenia and Slovakia) central and eastern European countries due to their entry to the European Union (EU) in May, 2004. They explain that entry to the EU is potentially a strong factor that has clearly changed the landscape of both the real and monetary sectors among member states. To identify the changes they apply the Markov regime switching model of Hamilton (1989) on the weekly data set from 1994 to 2006. The results indicate that stock returns fall into a high volatility regime following the financial crisis in South-Asia and Russia, in particular, the Russian economy has a predominant role. In many a cases, the switch of the volatility regime corresponds to changes in exchange rate arrangements as well. Altogether, with their entry to the EU these five emerging markets have moved into the low volatility regime from a high volatility regime.

The stock return and volatility response to monetary policy surprises is rigorously analysed by Hussain (2011). In his paper, he examines the effect of monetary policy actions of major

European countries (France, Germany, Switzerland and the UK) and the US stock index return and volatilities. He applies extensive intraday data on 5-minute price quotes along with a comprehensive dataset on monetary policy decisions and macroeconomic news announcements. To test the effect of monetary policy surprises on the conditional means and conditional variance this study uses time series models for high frequency data proposed by Anderson et al. (2003). According to Hussain (2011), this methodology successfully separates the effect of monetary policy surprises on stock indices from those of other macroeconomic variables. Moreover, this also reduces the problems of endogeneity and omitted variables bias in econometric estimation. The results indicate a significant impact of monetary policy surprises on both stock index returns and volatilities. The result also reveals an interesting fact that the press conferences held by European Central Bank (ECB) that follow monetary policy decisions on the same day have a clear impact on European index return volatility.

The structural changes in emerging markets' equity returns and volatility due to market liberalization policies are examined in several studies, and a significant influence of macroeconomic variables is reported. For example, Nguyen and Bellalah (2009) use monthly data of seven emerging markets (i.e. Argentina, Brazil, Chile, Colombia, Mexico, Malaysia and Thailand) and the MSCI world equity index over the sample period of 1985-2003. For modelling the volatility they apply bivariate GARCH-M approach and test under Bai and Perron's (1998, 2003a, b) stability procedure to detect the structural breaks. Their results indicate that the official liberalization dates have less explanatory power and the structural break dates are only found robust to the conditional volatility for Argentina and Chile. However, they report a significant relationship between changes in macroeconomic variables and stock market volatility, such as changes in exchange rate are positively influencing and inflation and interest rate are negatively influencing these emerging markets' volatility.

In the 1990s, South Africa and other Sub-Saharan African countries embarked on a series of financial market liberalization processes following South East Asian and Latin American countries. In his study, Ndako (2012) explores the impact of this process on structural breaks in equity returns and volatility of the South African stock market. Applying EGARCH model and the Bai and Perron (1998, 2003a, b) algorithm, three significant breaks are detected in conditional variance: first, during the period when the market responded to the financial crisis in South East Asia; second, the period coinciding with the revision of the weights of the South African effective exchange rate; and third, during the period when the government announced the reduction in transfer duties. In a separate paper, Babikir et al. (2012) use structural breaks and

GARCH models in forecasting stock market volatility in South Africa. They apply daily returns of Johannesburg Stock Exchanges all share index from 1995 to 2010 and find evidence of two structural breaks in unconditional volatility in December 2008 and July 2009. They assert that the break in 2008 is due to the impact of the global financial crisis and the break in 2009 is due to the systematic reaction of the South African Reserve Bank to a financial conditional index related to the mild recovery of the US economy.

6.2.2 Fiscal Policy shocks on equity markets

Theory and empirical evidence have not yet delivered clear-cut predictions on the impact of fiscal policy shocks on stock market price along with interest rates (Ardagna, 2009). Ardagna (2009) investigates how the levels of government deficit and public debt matter for the reaction of financial market to fiscal shocks using a panel of OECD countries from 1960 to 2002. He asserts stock market prices surge around times of substantial fiscal tightening and plunge in period of very loose fiscal policy. Further, he reports substantial decrease in government debt associated with larger reduction in interest rates and increases in stock market prices. Similarly, Afonso and Sousa (2011) analyse the fiscal policy shocks, particularly government debt and deficit from the US, the UK, Germany and Italy on their stock markets. They take a quarterly sample from 1970: QIII – 2007: QIV and model the variables in a unified framework, using a parsimoniously restricted multivariate time-series model. They identify fiscal policy shocks using information about the elasticity of fiscal policy variables to economic activity. The main results are: government spending shocks have a negative effect on stock prices; government revenue shocks have a small and positive effect on stock prices. Overall, they find fiscal policy plays a minor role in the observed pattern for stock prices in the US and Germany. However, shocks have an important effect on asset markets of the UK and Italy, however, only government revenue shocks contribute to an increase of volatility in equity markets.

According to financial economics, government spending has an impact on firms' expected cash flow and also the uncertainty about the impact of government policies can affect the rate at which future cash flows are discounted (see Belo et al., 2013). Similarly, they argue, if government spending has a significant impact on asset prices, it can be identified by the differential performance of firms with heterogeneous government exposure, ceteris paribus (Belo et al., 2013). The empirical evidence suggest that during Democratic presidencies, US firms with high government exposure experience higher cash flows and stock returns than Republican presidencies. The pattern holds even after controlling for firm-level characteristics, including market capitalization, book-to-market, firm momentum, firm market beta, and corporate political contribution, as well as business cycle fluctuations.

In an earlier study, Alesina et al. (1999) evaluates the effect of fiscal policy on profits and, as a result, investment using a panel of 18 OECD countries. They report three major findings in their paper. First, increases (reductions) of public spending reduce (increase) profits and, therefore, investment and the magnitude of these effects are substantial. Second, increases (reductions) in taxes reduce (increase) profits and investment, however, the magnitude of these tax effects is smaller. Finally, there may be nothing special in the behaviour of investment at the time of expansionary fiscal adjustments, not even any structural breaks in the reaction of investment around large fiscal consolidations.

The influence of fiscal policy shocks on asset prices is further extensively investigated in Agnello and Sousa (2013). They apply a panel vector auto-regression model and take samples from nine European countries (i.e. Belgium, Finland, France, Germany, Italy, Netherland, Portugal, Spain and the UK) and the US market over a period from 1967: QII - 2007: QIV to see the interdependencies. They report several findings in their paper, such as, positive fiscal shocks lead to temporary fall in stock prices; persistent response of asset prices for countries with a lower degree of openness and a larger impact for small countries; asset prices become more sensitive to fiscal policy shocks following the process of financial deregulation and mortgage liberalization.

In a recent study, Croce et al. (2013) have examined the effect of tax shocks and fiscal stabilization policies on important aspects of economic activity, namely asset prices and capital accumulation. They argue that fiscal policies affect corporate decisions, and hence asset prices through corporate taxation. Their production based general equilibrium model identifies that tax distortions can have severely negative effects on the cost of equity and investment, therefore, can reduce the profitability of the firms and their prices in the market. The relationship between tax policy shocks and financial markets is also explored in Arin et al. (2009). They look at the impact of different fiscal shocks and find that labour taxes have a smaller influence on stock returns than indirect taxes.

Surprisingly, Belo and Yu (2013) make a theoretical link between the government investment in public sector capital (such as, highways) and stock market. They use a neoclassical q-theory model of investment, where, firms make private investment decision to maximize the firm's market value. Public sector capital is specified as an input in the firms' production technology, and thus it may affect the productivity of the private inputs. Their study finds a positive relationship between public sector capital spending and stock returns that is consistent with the government's ability to increase the marginal productivity of private capital through investments in public goods.

In their general equilibrium model on the effect of government policy, Pastor and Veronesi (2012) assert that the government sets the rules of the game and government changes these rules from time to time, eliciting price reaction in financial markets. Naturally, policy changes are not exogenous; they are determined by various economic and political forces. When making its policy decisions, the government is motivated by both economic and noneconomic objectives, which could ultimately influence the capital market of the country.

6.2.3 Non-macroeconomic shocks on stock markets

Empirical evidence strongly suggests that the stock market is not only influenced by monetary and fiscal policies but also by non-macroeconomic information, such as, political uncertainty, national elections, changes in rules and regulations related to capital markets etc. For example, Alexakis and Petrakis (1991) examine the behaviour of a small equity market (Greece) and report that the stock index is significantly affected by socio-political factors and alternative investment opportunities rather than companies' profit and economic activity. Diamonte et al. (1996) argue that political risk represents a greater determinant of stock return in emerging markets than in developed markets. They show that average return is 11 percent higher per quarter in emerging markets experiencing increased political risk compared to markets where political risk is decreasing. However, the difference is only 2.5 percent a quarter for developed markets. Moreover, the difference between the impact of political risk in emerging and developed markets is statistically significant. Later, Bilson et al. (2002) reported similar evidence from 17 emerging and 18 developed equity markets. Their findings reveal that political risk is important in explaining return variation in individual emerging markets, particularly in the Pacific Basin, but not in developed markets. In investigating the effect of stock market liberalization on emerging market volatility, Nguyen and Bellalah (2008) find that large changes in emerging market volatility are often associated with major economic and political events.

For six East Asian emerging markets, namely, Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand, Wang and Theobald (2008) examine the regime-switching behaviour of equity return volatility following the introduction of liberalization policies in the mid to late 1980s and early 1990s. Their model detects two or three volatility states for the stock markets analysed and result suggest that the switching between regimes is associated with international and country-specific events, such as – Asian financial crisis, political instability, failed military coup attempts, Gulf-war and oil price shocks. They further claim that the impact of financial liberalization largely depends on country-specific characteristics rather than stand alone influences.

There is an interesting study about political uncertainty and stock market volatility by Chau et al. (2014), where they have distinguished between conventional and Islamic stock market indices; results indicate that these two groups of investments react heterogeneously to the recent political turmoil in the Arab World (i.e. Arab Spring). Following GARCH based methodologies they document a significant increase in the volatility of Islamic indices during the period of political unrest whereas the uprisings have had little or no significant effect on the volatility in conventional markets.

Other than the political risk, there are extensive literatures available where scholars in political science and economics have tried to link the financial market with national elections and electoral systems, e.g. Gemmill (1992), Leblang and Mukherjee (2005), Bialkowski et al. (2008). In his study, Gemmill (1992) examined the behaviour of the stock and options market in London during the 1987 election. He finds an extremely close relationship between opinion polls and the FTSE 100 Index of share prices. On the contrary to single election, Leblang and Mukherjee (2005) provide evidence from a series of general elections in the US and the UK over 1930-2000. Their results reveal that stock markets in the United States and Britain have been historically quite sensitive to elections and partisan politics. They argue that the sensitivity of financial markets to partisan politics indicates that the incumbent party can adopt monetary and fiscal policies that affect both real economic outcome and price movements in the stock market. Moreover, Bialkowshi et al. (2008) investigated stock market volatility around national election for 27 OECD countries. They considered several characteristics related to election and documented that the country-specific component of index return variance can easily double during the week around an election, which shows that investors are surprised by the election outcomes. They further argue that stock markets can become very unsettled during the period of important political changes.

The government plays a central role in capital market through its regulation, oversight, and enforcement of security issuance. Bengtsson et al. (2014) investigate this topic by examining a series of enforcement actions taken by the Securities and Exchange Commission (SEC) of the US. Results indicate enforcement actions influence the PIPE (i.e. private investment in public equity) investors. Earlier, Schwert (1981b) notes that following the efficient-markets hypothesis, any unanticipated changes in regulation result in a current change in security price and the price change is an unbiased estimate of the value of the change in future cash flows to the firm. The stock market's reaction to a proposed regulation is a function of the change in the probability that the regulation will be adopted and the dollar value of the expected impact of the regulation on shareholder wealth (see Schwert, 1981b; Binder, 1985). Contrary to Schwert (1981b), Binder (1985) examines the usefulness of stock returns in measuring the effect of regulation, particularly, when the dates on which market expectations change are not known and standard sources (e.g. the Wall Street Journal) are used to choose the announcement dates. He uses twenty major changes in regulatory constraints since 1987 and, applying either monthly or daily data, reports little evidence to detect the effect of regulation. Therefore, he concludes that stock returns will not be very useful in studying the effects of regulation when the dates that market expectation change are not known exactly and the standard sources are used to select announcements.

Following the previous literatures, researchers have investigated the reaction of the stock market to the changes of various regulatory requirements. For example, Green et al. (2000) provide evidence from transaction cost regulation, however, Bushee and Leuz (2005) examine economic consequences of reporting requirements. In their study, Green et al. (2000) draw regulatory lessons for emerging stock markets from an empirical study of the relationship between transaction cost and share price volatility in the London Stock Exchange. They particularly focus on pecuniary costs of trading, namely transactions taxes (stamp duty) and brokerage changes, which derive directly from regulation. Their findings suggest that changes in transaction costs have a significant and dependable effect on share price volatility and regulatory regime therefore need to take account of the impact of regulation on such costs. The SEC regulation on disclosure requirements also has significant benefits; Bushee and Leuz (2005) assert this statement from the Over-The-Counter Bulletin Board (OTCBB). They find that firms previously filing with the SEC experience positive stock returns and permanent increase in liquidity. However, compliance with this disclosure requirement under the 1934 Security Exchange Act incurs substantial cost for smaller firms.

In a recent study, Larcker, Ormazabal and Taylor (2011) examine the market reaction to legislative and regulatory actions pertaining to corporate governance. In particular, their paper investigates regulations proposed by the SEC, the state of Delaware, and various US senators and representatives that would limit executive pay, limit a firm's control of the proxy process (i.e. proxy access), and ban specific corporate governance provision (e.g. CEO-Chairman duality). The findings of this study are consistent with the view of governance which predicts that broad government actions that reduce executive pay, increasing proxy access, and ban such governance provisions are value destroying. Other findings include, the abnormal returns to recent events relating to corporate governance regulations are, on average, decreasing in CEO pay, decreasing in the number of large blockholders, decreasing in the ease by which small institutional investors can access the proxy process, and decreasing in the presence of a staggered board. Collectively, the results support the notion that the proposed governance regulations harm shareholders of affected firms.

Other than all the regulatory changes mentioned above, Bekaert (1995) places emphasis on a few more factors, such as, insider trading, degree of information asymmetry, automated trading, electronic reporting, and settlement procedures. These barriers are very important and can directly influence the growth of any capital market.

6.2.4 Firm level evidences of economic shocks

It is documented in earlier literature that firms are not homogeneously affected by news. For example, Wasserfallen (1989) explains that the effect of macroeconomic events may also depend on characteristics specific to a firm or an industry, such as, the amount of international trade, inflation, changes in money supply etc. Among others, Pearce and Roley (1985) examine the response of daily stock price to various macroeconomic announcements and conclude that mainly unexpected changes in monetary variables have a statistically significance influence. However, since the seminal study of Fama and French (1993) academic research started to explore the links between stock characteristics and macroeconomic fundamentals (see Aretz, Bartram and Pope, 2010).

Gertler and Gilchrist (1994) suggest that monetary policy should have disproportionate impact on borrowers with limited access to capital markets, everything else equal. They argue that small firms are more strongly affected by monetary policy shocks since they are likely to be face more constrained in financial markets for borrowing. In this vein, Ehrmann and Fratzscher (2004), Perz-Quiros and Timmermann (2000) and Thorbecke (1997) show that monetary policy creates larger effect on the returns of small firms. For example, using several measures of monetary policy and a variety of empirical techniques, results from size portfolios of Thorbecke (1997) indicate that monetary shocks have larger effects on small firms than larger firms. This evidence supports the hypothesis that monetary policy matters partly because it affects firm's access to credit.

Using a Markov-switching model with time-varying transitional probability, Perez-Quiros and Timmermann (2000) investigated the state-dependent effect of monetary policy on firm's size. They find small firms with little collateral should be more strongly affected by tighter credit market conditions in a recession state than large, better collateralized ones. Nearly a similar finding is reported in Basistha and Kurov (2008). They have shown from firm-level data that firms those are facing financial constraints are more affected by monetary shocks in tight credit conditions that the relatively unconstrained firms.

From the US equity markets, Ehrmann and Fratzscher (2004) show that there are strong industry-specific effects of monetary policy and firms with small size are affected significantly more by those policies. They explain, the effect of monetary policy on stock market returns is likely to differ across industries for various reasons; firms in cyclical industries, capital-intensive industries, and industries that are relatively open to trade are affected more strongly. Furthermore, interest rate, exchange rate, and cost of capital affect the expected future earnings in heterogeneous fashion across industries. In a separate study on the US market, Guo (2004) investigates how stock prices reacted to changes in the federal funds rate target in 1974-1979 and 1988-2000, respectively. He reports that the impact of monetary shocks is found to be significantly larger for small stocks than big stocks in the late 1970s, when business conditions were typically bad. The 'size effect', however, is not present in the 1990s, when business conditions were typically good. The pattern remains same for portfolios formed with book-to-market value ratio.

To provide evidence on the monetary transmission mechanism, Dedola and Lippi's (2005) study uses the effects of monetary policy shocks on the industrial activity of 21 manufacturing sectors in five OECD countries (France, Germany, Italy, the UK and the US). Their multivariate structural vector auto regression analysis reveals that the impact of monetary policy is stronger in industries that produce durable goods, have greater financing requirements, lower borrowing capacity and small size. Similarly, Peersman and Smets (2005) estimate the effect of common monetary policy shocks on 11 manufacturing industries in seven euro countries (Austria, Belgium, France, Germany, the Netherland, Italy and Spain). They also document the cross-industry heterogeneity of the output effect of an area-wide monetary policy innovation. In addition, on average the negative output effects of an interest rate tightening are significantly greater in recessions than in booms.

In an interesting and comprehensive paper, Cenesizoglu (2010) investigates the reaction of daily returns on the size and book-to-market value sorted portfolio to 21 macroeconomic variables.

He finds portfolios with different characteristics react differently to different news and even to similar news. For example, he reports, both at daily and monthly frequencies, large and growth firms react differently to employment news compared to small and value firms in expansion but not in recession. Using industry-level data for 19 emerging markets across three regions Donadelli and Persha (2014) explore the relative importance of country-level governance and macroeconomic policy uncertainty in explaining both national and regional industry-by-industry equity risk premium behaviour. Their static and dynamic approaches identify that some industries, such as, healthcare and basic materials in Asia and utilities and consumer service industries in East Europe and Latin America, perform consistently better than others.

Explaining the influence of fiscal policy on industries, Aghion et al. (2014) show that industries with a relatively heavier reliance on external finance or lower asset tangibility tend to grow faster, in terms of both value added and of labour productivity growth, in countries with more counter cyclical fiscal policies. They come to this conclusion from a panel data sample of manufacturing industries across 15 OECD countries over the period of 1980-2005. Similarly, Munteanu and Gondor (2012) investigate the impact of fiscal policy on the performance of the Romanian banking sector. They find that the bad financial performance of the banking system is associated with the period of contractionary fiscal policy, which they recommend as the pro-cyclical fiscal policy stance.

Following above literature review, it is documented that contrary to the relationship between macroeconomic variables with capital markets, evidence related to interdependencies with domestic non-macroeconomic factors is limited, particularly empirical studies on emerging markets are rare. Moreover, gaps also observed on the impact of those non-macro fundamentals on firms' characteristics, i.e. size, dividend yield and industry. Therefore, this study takes novel initiatives to contribute to these gaps and growing literatures. Here, we apply time-varying nonlinear model to show the influence of both macro and non-macro information on an emerging equity market.

6.3 Data and Research Methodology

6.3.1 Methodology

6.3.1.1 Pre-whitening and structural breaks

The main objective of this study is to investigate the timing of various macroeconomic and non-macro information and their influences on stock markets. Particularly, we want to see whether structural breaks in equity returns and their variances are explained by any such macro and non-macroeconomic news. Our motivation comes from the argument of Schwert (1989), who states that mean and variance are probably affected by the same macroeconomic factors and in this study we extent this argument by including non-macro factors (i.e. national election, political risk, changes in government policy, and changes in regulations) as mentioned in Bailkowski et al. (2008), Chou et al. (2014), Pastor and Veronesi (2012), and Bengtsson et al. (2014).

In this study we follow the procedure of detecting the structural breaks endogenously rather than specifying a prior date for the breaks and link them with only domestic macro and non-macro information (see Edwards and Susmel, 2003; Edwards et al., 2003; Aggarwal et al., 1999). For this, we apply pre-whitening proses of Gulen and Mayhew (2000) and Chau et al. (2014), in which they generate return innovations by estimating an autoregressive model. We do it in an effort to remove the effect of worldwide price movements and any predictability associated with lagged returns or day-of-the-week effects.

$$R_t = \alpha_0 + \sum_{i=1}^{a} \theta_i R_{t-i} + b_0 R_{L,t-1} + b_1 R_{R,t-1} + b_2 R_{W,t-1} + b_3 R_{St} + u_t \qquad \text{(i)}$$

Where, R_t is the daily return of the DSE all-share price index, R_L, R_R, and R_W are the daily return of local, regional and world equity indices over the sample period. The autoregressive terms R_{t-i}, are included in the return equation to account for the problem of autocorrelation potentially induced by nonsynchronous trading, which is particularly severe in emerging markets given their low level of liquidity (see Lee and Rui, 2001). R_{St} is day-of-the-week dummy for Sunday, as Chowdhury, Uddin and Anderson (2013) have identified a Sunday effect for the DSE all-share price index. We use the residual $\{u_t\}$ as our new filtered return series for this analysis and renamed it as $\acute{R}_t$.

In order to examine the impact of information surprises on stock returns and volatility, the empirical model assumes that the stock returns follows a time-varying GJR-GARCH process. Chang (2009) report that time-varying volatility of stock returns is an important and indispensable element when modelling the dynamics of financial asset returns. Further, this process is also able to capture the asymmetry in the reaction of daily volatility to macroeconomic news as mentioned in Cenesizoglu (2011). The process is:

$$\acute{R}_t = \alpha_0 + \sum_{i=1}^{a} \theta_i \acute{R}_{t-i} + \varepsilon_t, \qquad \text{(ii)}$$

$$\varepsilon^2 | I_{t-1} \sim GED(0, h_t) \qquad \text{(iii)}$$

$$h_t = \omega_0 + \sum_{i=1}^{p} \beta_i \, h_{t-i} + \sum_{j=1}^{q} \alpha_j \, \varepsilon_{t-j}^2 + \sum_{j=1}^{q} \gamma_j \, Z_{t-j}^- \varepsilon_{t-j}^2 \qquad \text{(iv)}$$

with $Z_t^- = 1$ if $\varepsilon_t < 0$ and $Z_t^- = 0$ otherwise. Further, $\acute{R}_t$ represents the log return of each price index, I_{t-1} is the set of information available at the beginning of time t, and the conditional density function is modelled as a generalized error distribution (GED). For a leverage effect, $\gamma_j > 0$, and the condition for non-negativity is $\omega > 0,\ \alpha_j > 0$, and $\beta_i \geq 0$, and $\alpha_j + \gamma_j \geq 0$. The autoregressive terms are included in the return equation to account for the problem of autocorrelation potentially induced by nonsynchronous trading, which is particularly severe in emerging markets given their low level of liquidity (see Lee and Rui, 2001).

The issue of multiple unknown structural changes or breaks in a single equation has generated a great deal of academic interest in financial time series (Banerjee and Urga, 2005). Bai (1997) and Bai and Perron (1998, 2003a, b) provide theoretical and computational frameworks by allowing multiple unknown breakpoints in a linear model estimated by least squares. In this study, we use Bai and Perron's (henceforth, BP) methodology for detecting the structural breaks in returns and volatility around the timing of macroeconomic and non-macro information.

According to the BP procedure we consider the following multiple linear regression model with *T* periods and *m* potential breaks (producing m+1 regimes):

$$y_t = x_t'\emptyset + z_t'\delta_j + \varepsilon_t, \qquad t = T_{j-1} + 1, \ldots, T_j \qquad \text{(v)}$$

Here, y_t is the observed independent variable (i.e. mean and conditional variance in this study), $x_t\colon (p \times 1)$ and $z_t\colon (q \times 1)$ are vector of covariance, and $\emptyset$ and $\delta\colon (j = 1, \ldots, m+1)$ are the corresponding vectors of coefficients and finally, ε_t is the disturbance at time *t*. While it is slightly more convenient to define the break dates to be the last date of a regime, however, we follow a different convention in defining the break dates to be the first date of the subsequent regime. We tie down the endpoints by setting $T_0 = 1$ and $T_{m+1} = T + 1$.

The break points $(T_1, \ldots, T_m)$ are treated as unknown and the objective is to estimate these unknown regression coefficients and break points using a sample of *T* observations. There are two structural changes presented in this model: the pure and the partial structural change model. When $\emptyset$ is not subject to shifts and is effectively estimated using the entire sample, the model is a partial change model; however, if $p = 0$, the model is called a pure structural change model where all the coefficients are subject to change (see Banerjee and Urga, 2005 for a detailed discussion). For each *m*-partition of the sample $(T_1, \ldots, T_m)$, denoted $\{T_j\}$, the associated least squares estimates of the parameters $\emptyset$ and δ are obtained by minimizing the sum of squared residuals (SSR) as $S_T(T_1, \ldots, T_m)$, the estimated break point $(\hat{T}_1, \ldots, \hat{T}_m)$ are given as the outcome of the algorithm:

$$(\hat{T}_1, \ldots, \hat{T}_m) = argmin_{T_1, \ldots, T_m} S_T(T_1, \ldots, T_m), \qquad \text{(vi)}$$

Where, the minimization is taken over all partitions $(\hat{T}_1, \ldots, \hat{T}_m)$ such that $T_i - T_{i-1} \geqq q$, thus the break-point estimators are global minimizers of the objective function.

BP provides several interesting estimating and testing issues to detect the number of multiple structural breaks: the *sup F* type test, the double maximum test and the test of ℓ versus $\ell + 1$ breaks. Their first test, *sup F* type test is a test of no structural break against the alternative of a known and fixed number of $m = k$ structural breaks. The partition is defined as $T_i = [T\lambda_i]$, thereby determining the fractions in the sample at which the breaks occur as $(\hat{\lambda}_1, \ldots, \hat{\lambda}_k)$. Following the generalization of Andrews (1993) and other for the case $k = 1$, the test is:

$$supF_T(k; q) = F_T(\hat{\lambda}_1, \ldots, \hat{\lambda}_k; q) \qquad \text{(vii)}$$

Where, $(\hat{\lambda}_1, \ldots, \hat{\lambda}_k)$ minimize the global SSR under the specified trimming. The test allows for the breaks to be asymptotically distinct and the limiting distribution of the test depends on the nature of the regressors and the presence or absence of serial correlation and heterogeneity in the residuals.

The second type of test is double maximum and this generalization relates to relaxing the assumption that the number of breaks is known. The test is carried out under the null hypothesis of UD_{max} and WD_{max} of no structural breaks against an unknown number of breaks given some upper bound *M*. The UD_{max} gives an equal weight while the WD_{max} test gives weight to individuals test in such a way that the marginal *p* values are equal across the value of *M* bound. The test algorithms are (see Bai and Perron, 1998 and 2003b for detailed discussions):

$$UD_{max}F_T(M, q) = max_{1 \le m \le M} F_T(\hat{\lambda}_1, \ldots, \hat{\lambda}_k; q) \qquad \text{(viii)}$$

Where, $\hat{\lambda}_1 = \frac{\hat{T}_j}{T} (j = 1, \ldots, m)$ are the estimates of the break points obtained using the global minimization of the SSR assuming segments of minimal length $\hbar = \epsilon T$ (ϵ is the trimming parameter and *T* is number of observations).

$$WD_{max}F_T(M, q) = \max_{1 \le m \le M} \frac{c(q, \varphi, 1)}{c(q, \varphi, 1)} F_T(\hat{\lambda}_1, \ldots, \hat{\lambda}_k; q) \qquad \text{(ix)}$$

BP initially provides the critical values for $M = 5$ and $\epsilon = 0.05$ for both UD_{max} and WD_{max} test and later these have been extended in Bai and Perron (2003b) to cover a wider range of values of ϵ.

Finally, BP proposed their third test for ℓ versus $\ell + 1$ breaks, labelled $\sup F_T(\ell + 1|\ell)$. The test amounts to the application of $(\ell + 1)$ tests of the null hypothesis of no structural changes against the alternative hypothesis of a single change. It is applied to each segment containing the observations $\hat{T}_{i-1} + 1$ to $\hat{T}_i (i = 1, \ldots, \ell + 1)$ using the convention that $\hat{T}_0 = 0$ and $\hat{T}_{\ell+1} = T$.

Bai and Perron (2003b) suggest several procedure of information criteria to select the number of breaks in a model, such as, the Bayesian Information Criterion (BIC) of Yao (1988), the modified Schwarz Criterion (LWZ) of Liu et al. (1997) and AIC. The BIC and LWZ perform reasonably well in the absence of serial correlation in the errors but choose a higher value than the true one in the presence of serial correlation. On the other hand, with no serial correlation and with large coefficients on the lagged dependent variable the LWZ do a well under the null of no break but underestimates the number of breaks when some are present. Therefore, BP (Bai and Perron, 1998) propose an alternative criterion, which is directly based on a sequential application of the $\sup F_T(\ell + 1|\ell)$ test, where *m* breaks are estimated from the data in a sequential manner.

6.3.1.2 Regime Switching GARCH model

We use Markov Regime Switching GARCH (MS-GARCH) model of Haas et al., (2004) to check the robustness of structural breaks and interdependence between economic information and stock markets. The advantage of MRS model is that it allows the mean and variance of stock returns to switch across different states, taking into account any change in the mean and variance over the sample period (Moore and Wang, 2007). It is documented in previous literatures that switching between regimes is connected with different country specific macroeconomic events, changes in government policy, financial crises etc. (see Chang, 2009; Moore and Wang, 2007, Sims and Zha, 2006). For example, Chang (2009) finds evidence that macroeconomic variables are helpful in determining the timing of regime switching. Further, it is stated in Hamilton (1988) that market participants perceive the stock market in a discrete time, and the perception will then be translated into the volatility of returns.

A generalization to Markov-switching GARCH models is developed by Gray (1996) and later modified by Klaassen (2002), which allows all its parameters to change between regimes and overcome the problem of path dependence of Cai (1994) and Hamilton and Susmel (1994).

However, its analytical intractability is a serious drawback (see Haas et al., 2004). Because, as they explained, in the context of MS-GARCH models, analytically tractable expression for the covariance structure of the squared process can aid in understanding the interaction of the different sources of volatility persistence, such as, persistence due to shocks and persistence due to regime. Therefore, their (i.e. Haas et al., 2004) new model has the advantage of being analytically tractable and allows to drive stationarity conditions and further dynamic properties of the process. Surprisingly, the fourth-moment structure of this model is able to work out, that does not seem possible for the other MS-GARCH model (see Andersen et al., 2009).

Haas et al., (2004) discuss, in their new specification, the regime variances only depend on past shocks and their own lagged values. Therefore, this gives rise to Markov-switching GARCH model that is straightforwardly estimated by maximum likelihood, analytically tractable, and offers an appealing disaggregation of the conditional variance process. Another interesting aspect of this proposed model is that it is governed by the high-volatility regime which means high-volatility regime variance in $t-1$ determines the volatility dynamics irrespective of the shift. Haas et al., (2004) argue this result in an instantaneous shift in variance, which is in agreement with the notion of a regime shift as put forward by Hamilton (1990) and also Dueker (1997) that volatility often increases substantially in a short amount of time at the onset of a turbulent period.

To model the regime-switching behaviour in the GARCH (1,1) process, we use the following empirical model of Hass et al., (2004):

$$\acute{R}_t = \mu(S_t) + \epsilon_t \tag{x}$$

$$\epsilon_t = h_t(S_t)^{1/2} u_t, \quad u_t \sim N[0,1] \tag{xi}$$

$$h_t(S_t) = \omega_0(S_t) + \beta_1(S_t) h_{t-1}(S_t) + \alpha_1(S_t)\epsilon_{t-1}^2 \quad S_t = 0, \dots, S-1. \tag{xii}$$

Where, $\acute{R}_t$ is the filtered return series and $\epsilon_t$is the error term. This model assumes that the current value of the conditional variance in each regime depends on the lagged value of the same conditional variance in the previous regime, which means they assume the parallel existence of several conditional variances. Anderson et al. (2009) claim this is not the case in other MS-GARCH models. The latent Markov state variable S_t, determines which process is selected for each time. The prime difference of this model with standard MS model is that it switches both parameters and processes while the latter model only switches on parameters. The model seems intuitively straightforward, nevertheless; each GARCH regime is recursively updated, starting from $\varepsilon_0^2 = h_0(0) = \cdots = h_0(S-1) = \frac{1}{T}\sum_{t=1}^{T} \epsilon_t^2$, and requiring only information from the previous period's volatility and residual. The β and α are the persistence parameters in each regime. The stationary distribution of the Markov chain will be denoted by $\pi_\infty = [\pi_\infty^1, \pi_\infty^2, \dots, \pi_\infty^{s-1}]$ (see Hass et al., 2004 for further discussions).

6.3.1.3 Cross-sectional Evidence

Finally, we investigate the reaction of portfolios based on firm characteristics to macroeconomic shocks or news following the argument of the seminal study of Fama and French (1993); they show that factors based on stock characteristics can also capture variations in equity prices. In particular, we want to analyse how the sensitivity of risk and expected returns with respect to macro and non-macro news depends on firm size, dividend, ownership and sectors. Because, little is known about the reaction of daily returns on portfolios with different characteristics to unexpected changes in macroeconomic conditions (see Cenesizoglu, 2011). In their paper, Ehrmann and Fratzscher (2004) specifically mention that more research is needed to understand why individual stocks react so differently to monetary policy shocks and what the driving force is behind this reaction.

In order to discuss the influence of macro and non-macro information on daily returns and variance of firms based on size, dividend and sectors, the empirical model assumes returns ($\acute{R}_t$) follow the following process, similar to equation (ii), (iii) and (iv)

$$\acute{R}_t = \alpha_0 + \sum_{i=1}^{a} \theta_i \acute{R}_{t-i} + \sum_{i=1}^{a} \vartheta_i d_i + \varepsilon_t, \qquad \text{(xiii)}$$

$$\varepsilon^2 | I_{t-1} \sim GED(0, h_t) \qquad \text{(xiv)}$$

$$h_t = \omega + \sum_{i=1}^{b} \xi_i \varsigma_i + \sum_{i=1}^{p} \beta_i h_{t-i} + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-j}^2 + \sum_{j=1}^{q} \gamma_j Z_{t-j}^{-} \varepsilon_{t-j}^2 \qquad \text{(xv)}$$

Where, $\acute{R}_t$ is the filtered return of each of the value-weighted indices for firm characteristics; d_i and ς_i are the dummy variables for macro and non-macro variables in mean and volatility equations respectively. The significance of ϑ_i and ξ_i implies the reaction of each portfolio to each of the macroeconomic and non-macro information around the structural breaks or regimes switching.

6.3.2 Data

For detecting the structural breaks and regime shifts we use daily index of DSE (Dhaka Stock Exchange) all-share price from Datastream over a period from 1 January, 1990 till 31 December,

2012. The daily market capitalization, dividend yield and market price for each of the 265 firms are also collected from Datastream. However, firm level data is only available in Datastream from 1 January 2000 till 31 December 2012; therefore we take this dataset which includes more than one million observations. We divide all the 265 firms into four sectors, namely, manufacturing, service, financial and miscellaneous and the value weighted index for each of the sector is calculated based on the algorithm given in the Dhaka Stock Exchange. Finally, we also consider international benchmark indices to proxy for the world, regional and local influences, those indices are – MSCI (i.e. Morgan Stanley Capital International) World, MSCI Emerging Market, MSCI Emerging Market Asia and Industry specific (i.e. Financial Sector, Manufacturing and Service) indices from MSCI World and MSCI Emerging Market. Macroeconomic and non-macroeconomic events, which are considered over the sample period for this study, are listed in Appendix C.

6.4 Empirical results

This section discusses the empirical results based on the methodologies described in the previous section. We present the pre-whitening and summary statistics in section 6.4.1. The structural breaks in stock returns and volatility and timing of domestic macro and non-macroeconomic events are explained in section 6.4.2; where section 6.4.2.1 shows the statistical results and section 6.4.2.2 discusses those macro and non-macro events. We check the robustness of structural breaks and timing of news using Markov Switching (MS) GARCH model in section 6.4.3. Finally, section 6.4.4 describes the impact of macro and non-macroeconomic events on portfolios based on several firm characteristics.

6.4.1 Pre-whitening and summary statistics

The results of preliminary regressions are presented in Table 6.1 to calculate the new return series using equation (i). The table shows estimated parameters for overall market (i.e. DSE all-share price index) and each of the portfolios based on various market characteristics, such as, firm size, dividend yield and sectors. For firm size portfolios, we divide all listed companies (which are about 265 firms over the sample periods) in DSE into ten different groups based on their daily market capitalization from 2000 to 2012. Therefore, each of the group (from First to Tenth) represents ten percent firms. We fit this autoregression model to return series to remove the effect of worldwide price movement on price and also to correct the presence of possible spurious autocorrelation induced by nonsynchronous trading. Empirically this is a serious problem particularly in emerging markets given their low level of liquidity (see Lee and Rui, 2001). The Sunday dummy (b_3) is applied in line with the argument of Chowdhury et al., (2013) and Chowdhury and Sharmin (2012) as they have identified day-of-the-week effect in DSE. The coefficient of Sunday effect is found statistically significant for overall market; however, for portfolios it is significant at largest sized firms, high yield firms, and service and manufacturing industry. The autoregressive coefficients (i.e. from θ_1 to θ_5), on the other hand, are statistically significant for all return series and their order has been selected based on Bayesian Information Criterion (BIC).

Surprisingly, the impact of lagged local, regional and world market index (i.e. b_0 to b_2) is not found significant for most of the portfolios. The world index is significant at five and ten percent level for the market and five other portfolios, i.e. top 20% firms, high yield firms, financial, and service sectors. However, local and regional factors are reported significant only for DSE itself, top 10% firms, and financial industry. This result, therefore, support the argument of French and Poterba (1991), Baxter and Jermann (1997), and Bialkowski et al. (2008) that where investors have little opportunity for international diversification, market exhibit strong home bias. Moreover, it validates our conjecture based on Wasserfallen (1989) and Wang and Theobald (2008) that the macroeconomic effects on the stock market are generally of a purely domestic nature. Finally, the F-statistics and Wald test given in the last two columns explain overall fitness of the regression model. Results indicate models are fit and coefficients are significantly different from zero.

Table 6.2 reports the summary statistics of unpredictable return series $\{\acute{R}_t\}$ that we have computed using equation (i). This new return series are used to examine the behaviour of stock market with respect to timing of macro and non-macroeconomic informations. From excessive skewness and kurtosis (column six and seven) it is clearly evident that return series are non-normal. These higher skewness and kurtosis have been also identified as common characteristics of emerging markets' return by Bekaert et al. (1998). Interestingly, the market and each portfolio display almost similar standard deviation estimates (in column five and it is a measure of unconditional volatility). The Ljung-Box (LB) statistics are reported in column eight and they are, however, not statistically significant, indicate that there is no serial correlation in our filtered return series. To identify the presence of ARCH effect, we use ARCH-LM test with 5 degree of freedom and results show (in column nine) that there are still temporal dependencies in the higher moment of return distribution. Finally, Engle and Ng (1993) test for the potential asymmetry in volatility is applied to determine whether an asymmetric model is required for a given series, or whether the symmetric GARCH model can be deemed adequate. The joint test results suggest that there are significant asymmetries in volatility responses. Therefore, the statistical nature of return distribution allows us to use the asymmetric autoregressive conditional heteroskedasticity model for detecting the influence of macro or non-macro information in the variance process. However, for the third category of firm size and miscellaneous sectors sign and size bias test of Engle and Ng (1993) are not found significant, which implies symmetric GARCH model is adequate to capture the ARCH effect and volatility clustering.

Table 6.1: Results from the preliminary regression.

	α_0	θ_1	θ_2	θ_3	θ_4	θ_5	b_0	b_1	b_2	b_3	F statistics	Wald test
Panel A: Overall market												
DSE	0.0001	0.0846***	-0.0702***	0.0322**	0.0211*	0.0248*	-0.0242	0.0307*	0.0347**	0.0007*	9.11***	9.94***
	(0.0129)	(6.5388)	(-5.4179)	(2.4784)	(1.6553)	(1.9183)	(-0.8127)	(1.7556)	(1.9606)	(1.7509)	(0.00)	(0.00)
Panel B: Firm Size												
First	0.0006**	0.0400**	0.0396**	0.0683***	0.0055	0.0029	0.0320*	-0.0438	0.0727**	0.0009*	4.2564***	4.40***
	(1.9954)	(2.3782)	(2.2915)	(3.9601)	(0.3190)	(0.1672)	(1.7161)	(-0.7021)	(1.9682)	(1.6588)	(0.01)	(0.00)
Second	0.0006**	0.0222	0.0094	0.2085***	0.0597***	-0.0282*	0.0255	-0.0408	0.0149*	-0.0004	19.62***	18.01***
	(1.9654)	(1.2884)	(0.5471)	(12.3827)	(3.4733)	(-1.6529)	(0.6295)	(-0.7235)	(1.6851)	(-0.1199)	(0.00)	(0.000)
Third	0.0004	-0.0025	0.0043	0.1006***	-0.0098	-0.0043	-0.0265	0.0634	-0.0352	-0.0001	4.0057***	3.71***
	(1.0545)	(-0.1592)	(0.2485)	(5.8669)	(-0.5663)	(-0.2500)	(-0.5034)	(0.8646)	(-0.7869)	(-0.1639)	(0.00)	(0.000)
Fourth	0.0004	0.2087***	0.0783***	0.1663***	-0.0653***	-0.0237	-0.0212	0.0104	0.0039	0.0009	38.73***	35.24***
	(0.7356)	(12.1146)	(4.4591)	(9.5724)	(-3.7181)	(-1.3751)	(-0.3739)	(0.1319)	(0.0809)	(1.1165)	(0.00)	(0.00)
Fifth	0.0003	0.0989***	0.0042	0.2923***	-0.0165	-0.0146	0.0288	-0.0239	-0.0274	0.0001	39.54***	6.64***
	(1.3488)	(5.7827)	(0.2431)	(17.6432)	(-0.9528)	(-0.0849)	(0.7590)	(-0.4517)	(-0.8502)	(0.2237)	(0.00)	(0.00)
Sixth	0.0005	0.0767***	-0.0088	0.3775***	0.0022	-0.0257	0.0451	-0.0492	-0.0278	-0.0005	66.56***	5.43***
	(1.3706)	(4.4554)	(-0.5095)	(23.5567)	(0.1270)	(-1.4913)	(1.1412)	(-0.8933)	(-0.8291)	(-0.9060)	(0.00)	(0.00)
Seventh	0.0003	0.0065	0.0255	0.1892***	0.0467***	-0.0099	0.0218	-0.0607	0.0333	0.0000	15.61***	14.22***
	(1.3647)	(0.3752)	(1.4850)	(11.1867)	(2.7118)	(-0.5740)	(0.5699)	(-1.1346)	(1.0204)	(-0.1219)	(0.00)	(0.07)
Eighth	0.0002	0.2235***	0.0563***	0.0552***	0.0193	0.0491***	0.0043	-0.0103	-0.0093	0.0000	30.64***	35.78***
	(0.6582)	(12.9733)	(3.1876)	(3.1308)	(1.0923)	(2.8535)	(0.1282)	(-0.2198)	(-0.3253)	(0.0422)	(0.00)	(0.00)
Ninth	0.0003	0.1794***	-0.1403***	0.2314***	-0.0127	0.0600***	0.0179	-0.0391	0.0118	-0.0004	33.43***	15.15***
	(1.1340)	(10.4303)	(-8.0394)	(13.4776)	(-0.7261)	(3.4929)	(0.5212)	(-0.8199)	(0.4059)	(-0.8446)	(0.00)	(0.00)
Tenth	0.0000	0.0912***	0.0422**	0.0703***	0.0259	-0.0006	-0.0192	0.0324	-0.0176	0.0000	7.38***	6.36***
	(0.4272)	(5.2962)	(2.4424)	(4.0759)	(1.4969)	(-0.0355)	(-1.1124)	(1.3467)	(-1.1992)	(-0.3248)	(0.00)	(0.00)
Panel C: Dividend Yield												

High	0.0004	0.1103***	0.0386**	0.3376***	-0.0003	-0.0443***	0.0217	-0.0377	0.0325*	0.0009**	59.54***	14.25***
	(1.4103)	(6.4076)	(2.2280)	(20.6658)	(-0.0179)	(2.5686)	(0.7606)	(-0.9483)	(1.8453)	(2.1269)	(0.00)	(0.00)
Low	0.0004*	0.1488***	0.0441**	0.1963***	-0.0323*	-0.0235	-0.0093	0.0137	-0.0058	-0.0000	27.85***	17.14***
	(1.8187)	(8.6420)	(2.5321)	(11.4699)	(-1.8547)	(-1.3650)	(-0.3636)	(0.3845)	(-0.2685)	(-0.1600)	(0.00)	(0.00)
Panel D: Industry [a]												
Financial	0.0011	0.0826***	0.0121	0.1366***	0.0359**	-0.0136		0.0197*	0.0093**	0.0000	13.31***	11.53***
	(3.4744)	(4.7938)	(0.6977)	(7.9743)	(2.0792)	(-0.7870)		(1.9036)	(2.1420)	(0.0647)	(0.00)	(0.00)
Service	0.0004	0.1361***	0.1100***	0.1219***	-0.0325*	-0.0371**		-0.0334	0.0488*	0.0014*	25.47***	25.33***
	(0.7786)	(7.9003)	(6.3381)	(7.0305)	(-1.8706)	(-2.1561)		(-0.9945)	(1.7233)	(1.6991)	(0.00)	(0.00)
Manufacturing	0.0003	0.1534***	0.0104	0.3472***	-0.0072	-0.0389**		0.0056	-0.0269	0.0004**	75.45***	21.43***
	(1.1645)	(8.9163)	(0.5978)	(21.2109)	(-0.4109)	(-2.2571)		(0.2577)	(0.0188)	(2.1711)	(0.00)	(0.00)
Miscellaneous	0.0003	0.1199***	0.0251	0.0911***	0.0168	0.0147		-0.0101	0.0066	0.0003	12.26***	13.59***
	(1.6015)	(6.9686)	(1.4485)	(5.2740)	(0.9682)	(0.8530)		(-0.8573)	(0.4771)	(1.0516)	(0.00)	(0.00)

Note: the table reports the results from the pre-whitening regression of each categorical returns using following model:

$$R_t = \alpha_0 + \sum_{i=1}^{a} \theta_i R_{t-i} + b_0 R_{L,t-1} + b_1 R_{R,t-1} + b_2 R_{W,t-1} + b_3 R_{St} + \acute{R}_t$$

where, R_t is the daily return for each of the category, R_L, R_R, and R_W are the daily return on local, regional and world market index, R_S is the Sunday dummy to consider day-of-the-week effects. The model is estimated for overall market (Panel A) and firms based on size (Panel B) and dividend yield (Panel C). However, for each of the industry (Panel D), we modify the model: $R_t = \alpha_0 + \sum_{i=1}^{a} \theta_i R_{t-i} + b_1 R_{LR,t-1} + b_2 R_{W,t-1} + b_3 R_{St} + \acute{R}_t$ and include industry specific equally weighted MSCI emerging market (R_{LR}) and MSCI world (R_W) index as a proxy of local, regional and world factors. The only exception is miscellaneous group, where we have applied overall MSCI emerging market and world index. The Wald version of joint test follows an F-distribution with $(m, T-k)$ degree of freedom. The lag order is selected based on Schwarz Information Criterion (SC). Each firm in the size group represent 10% of listed companies in DSE. The t-statistics are given in parentheses.

[a] Financial sector (Banks, FIs and Insurance); Manufacturing (Foods, Pharmaceuticals, Textile, Engineering, Ceramics, Tannery, Paper & Printing, Jute and Cement); Service (Fuel & Power, Service & Real Estate, IT, Telecommunication and Travel & Leisure); Miscellaneous (all other firms)

***, ** and * are statistically significant at 1%, 5% and 10% level.

Table 6.2: Summary statistics of filtered returns

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	LB(6)	ARCH(6)	Joint
Panel A: Overall market									
DSE	0.0000	0.3123	-0.3466	0.0172	-0.1339	87.6241	0.1338	462.08*** (0.00)	33.10*** (0.00)
Panel B: Firm size									
First	0.0000	0.2119	-0.2509	0.0150	0.5555	55.6251	1.4240	26.43*** (0.00)	34.87*** (0.00)
Second	0.0000	0.1680	-0.1286	0.0136	0.3008	21.8433	6.8161	109.71*** (0.00)	95.76*** (0.00)
Third	0.0000	0.3034	-0.1258	0.0177	5.9896	149.5463	0.1198	11.65* (0.082)	0.99 (0.80)
Fourth	0.0000	0.3007	-0.1341	0.0190	2.4228	43.9293	6.6748	698.25*** (0.00)	323.11*** (0.00)
Fifth	0.0000	0.1011	-0.0676	0.0128	0.2397	7.8352	1.7051	446.87*** (0.00)	167.18*** (0.00)
Sixth	0.0000	0.1293	-0.0773	0.0133	0.3016	11.4094	3.1791	472.07*** (0.00)	225.54*** (0.00)
Seventh	0.0000	0.2358	-0.2235	0.0129	0.6004	65.5904	1.7781	1141.52*** (0.00)	679.18*** (0.00)
Eighth	0.0000	0.0885	-0.0743	0.0113	0.3962	9.7747	2.3601	247.99*** (0.00)	361.55*** (0.00)
Ninth	0.0000	0.2486	-0.2293	0.0115	1.4984	119.5576	0.5692	912.66*** (0.00)	36.39*** (0.00)
Tenth	0.0000	0.0450	-0.1197	0.0185	-2.6321	69.2258	0.0156	28.05*** (0.00)	22.40*** (0.00)
Panel C: Dividend Yield									
High yield	0.0000	0.0885	-0.0659	0.0096	0.5351	11.7453	3.7606	328.28*** (0.00)	188.46*** (0.00)
Low yield	0.0000	0.1579	-0.0830	0.0168	3.5516	72.1091	6.4819	67.77*** (0.00)	47.85*** (0.00)

Panel D: Industries									
Financial	0.0000	0.1316	-0.1699	0.0130	-0.0990	21.7485	5.0792	82.74*** (0.00)	70.73*** (0.00)
Service	0.0000	0.3048	-0.2901	0.0197	3.8164	96.9785	1.4944	563.11*** (0.00)	376.68*** (0.00)
Manufacturing	0.0000	0.0897	-0.0890	0.0085	0.5353	16.0374	3.1463	317.65*** (0.00)	92.56*** (0.00)
Miscellaneous	0.0000	0.0457	-0.1608	0.0064	-3.6194	126.0478	0.0265	34.93*** (0.00)	5.08 (0.17)

Note: This table shows the summary statistics of filtered return series from pre-whiting process for overall market and other categories. LB(6) is the Ljung-Box Q test of serial correlation for the return, the test statistics are distributed as χ^2 with 6 degree of freedom. ARCH(6) is the Lagrange Multiplier LM test for ARCH effects and distributed as a χ^2 with 6 degree of freedom. The joint test results are Engle and Ng's (1993) test for the potential asymmetry in volatility. The test statistics is a F-statistics for the null hypothesis of $c_1 = c_2 = c_3 = 0$ of the following regression:

$\Upsilon_t^2 = c_0 + c_1 \mathrm{K}_t^- + c_2 \mathrm{K}_{t-1}^- \varepsilon_{t-1} + c_3 \mathrm{K}_t^+ \varepsilon_{t-1} + \upsilon_t$

where, Υ_t^2 is the squared standardized residuals, K_t^- is a dummy variable that takes a value of unity if $\varepsilon_{t-1} < 0$ and zero otherwise; and K_t^+ is a dummy variable that takes a value of unity if $\varepsilon_{t-1} > 0$ and zero otherwise.

***, ** and * are statistically significant at 1%, 5% and 10% level.

6.4.2 Structural breaks and timing of macro and non-macro news

6.4.2.1 Empirical results of the models

In financial markets, information is readily available and prices are sensitive to investors' expectations about the future (Bjornland and Leitemo, 2009), hence, they need to know how returns and fundamentals are affected by unexpected changes in macroeconomic conditions for portfolio allocation, risk management and asset pricing purposes (Cenesizoglu, 2011). Flannery and Protopapadakis (2002) propose macroeconomic variables are excellent candidate for extra-market risk factors, because changes in those variables simultaneously affect many firms' cash flows, risk-adjusted discount rate, and number and types of investment opportunities. All these studies agree that there is a close connection between changes in return and volatility process and arrival of macroeconomic release. However, less is known about their form of association (Rangel, 2011). In this section of the study, therefore, we investigate interdependences of both macro and non-macro information with stock market by identifying structural breaks in return and conditional variance around the timing of those news. As explained in Moore and Wang (2007) due to structural changes stock prices should reflect expectations of future dividend, interest rate and risk premia, which in turn depend on macroeconomic conditions.

In order to capture the changing behavior of return and volatility we use the GARCH family model and test for breaks at unknown times in the parameters in mean and variance equation. In our approach, we do not impose a prior date of the breaks, but test simultaneously for the existence of a change in the parameter in the process. As Eizaguirre et al. (2004) assert, the location of endogenous structural breaks in time series has been a matter of intense research in the last few years and most of the techniques have been initially developed for estimation and location of endogenous breaks in the mean parameters of trend models. However, this study uses a non-linear GARCH model as documented in Andreou and Ghysels (2002) and Eizaguirre et al. (2004). For identifying the breakdates, we use general framework of Bai and Perron (1998, 2003a, b) and sequential procedure to estimate the critical values. This is because the expression for the calculation of a confidence interval for the breakpoint cannot be directly applied (see Eizaguirre et al., 2004).

The results are reported in Table 6.3 (from 6.3a to 6.3e), where Table 6.3a & 6.3b report estimation of breakpoints in return and Table 6.3c & 6.3d report estimation for conditional variance. Breakdates are summarized in Table 6.3e. We apply global optimization approach as recommended in Bai and Perron (1998) to minimize the sum-of-squared residuals and sequential determination for detecting multiple breaks. Our sequential test of l breaks versus none (Table

6.3a and 6.3c, respectively for return and volatility) begins with a single break until the null is not rejected. This test also gives us the unweighted (UDmax) and weighted double maximize (WDmax) statistics. Bai and Perron (2003b) states that it is always a useful strategy to first look at the UDmax or WDmax tests to see if at least one break is present. If these statistics indicate the presence of at least one break, then the number of breaks can be decided based upon a sequential examination of the $supF_T(\ell + 1|\ell)$ statistics (Table 6.3b and 6.3d for return and volatility respectively) constructed using global minimizers for the break dates (see discussion in methodology). This method leads to the best results and is recommended for empirical applications (Bai and Perron, 2003b).

Table 6.3a: Multiple Structural Breaks in Returns (m versus none)

Sequential F-statistic determined breaks:				6	
Significant F-statistic largest breaks:				6	
UDmax determined breaks:				2	
WDmax determined breaks:				2	
Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value[a]	
1 **	8.871252	26.61376	26.61376	14.60	
2 **	10.31910	30.95729	35.25557	12.82	
3 **	6.292512	18.87754	24.04991	11.46	
4 **	5.029859	15.08958	21.16310	10.41	
5 **	5.697689	17.09307	26.02281	9.59	
6 **	5.470374	16.41112	27.22754	8.80	
UDMax statistic**		30.95729	UDMax critical value[a]		14.85
WDMax statistic**		35.25557	WDMax critical value[a]		16.07

Note: The table reports OLS estimation of the Bai-Perron tests of m versus none globally determined breaks in the return series using sequential evaluation. The test statistics employ HAC covariance (option includes - pre-whitening with lags specification from Schwarz Information Criteria using observation based maximum lags, Bartlett Kernel, and Newey-West fixed bandwidth method). The model allows heterogeneous error distribution across breaks with trimming $\in = 0.10$.
***, ** and * are significant at 1%, 5% and 10% levels.
[a] Bai-Perron (Econometric Journal, 2003) critical values.

Table 6.3b: Multiple Structural Breaks in Returns (L+1 versus L)

Sequential F-statistic determined breaks:			2
Significant F-statistic largest breaks:			2
Break Test	F-statistic	Scaled F-statistic	Critical Value[a]
0 vs. 1 **	8.871252	26.61376	13.47
1 vs. 2 **	6.274779	18.82434	15.25

Note: The table reports OLS estimation of the Bai-Perron tests of L+1 vs L globally determined breaks in the return series using sequential evaluation. The test statistics employ HAC covariance (option includes - pre-whitening with lags specification from Schwarz Information Criteria using observation based maximum lags, Bartlett Kernel, and Newey-West fixed bandwidth method). The model allows heterogeneous error distribution across breaks with trimming $\epsilon = 0.20$.
***, ** and * are significant at 1%, 5% and 10% levels.
[a] Bai-Perron (Econometric Journal, 2003) critical values.

As reported in Table 6.3a, there are six breakpoints identified in our daily return sample based on sequential F-statistics within l breaks versus none framework. In each case, the scaled and weighted F-statistics values are significantly greater than critical values. Nonetheless, using UDmax and WDmax statistics (30.96 and 35.26 respectively against critical values of 14.85 and 16.07), it is found that return series changes its behavioural pattern for twice. Therefore, for empirical explanations we re-estimate the model using sequential test of $l + 1$ versu l globally determined procedure (which is $supF_T(\ell + 1|\ell)$) and results are given in Table 6.3b. We get two breakpoints are statistically significant at 95% confidence interval and their scaled F-statistics 26.61 and 18.82 are also larger than Bai and Perron (2003b) asymptotic critical values.

Bai and Perron (1998) mention, endogenous structural breaks can also accommodate changes in the variance. Hence, we first, estimate the conditional variance using asymmetric GJR-GARCH approach as recommend in Table 6.2 that joint test of Engle and Ng (1993) is significant and then we determine possible behavioral changes applying Bai and Perron (1998, 2003a,b) sequential procedure. Results are shown in Table 6.3c and 6.3d; in 6.3c our l breaks versus none model identify six breaks according to sequential F-statistics value and five breaks based on UDmax and WDmax statistics. Our re-estimation using $supF_T(\ell + 1|\ell)$ model confirms that all the breakdates are significantly larger than Bai and Perron (2003b) asymptotic critical values and also significant at 5 percent level.

Table 6.3c: Multiple Structural Breaks in Conditional volatility (m versus none)

Sequential F-statistic determined breaks:				6	
Significant F-statistic largest breaks:				6	
UDmax determined breaks:				5	
WDmax determined breaks:				5	
Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value[a]	
1 **	7.796544	31.18617	31.18617	16.76	
2 **	103.9914	415.9655	473.6128	14.72	
3 **	1105.936	4423.744	5574.583	13.30	
4 **	862.5777	3450.311	4720.588	12.25	
5 **	4111.920	16447.68	24416.58	11.29	
6 **	3743.174	14972.70	24082.76	10.42	
UDMax statistic**		16447.68	UDMax critical value[a]		17.00
WDMax statistic**		24416.58	WDMax critical value[a]		18.38

Note: The table reports OLS estimation of the Bai-Perron tests of m versus none globally determined breaks in the conditional variance series using sequential evaluation. The test statistics employ HAC covariance (option includes - pre-whitening with lags specification from Schwarz Information Criteria using observation based maximum lags, Bartlett Kernel, and Newey-West fixed bandwidth method). The model allows heterogeneous error distribution across breaks with trimming, $\in = 0.10$.
***, ** and * are significant at 1%, 5% and 10% levels.
[a] Bai-Perron (Econometric Journal, 2003) critical values.

Table 6.3d: Multiple Structural Breaks in Conditional Volatility (L+1 versus L)

Sequential F-statistic determined breaks:			5
Significant F-statistic largest breaks:			5
Break Test	F-statistic	Scaled F-statistic	Critical Value[a]
0 vs. 1 **	7.796544	31.18617	16.76
1 vs. 2 **	6.597967	26.39187	18.56
2 vs. 3 **	157.3814	629.5254	19.53
3 vs. 4 **	30.65360	122.6144	20.24
4 vs. 5 **	30.65360	122.6144	20.72

Note: The table reports OLS estimation of the Bai-Perron tests of L+1 vs L globally determined breaks in the conditional variance series using sequential evaluation. The test statistics employ HAC covariance (option includes - pre-whitening with lags specification from Schwarz Information Criteria using observation based maximum lags, Bartlett Kernel, and Newey-West fixed bandwidth method). The model allows heterogeneous error distribution across breaks with trimming $\in = 0.15$.
***, ** and * are significant at 1%, 5% and 10% levels.
[a] Bai-Perron (Econometric Journal, 2003) critical values.

Estimated dates for structural changes in DSE conditional variance are reported in Table 6.3e and they are 22 November 1996, 25 July 2000, 21 September 2004, 9 January 2007 and 15 September 2010 (see also Figure 7.1). The Table 6.3e also show the structural breaks dates for equity returns, which are on 21 November 1996 and on 12 April, 2005 respectively. In Figure 6.1 we link the breakpoints with the daily price index of DSE over the sample period 1990-2012. It shows that the break dates are coincide with the major price fluctuations of this stock market. It is evident that there are two big slumps happened in DSE in 1996 and 2010 respectively and two minor crashes happened in 2005 and 2008.

Table 6.3e: Estimated Breaks Dates

	Sequential evaluation of Bai-Perron tests of m versus none globally determined breaks	**Sequential evaluation of Bai-Perron tests of L+1 vs. L globally determined breaks**
In Return Model	18 January, 1994; 21 November 1996; 6 May 1999; 7 January 2002; 12 April 2005; and 6 September 2010.	21 November 1996 and 12 April 2005
In Conditional Variance Model	28 July 1994; 22 November 1996; 25 July 2000; 21 September 2004; 9 January 2007; and 15 September 2010.	22 November 1996; 25 July 2000; 21 September 2004; 9 January 2007; and 15 September 2010.

Note: This table summarizes the estimated structural break dates using both the Bai-Parron tests of m versus none and L+1 vs. L globally determined breaks approach. The dates are found in the least square model of return and conditional volatility series. We follow the strategy recommended in Bai and Perron (2003b), according to them it is a useful strategy to first look at the UDmax or WDmax tests to see if at least one break is present. If these indicate the presence of at least one break, then the number of breaks can be decided based upon a sequential examination of the $supF_T(\ell+1|\ell)$ statistics constructed using global minimizers for the break dates (i.e. ignore the test $F(1|0)$ and select m such that the tests $supF_T(\ell+1|\ell)$ are insignificant for $\ell \geq m$). This method leads to the best results and is recommended for empirical applications (Bai and Perron, 2003b).

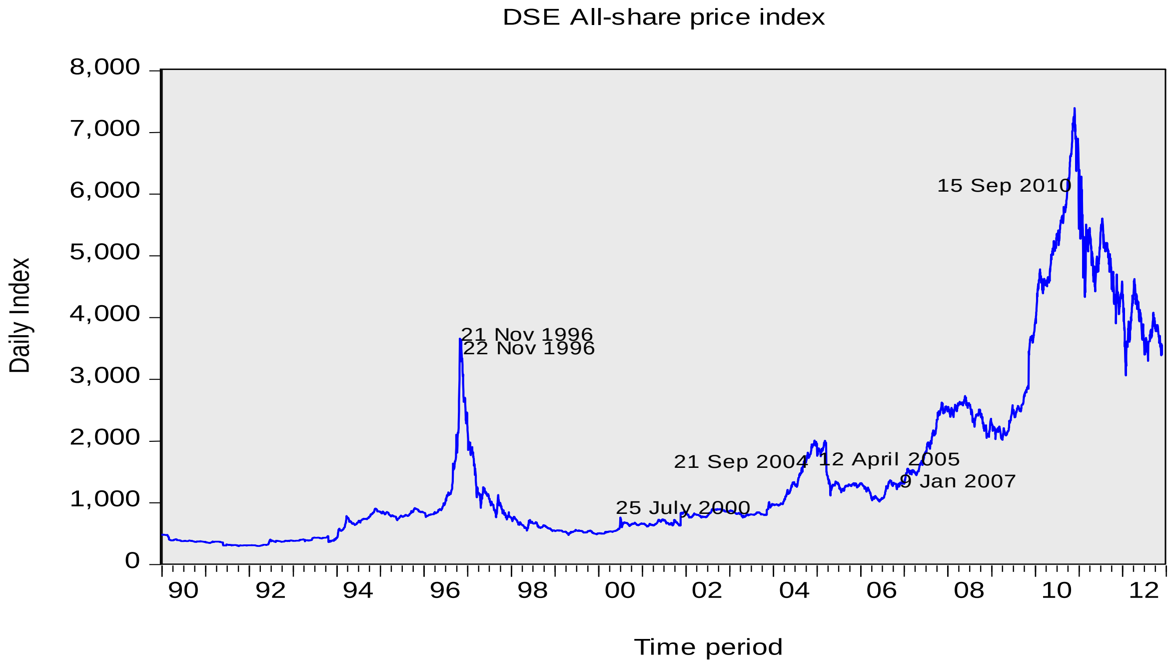
6.4.2.2 Post-hoc rationalization of structural break dates

Interestingly, the stock market of Bangladesh has got first structural break both in return and variance respectively on 21st and 22nd November 1996. Historically, the year is distinctly significance to the people of this country as they have celebrated silver jubilee anniversary of their independence. However, despite 25 years of freedom, the young republic continued to be plagued by political instability, popular unrest, and economic uncertainty (see Kochanek, 1997).

He also adds, the two-year anti-government movement – 175 days of political disturbance, including 92 days of country-wide hartal and 22 days of continuous non-cooperation have dampened the hope for a six percent economic growth. Within these political riots Constitution has adopted the 13th amendment (passed on 26 March) for the creation of an interim government (a non-political Caretaker Government) to conduct all future election of the country. On 23rd June a new political government took office following the national election on 12th of the same month. After long lasting political and economic crisis government took several steps to fuel the economic growth and improve the investors' confidence, such as, reducing import duties, special incentives to foreign investors and reducing domestic tax to stimulate private sector development. As a result, the broad money supply during this year has increased by an average compounded annual growth rate of 14 percent and credit to the private sector has risen by 19 percent.

As economic information is reflected in share price, the stock market of Bangladesh has shown a sign of improvement after the election and formation of new government. Wahab and Faruq (2012) assert investors' confidence has boosted by the restoration of political stability and by November 5th DSE all-share index soared to nearly 3700 from 1000 points just in nine months. The market capitalization has reached to $6 billion. The newly elected government interpret this development as fundamental strength of the economy and people's confidence in the new government. However, in order to control price hike above 10 percent in a day SEC (Security Exchange Commission Bangladesh) imposed circuit breakers in October (Ahmed et al., 2012). Unfortunately, both the DSE and SEC have failed to operate the circuit breaker in restricting the rise and fall of share prices beyond certain limit on a particular day which resulted in abnormal rise in the share price. Hence, within just first five days of November market has increased by 22 percent and in a sudden turn of events after that day, most stock price slumped and this lead to the starting of downward trend in both the stock price and the indices (see The Economist, 1997; Wahab and Faruq, 2012). The Economist (1997) reports, Dhaka briefly earned the distinction of being one of the world's best-performing markets and from September to November, the all-shares index soared from around 1,000 to nearly 3,700, then, started to fall. Situation become worse when foreign investors have started to offload their holding with the expiry of the lock-in period (see Ahmed et al., 2012). Ironically, the stock market faced first ever collapse and entered into a new regime. In another nine months (September 1997) index came down to nearly 800 point, that means 79 percent fall from the peak (see Figure 6.1). Surprisingly, for next seven years until 2004, DSE all-share price index didn't cross 1000 points.

Figure 6.1: Structural Break dates in daily price index



There are many reasons asserted by the economist and market experts to clarify this sudden bubble and bust. Mostly the presence of illegal Kerb market[24], an inadequate infrastructure, a weak settlement system, insufficient dissemination of information system, lack of credibility and transparency of the authorities of the listed companies, weak policy by regulatory authorities contributed to manipulations in the market, creating artificially hyped demand for speculative stocks (see Wahab and Faruq, 2012). The Economist (1997) describes the situation as "slaughter of the innocents"; innocent and ignorant small investors were slaughtered indiscriminately at the altar of lust for more money by the fortunate few. The bust of 1996 is considered as one of the worst nightmares for small investors in Bangladesh and some still hold negative impression of about the market (Ahmed et al., 2012).

Following the fall, the regulatory bodies and government took several steps to restore the market confidence, e.g. filing 15 share-scam cases in court and adopting Capital Market Development Program in November 1997. Further, DSE introduce automated trading system in 1999 and

[24] This was an unofficial street-market operated in 1996 in front of the DSE head office in Dhaka. During the latter half of 1996, Bangladesh's stock market experienced a major bull run, market capitalization rose by 265%, average daily turnover increased by over 1000%, and the share price index jumped by over 260%. At this time due to inability of the existing stock exchange and security exchange commission to service the requirements of small retail investors who jumped on the bandwagon, a huge unofficial kerb market in shares developed (see Asian Development Bank, 2005). Investors started to trade share certificate outside the DSE premises and that also gave birth of fake and forged share certificates.

SEC launch new settlement of transaction regulation. Within all these initiatives and regulatory changes the general index was rolling around 700 points and market takes second structural break in volatility in July 2000. Rashiduzzaman (2001) avows, in the year 2000, Bangladesh was mired in lawlessness, intractable governance, executive-judiciary acrimony, enfeebled diplomacy, and economic stagnation. Size of the public debt had increased to 31.3% and much of the government's borrowing was coming from commercial banks (see Ahmed, 2000; Rashiduzzaman, 2001). As a result overall money supply in the economy had increased by 18.6%. Therefore, we can conjecture that the structural break in volatility may be the consequence of excessive government debt as explained in Ardagna (2009) and Afonso and Sousa (2011). For example, Ardagna claim government debt can influence the share price through interest rate channel, such as, increases in government debt increase interest rate and decrease the share price. Similarly, Afonso and Sousa (2011) report that government spending shocks have a negative effect on stock price. In Bangladesh higher government debt creates double impacts, in one hand, it increases public sector spending and on the other side, squeezes the credit opportunities (i.e. crowding out effect) for private sector, all together negatively affect the stock market.

In April 2004, after seven long years DSE index had again crossed 1000 points, however, the macroeconomic and political conditions were worse than usual. The situation is well portrayed in Riaz (2005); he explains rising political violence and religious militancy, coupled with the ruling government's vindictive attitude and the main opposition party's intransigence, had created an unstable environment that is likely to inflict still further damage on Bangladesh's democracy. On 1 April, in one instance, police and coast guard office seized 10 truckloads of arms and ammunition (see The Guardian, 2014). Further, in an assassination attempt on former Prime Minister Sheikh Hasina Wajed on August 21 in a party rally in Dhaka has been killed twenty people including a senior leader and injured more than hundred people. The attack sent a shock wave through the country and drew international condemnation; the FBI and Interpol sent investigators (Riaz, 2005).

Surprisingly, a month later on 21 September third structural break happens in the volatility of DSE general index. Therefore, it could be easily conjectures that the change in this equity market behavior has connection with the political uncertainty. Existing literatures also support this idea and claim that this relationship is particularly strong in emerging market compared to developed economy. For example, Diamonte et al. (1996) and Bilson et al. (2002) report political risk factors are important determinant to explain return variations in emerging than developed markets. Beside, this political instability, Bangladesh experienced its worst floods in July 2004 that hit 30 million people and the value of damage is estimated to $2billion (see Riaz, 2005). Rising budget deficit, declining foreign aid and investment forced the government to borrow from commercial banks, such as, 52.2% of fiscal deficit of 2004 is financed from domestic sources (see Kibria, 2004 and Riaz, 2005). Macroeconomic failure and political risk jointly influenced the stock market in this year, as Nguyen and Bellalah (2008) assert that large changes in emerging market volatility are often associated with major economic and political events.

After an eventful year, Bangladesh stood at a crossroads, Islamist challenges, a crisis of governance, and the absence of the rule of law in 2005 (Riaz, 2006). Facing all these challenges, however, central bank takes expansionary monetary policy in 2005 for channelling economic recovery from the flood disaster. CPD (2005) states, soon after the flood government restrained its borrowing to give more room to the private sector. The year-to-year growth rate of total credit reached to 18.4 percent and out of that private sector share increased to 77.7 percent by March 2005. Moreover, government encourages banks and non-bank financial institutions to disburse more credit by lowing interest on loan, i.e. all four nationalized commercial banks have reduced their interest rate on loans by 3.5-4 percent compare to 2001 (see Bangladesh Economic Review, 2005). The share of bank borrowing in total outstanding public debt also has increased to 37.5 percent in March 2005. At the same time Bangladesh Bank (which is the central bank of Bangladesh) uses and changes rate of various monetary instruments like repo, reverse-repo, rate of treasury bills/bonds and cash reserve requirement (CRR). For example, Bangladesh Bank increases the cash reserve ratio to 4.5 and 5 percent respectively in March and October 2005 from 4 percent. On the other hand, statutory liquidity reserve (SLR) is increased to 18% from 16% in October of the same year. Central bank changes all these rates to control the growing challenge of inflation, which has increased to more than 7 percent at the end of 2005.

The equity market took its second break in returns in April, 2005 at the transition between expansionary and contractionary monetary policy. A sudden tight policy from central bank may be influenced the market and push into a different regime. From Figure 6.1, we can see that overall DSE was at growing phase during the early period of 2005, even, SEC and government undertake different initiatives, such as tax rebate, margin facilities, issuance of mutual fund registration certificates, establishment of Over-the-Counter (OTC) market etc. to attract new investors and escalating market confidence (see Ahamed, 2006 and Bangladesh Economic Review, 2005). Moreover, Goldman Sachs included Bangladesh in 'Next-11' list based on macroeconomic strength. Nevertheless, beside all these initiatives and recognition, change in market behaviour of DSE is found linked with this unexpected change in monetary policy as reported in many previous literatures, e.g. Pearce and Roley (1983, 1985). They find stock price respond only to the unanticipated changes in money supply (Pearce and Roley, 1983). In a later study, they further documented significant effect of new information released related to monetary policy on stock market and limited evidence for other factors, such as, inflation and real activities (Pearch and Roley, 1985).

Bangladesh will long remember 2007, as the year in which their fledgling democracy is interrupted and the country is hovered between democracy and dictatorship (Hagerty, 2008). The political crisis has started on 28 October, 2006 when a caretaker government (CG) assumed power following the end of term of ruling government (i.e. Bangladesh National Party or BNP). The opposition party (i.e. Awami League or AL) has questioned about the neutrality of head of CG and election commission. With political gridlock came a violent clash that killed some 30 people and injured hundreds more (see BBC, 2006 and Hagerty, 2007). On 3 January 2007 AL and the smaller parties of its Grand Alliance boycott the general election to be held on 22 January 2007 by complaining the lack of an accurate voter list. More widespread violence and political rioting followed (Rahman, 2007). Consequently, one of the world's largest democracies in the Muslim world seemed to be descending into chaos, with violence, strikes, transport blockades and business instability adding to an already strong sense of tension (see Rahman, 2007).

President Iajuddin Ahmed, with the army's backing, declared a state of emergency on January 11, effectively suspending all political activity across the country (Hagerty, 2008). In effect, Bangladesh was governed jointly by the CG and army until the new government formed in 2009 (see The Economist, 2007 and Hagerty, 2008). Within this political catastrophe the Dhaka Stock Exchange got its fourth structural break in volatility on 9 January 2007. Undoubtedly, this is the reflection of investors' reaction to the political crisis and uncertainty about economic future. However, fortunately, due to the confidence on new CG, market soon get a positive vive and reached to ten years high since 1996, up 66% in 2007 alone (see Figure 6.1). The investment company J.P. Morgan named Bangladesh as "one of the 'Frontier Five' market worth investing and Mark Matthews, head of Asia-Pacific equity strategy at New York-based Merrill Lynch, says Bangladesh 'is probably the best reform story in Asia' (see Thakur, 2007).

The fifth and final structural break in DSE happened in its volatility on 15 September 2010, in the year when DSE was named as one of the best performing markets in the world (see Rintoul, 2012), however, unfortunately suffered another historic plunge. The momentum that this market has got in 2007 continued and by February 2010 it crossed 5500 points, a sharp 135 percent jump from March 2009. The Economist (2011) reports, since 2007, the Dhaka Stock Exchange had outperformed almost all the world's market and gaining by as much as 410% in value over the period. However, between March-April 2010 market was slowed mainly due to a cautionary approach by investors and subsequent market correction (see Wahab and Faruq, 2012). From May-June again market started to increase and reached at 6154 points at the end of June. Such heady gains fed a hunger for investing among small-time players, even among those who knew little about the stocks they are trading (see Chowdhury, 2012). For example, Table 6.4a shows the trend of number of operating investors in the stock market and it indicates 100% growth in investors account and 81.42% growth in institutional account. There were fewer than 50,000 individual investors in 1996 and now, 14 years on, almost in step with the internet's expansion and the flourishing of brokerage firms across the Bangladesh, there are 3.5 million investors hailing from every town and city (The Economist, 2011).

Table 6.4a: Number of investors in DSE

Category of investors	Number of Accounts in Operation 2007	2008	2009	2010	2011	Growth Rate
Individual	848,808	1,091,532	878, 752	1,581,505	1,702,052	100.52 %
Institutional	3,671	4,865	4,096	5,941	6,660	81.42%

Source: Annual report of Central Depository Bangladesh Limited (CDBL)

On the other hand, due to huge amount of surplus funds in banking and private sectors, as well as lack of investment opportunities in productive sectors both individuals and commercial banks re-directed their investment into capital market (CPD, 2011). Even funds disbursed to industrial enterprises as term loan, working capital and over-draft against workers' salary were reported to have been diverted to stocks. The Economist (2011) reports, the ongoing energy crisis and other infrastructural problems have curtailed opportunities for private investment and as a result, both banks and financial institutions had invested very heavily in the stock market. For example, in 2010 there was a reduction of deposit rate of NSD (national saving deposit) and interest rate of wage earners' bond as well as imposition of tax at source on interest income and cancellation of automatic re-investment of wage earners' bonds (see CPD, 2011 for detail discussion). On top of that, about 4.27 billion of 'black money' flowed into stocks, which is equal to 25 per cent of the total volume on the Dhaka Stock Exchange, in the financial year ended June 30, 2010. Indeed, investors jump into the market to grab the short-term opportunity of earing huge returns from DSE. According to Table 6.4b investors receive relatively higher return on investment, such as, 51 percent companies declared more than 30 percent right shares in FY2009-10 compare to 34 and 35 percent in previous two years. In addition, Table 6.4c exhibits that the capital gains in short-term trading of shares were higher than the long-term investment. The augmented investors' expectation and confidence was also reflected in the large amount of public subscriptions. In 2010, twenty-one new companies (including 8 mutual funds) offloaded their shares amounting to 33.8 billion in local currency through public offering. Against IPOs, 109.2 billion is oversubscribed which is almost twelve times higher than the IPO value (see Wahab and Faruq, 2012). The excessive demand of equities and the high growth of liquidity hit the market via the overshooting the prices of the stocks.

Table 6.4b: Return on Investment in DSE for over one year

Types of Benefit	FY2007-08 No of Companies	FY2007-08 Cumulative Share (%)	FY2008-09 No of Companies	FY2008-09 Cumulative Share (%)	FY2009-10 No of Companies	FY2009-10 Cumulative Share (%)
Right share		0	3	1	25	22
50% and Above	23	12	30	14	20	41
40%-49%	5	15	12	20	2	43
30%-39%	34	34	40	37	9	51
20%-29%	36	55	38	54	18	67
10%-19%	56	86	80	90	21	87
1%-9%	14	94	11	95	7	93
No dividend	10	100	11	100	7	100
Total Companies held AGM [a]	178		225		109	
Total No of Listed Companies	271		282		243	

Source: Centre For Policy Dialogue (CPD) Bangladesh. [a] AGM is Annual General Meeting.

Table 6.4c: Potential Capital Gain from different share groups

Category	FY2007-08			FY2008-09			FY2009-10		
	Highest	Average	Lowest	Highest	Average	Lowest	Highest	Average	Lowest
DSE 20	345.98	93.58	-21.51	99.39	11.78	-31.85	184.32	48.73	-25.85
Z-group	371.43	100.3	-6.82	330.77	78.68	-34.87	2198.73	341.1	-29.93

Source: Centre For Policy Dialogue (CPD) Bangladesh.

Note: DSE 20 are the top 20 performing share in DSE, however, Z-group includes companies which have failed to hold the current annual general meetings or have failed to declare any dividend or which are not in operation continuously for more than six months or whose accumulated loss after adjustment of revenue reserve, if any, is negative and exceeds its paid up capital.

In their July-December Monetary Policy Statement (MPS), Bangladesh Bank has anticipated the possible diversion of industrial load to the capital market. They also have identified 12 commercial banks who have invested more than the stipulated amount (i.e. not more than 10 percent of total liabilities) into stocks. To control bank's exposure to stock market, Bangladesh Bank, therefore, issue directives to adjust their investments and loan portfolios by November 2010 and 15 February 2011 respectively. Based on our empirical analysis, market changes its volatility behaviour on 15 September 2010 a month later to the new MPS, which means a major price plunge is now just a matter of time. In line, on 2 October, 2010 the parliamentary watchdog raise their concern that capital market is not driven by market fundamentals – dividend yields, price earnings ratio and other indicators are not working in the market and it is an alarming sign (see Zaman, 2010). However, stocks continue to rise defying the warning of bourses and experts of possible massive price correction. The SEC has applied several directives to control the price jumps and possible market fall, e.g. withdrawal of netting facilities, limiting the margin loan, changing private placement regulations (see The Financial Express, 2010a).

On 1 December 2010, market reached to 8723.51 points and on the same day, central bank sent fifty teams in different commercial banks to investigate whether they comply with the directives to adjust their investment by November. Couple with this irregularity, central bank was also fighting with rising inflation that climbed to 12 percent. Therefore, a tight monetary policy was likely and as a short term measure, Bangladesh Bank had hiked the cash reserve ratio (CRR) and statuary liquidity ratio (SLR) by five basis points to 6 and 19 percent respectively (see The Financial Express, 2010b). 5 December 2010 was the last day of the year when general index reached to all-time high 8918.51 points and turnover at 32.50 billion in local currency. Unsurprisingly the bubble burst (Chowdhury, 2012). The DSE witnessed its biggest one day fall on 19 December 2010 by 551.76 points or 6.71 percent. Experts reported that this was due to the profit-taking behaviour of investors, mostly by the institutions to report high return on investment in their balance sheet (The Financial Express, 2010c). The Economist (2011) claims that the crash was probably triggered by an attempt on the part of Bangladesh's central bank to restricted the private banks' exposure to the exchange. Market continued to fall and riots around DSE threatened to become a regular feature of life in the capital (The Economist, 2011). On 9 and 10 January 2011 it declined by 600 and 660 points respectively, which is equivalent to 7.75 and 9 percent fall. In probe committee report, Khaled (2011) mentioned that due to trigger sale from 2 January 2011 market was experienced its highest drops in share price and it ultimately crashed from 9 January 2011 (see Figure 6.1).

With the political stakes having grown higher – as the investing class has grown broader – and with elections due in hundreds of municipalities this month, the AL government could not sit idle (The Economist, 2011). The government created pressure on Bangladesh Bank and SEC to improve the market condition. As a result, recovery was initiated by pushing huge amount of money into market, increasing margin loan ratio, extending the deadline for submitting and adjusting the loan portfolios. Besides all these, unfortunately, market started to decline except one day jump of 15.6 percent on 11 January 2011 and reached at 5203.08 points at the end of February 2011.

Overall, in comparison to 1996, the current market is wide, the regulatory bodies are more concentrated, there is improved information and settlement system in place and issuer companies are more transparent with regular financial statement submission (Wahab and Faruq, 2012). However, several policies and parties are responsible for this bubble and the burst. For example, lack of investment opportunities, excessive liquidity in the market, significant growth in foreign remittance, huge inflow of new investors, lack of transparency in BO (i.e. Beneficiary Owner) account, inadequacy of SEC – regulatory performance and weak institutional capacity, sudden contractionary monetary policy by the central bank, presence of bull cartels, inefficiency in book building method – that increases the chance of price manipulation, lack of proper monitoring by the central bank – that allows commercial banks invest heavily into stock markets, lack of proper coordination between two leading regulatory bodies – SEC and Bangladesh Bank (see The Economist, 2011; CPD, 2011; Khaled, 2011; Chowdhury, 2012; and Moazzem and Rahman, 2012).

6.4.3 Markov regime switching GARCH model

A Markov Switching model (MS) is a nonlinear specification in which different states of the world affect the evolution of a time series (Hass et al., 2004). They state the dynamic properties depend on the present regime, with the regimes being realizations of a hidden Markov chain with finite state space. The objective of this section is to use Markov-switching GARCH (MS-GARCH) model to better describe the volatility behaviour of DSE price series as highlighted in literatures, e.g. Guidolin and Timmermann (2007). We use it because, the accumulated evidence from empirical research suggests that the volatility of financial markets displays some type of persistence that cannot be appropriately captured by the classical GARCH model (see Bauwens et al., 2010). Furthermore, it is based on the assumption that the stock return may change across different volatility regimes, which are characterized by the different perceptions of market participants, which in turn depends on macroeconomic conditions and translated into stock prices (See Moore and Wang, 2007). In this vein, Marcucci (2005) assert financial returns exhibit sudden jumps due not only to structural breaks in the real economy, but also to changes in the operators' expectations about the future, stemming from different information or dissimilar preferences.

In literature several authors have proposed models based on regime changes, e.g. Schwert (1989), Cai (1994), Hamilton and Susmel (1994), Gray (1996), Klaassen (2002), Haas, Mittnik and Paolella (2004), Bauwens et al. (2010). Schwert (1989) considers a model in which returns can have a high or low variance, and a two-state Markov process determines the switches between these states. Cai (1994) and Hamilton and Susmel (1994) use an ARCH model with regime-switching parameter to account sudden changes in the volatility. They use an ARCH specification instead of a GARCH to avoid the problem of infinite path-dependence. Later, Gray (1996) suggests a generalization to Markov-switching GARCH model which subsequently modified by Klaassen (2002) that overcome the problem of path-dependence. In this study we use a new approach proposed by Haas, Mittnik and Paolella (2004). This new model generalizes the previous MS-GARCH models to a multi-regime setting which has the advantage of being analytically tractable and allows the authors to derive richer dynamics for the process involved (Marcucci, 2005).

The estimated results of MS-GARCH model over the sample period using filtered return series are reported in Table 6.5a. First three sections of the table shows the parameters characterizing the dynamics within each of the regimes, with the regimes being ordered with respect to a declining stationary regime probability, that is $\pi_{\infty}^{1} > \pi_{\infty}^{2} > \pi_{\infty}^{3}$. $V_{i,} i = 1,2,3$ denotes the regime-specific volatility persistence, that is, $V_i = \alpha_{1i} + \beta_1$ for the models with normally distributed innovations, and $V_1 = \nu(\nu - 2)^{-1}\alpha_{11} + \beta_1$ for others, where, ν is the degree of freedom parameter. The last section displays the transition matrix *P*. Result identifies that there is a nonstationary regime in MS-GARCH (1) and MS-GARCH (3) (i.e. for some *i*, we have $\alpha_{1i} + \beta_1 > 1)$. Interestingly, the weight of α_{1i}'s is more and less weight on $\beta_1{}'s$ in nonstationary regime than stationary regime.

Table 6.5a: Estimated parameters for MS-GARCH model

	MS-GARCH (1)	MS-GARCH (2)		MS-GARCH (3)		
ω_{01}	0.0040	0.0010		0.0003		
	(0.0002)	(0.0000)		(0.0000)		
α_{11}	0.2214	0.1984		0.0101		
	(0.0158)	(0.0144)		(0.0020)		
β_1	0.7819	0.7429		0.6947		
	(0.0118)	(0.0145)		(0.0326)		
V_1	1.0033	0.9413		0.7048		
π_∞^1	1	0.6793		0.5854		
μ_1	-0.0003	-0.0004		-0.0004		
	(0.0002)	(0.0000)		(0.0000)		
ω_{02}		0.0154		0.0015		
		(0.0022)		(0.0001)		
α_{12}		0.1851		0.2232		
		(0.6481)		(0.0192)		
β_2		0.7677		0.7971		
		(0.0536)		(0.0136)		
V_2		0.9528		1.0203		
π_∞^2		0.3831		0.4710		
μ_2		-0.0020		-0.0002		
		(0.0022)		(0.0001)		
ω_{03}				0.02165		
				(0.0068)		
α_{13}				0.0403		
				(0.3552)		
β_3				0.7637		
				(0.1191)		
V_3				0.8040		
π_∞^3				0.1514		
μ_3				-0.0059		
				(0.0064)		
				0.5458	0.4170	0.0372
				(0.0263)	(0.0263)	(0.0103)
		0.9367	0.0633			
		(0.0074)	(0.0074)			
p	1					
				0.1404	0.8442	0.0154
				(0.0124)	(0.0122)	(0.0.0161)
		0.9917	0.0083			
		(0.0117)	(0.0117)			
				0.4959	0.5041	0.000
				(0.0132)	(0.0947)	(0.0113)

Note: Standard errors are in first brackets, based on numerical Hessian matrix.
The top row is the estimated model, which is Markov Switching GARCH model for state (S_t) 1, 2 and 3. $V_i, i = 1, 2, 3$, is the component-specific degree of volatility persistence, that is $V_i = \alpha_{1i} + \beta_1$ for the models with normally distributed innovations, and $V_1 = \nu(\nu - 2)^{-1}\alpha_{11} + \beta_1$ for others, where, ν is the degree of freedom parameter. Each model uses uniform probabilities to start recursion. The invariant measure estimes are added up to unity.

Table 6.5b lists the properties of each of the estimated models, such as, the likelihood ratio (LR) test, Davies (1987) upper bound significance, information criterion, Ljung-Box statistics, ARCH LM test etc. The selection of the regime switching process is complicated by the fact that under the null hypothesis of one regime the elements of the transition matrix are not identified (see Morana and Beltratti, 2002). As a consequence, the likelihood ratio test does not have the usual χ^2 asymptotic distribution. Therefore, following Morana and Beltratti (2002), Moore and Wang (2007) and others we can use the Davies (1987) upper bound test with other specification test results to determine the optimal number of states for the DSE. The Davies upper bound is based on an adjustment to the LR test statistics, and provides an upper bound for the correct probability value (details of this test are presented in Appendix A of Garcia and Perron, 1996). Together with LR and Davies upper bound *p*-value we can exclude one state model and limit our choice between S=2 and S=3; since, Davies upper bound for MS-GARCH (1) is not found statistically significant.

Table 6.5b: Properties of each of the MS-GARCH model

	MS-GARCH (1)	**MS-GARCH (2)**	**MS-GARCH (3)**
Panel A: For overall model			
LR test	2694.0 [1.000]	6812.2 [0.000]	7793.0 [0.000]
AIC	5.7388	6.4235	6.5847
BIC	5.7344	6.4123	6.5656
Log-likelihood	17214.80	19273.93	19764.30
No. of Parameter	4	10	17
Panel B: Standardized residuals			
Mean	0.0156	0.0274	0.0159
Variance	0.9988	0.9203	0.8708
Skewness	1.4326	0.0328	0.0135
Kurtosis	188.61	1.3636	0.0533
LB (10)	9.45 (0.57)	9.35 (0.56)	28.13 (0.00)
LB^2 (10)	0.25 (1.00)	10.11 (0.43)	18.65 (0.05)
ARCH (5)	0.03 (0.99)	1.57 (0.17)	3.29 (0.01)
Normality test	12740.00 (0.00)	326 (0.00)	0.99 (0.61)

Note: LR is the likelihood ratio test value for different state, such as, S=1 against S=2; S=2 against S=3 and S=3 against S=1. The number in the square bracket is the Davies (1987) upper bound p-value. The Davies upper bound is based on an adjustment to the LR test statistics, and provides an upper bound for the correct probability value. Details of this test are presented in Appendix A of Garcia and Perron (1996). P-values are given in the first brackets. AIC = -2L + 2K and BIC = -2L + K log T, where T is the sample size. LB and LB^2 stands for Ljung-Box statistics of standardized residuals and squared standardized residuals at 10 lags. ARCH is the Lagrange multiplier test for autoregressive conditional heteroskedasticity up to order 5. Normality test reports the Jarque-Bera statistics.

However, according to the values of log-likelihood function and two information criteria (i.e. Bayesian Information Criterion and Akaike Information Criterion), the fitness of two-state

Markov-switching GARCH model is better than three-state model. Furthermore, Lagrange Multiplier (i.e. ARCH LM) test and Ljung-Box statistics of squared residuals show that two-state model successfully capture the volatility clustering. Schwert (1989) and Perez-Quiros and Timmermann (2000), among other, also suggest and determine two possible states to investigate the dynamic behaviour of stock returns. Finally, comparing the empirical kurtosis coefficients computed (see Table 6.1) and those implied by the estimated model (see Table 6.5b), it could be noted that the MS-GARCH models fit the empirical kurtosis very well. This indicates that, in the context of regime-switching GARCH models the normal assumption may be adequate (see Haas et al., 2004).

Figure 6.2 displays the time series of smoothed probabilities for the two-state Markov-switching GARCH model. The graph indicates DSE returns are frequently swung between high and low regimes all-along the sample period from 1990 to 2012, like many other markets documented in Moore and Wang (2007). However, similar to the previous section, market returns prominently swing to second regime in 1996, 2000, 2004-2005, 2007 and 2010-2011. It is evident earlier that volatility upsurge in DSE due to both macro and non-macroeconomic (e.g. political uncertainty) information and it is well captured in this MS-GARCH model. In particular, we can see four different periods of changing pattern in equity returns – 1990-1994, 1994-2002, 2002-2004 and 2004-2012. Where market is less turbulent in between 1990-1994 and 2002-2004 and more turbulent in other two periods (see Figure 6.2).

Figure 6.2: Smoothed state probability

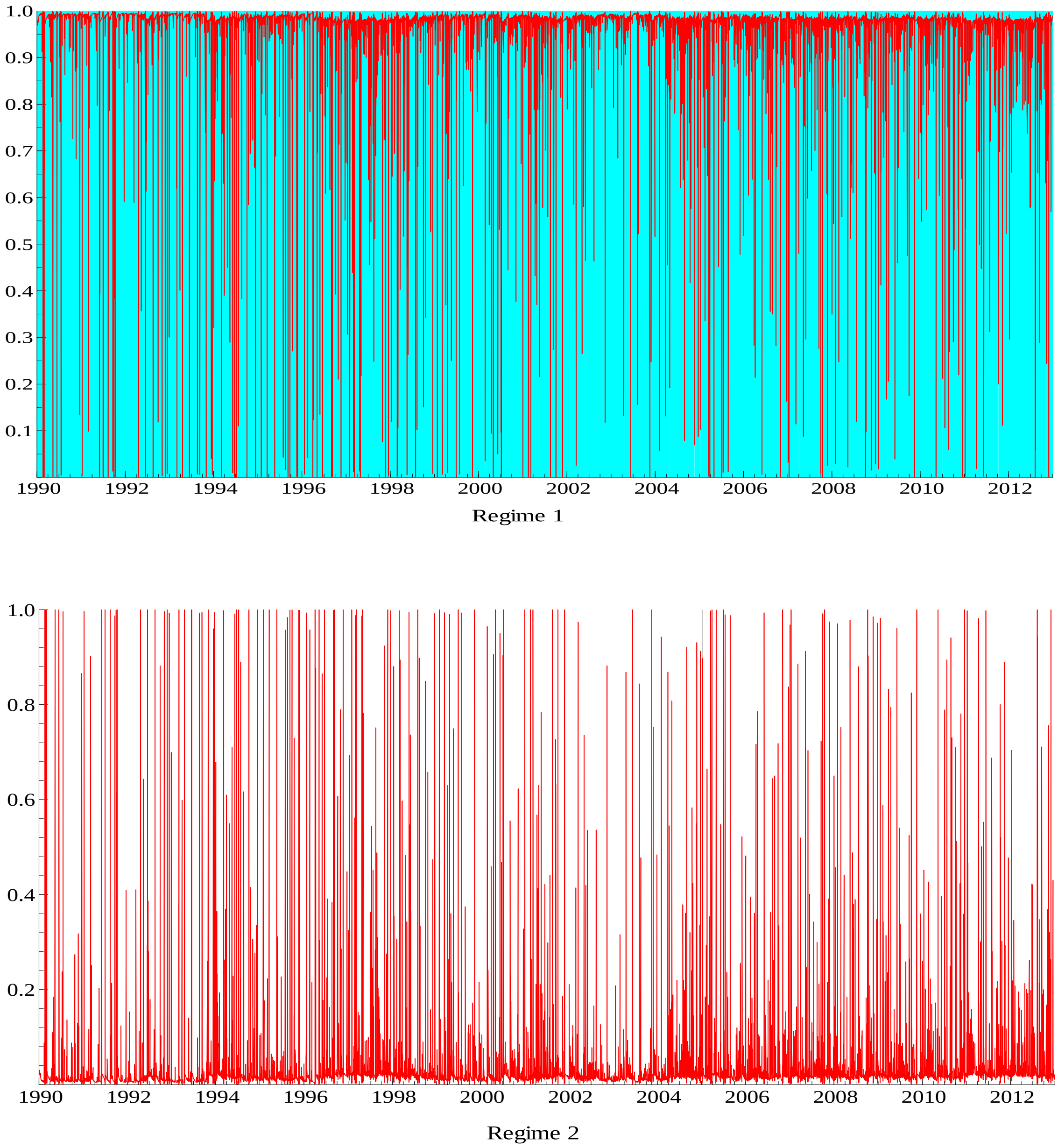
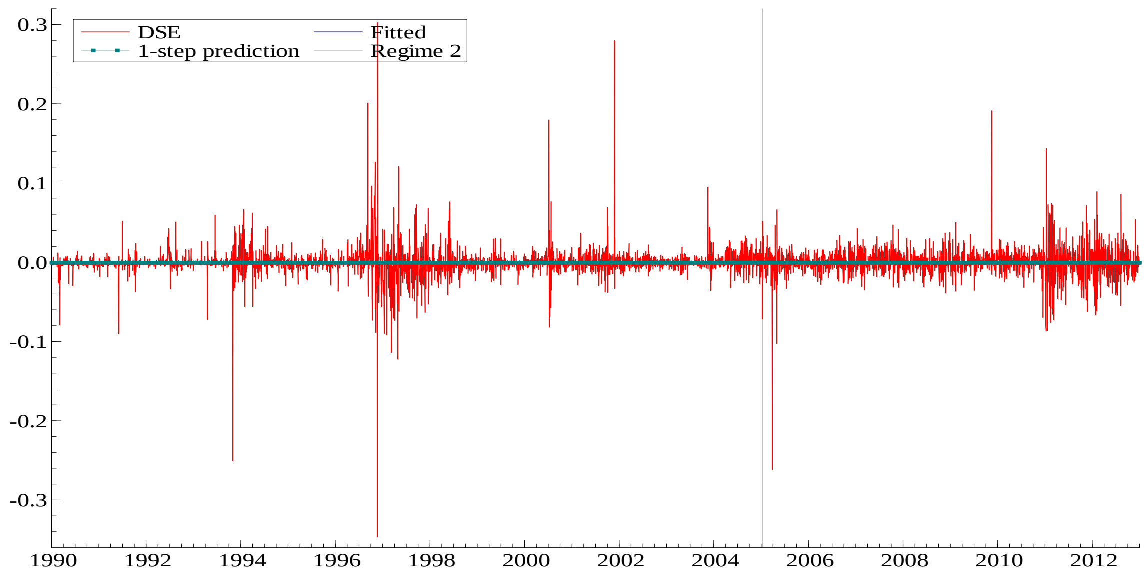


Fig. 6.2: Smoothed state probabilities: two-state model for stock returns. The graph plot the smoothed probabilities of regimes 1 and 2 for the multivariate regime switching GARCH model comprising the returns of DSE all-share price index from January 2000 till December 2012.

Nevertheless, most interesting outcome evident from Markov-switching GARCH model is displayed in Figure 6.3, overall market enters into a greater turbulent state around 2005. This result is very much consistent with structural breaks point test reported in Table 6.3e, DSE takes one break in return and three breaks in volatility since mid-2000s. Besides Figure 6.1 shows that equity price fluctuations are more profound in 2004-2012 periods compare to the periods from 1990 to 2003. From this differential behaviour, we could conjecture that market becomes more information sensitive since late 2004. Therefore, any changes in monetary and fiscal policy or political state are priced in DSE. Yet, we have to admit the conclusion of Fair (2002), there are many large changes correspond to no obvious events and so many large changes appear to have no easy explanation.

Figure 6.3: Distribution of daily index return



For example, surprisingly, market does not show any major price variation (both in structural breaks and MS-GARCH) around the timing of introducing the floating exchange rate system (which is 31 May 2003) in Bangladesh. However, in literature the interrelationship between exchange rate and financial markets is evident, e.g. Moore and Wang (2007), Hau and Rey (2006), Kanas (2002). In particular, Moore and Wang (2007) assert that the different exchange rate system may often be the cause of unstable fundamentals, which are then transmitted to stock market. The findings of Kanas (2002) suggest that volatility of stock returns is a significant determinant of the volatility of exchange rate changes. In DSE immediate change in stock price may not happen due to any substantial appreciation or depreciation of local currency until early 2005. Supporting our argument, Dornbusch and Fischer (1980) suggest when a shock causes the home currency to appreciate, then the less favorable terms of trade are going to cause a decline in local stock prices and vice versa. Fortunately, that does not befall in Bangladesh until 2005.

6.4.4 Impact on portfolios based on different characteristics

Returns on different portfolios not only react to different news but also react differently to the same news and reactions of portfolios to macroeconomic news also change over the business cycle (Cenesizoglu, 2011). This is because macroeconomic fundamentals reflect the state of the economy and the equity market returns is highly correlated with the macroeconomic fundamentals (Aretz et al., 2010). Furthermore, Chen and Wu (2014) assert firms in different business typically face different levels of competition and product cycle. Therefore, the likelihood of default can differ significantly for firms in different sectors even though they have similar balance sheets. Following all those arguments, in this final section of the paper, we want to investigate the ability of macro and non-macroeconomic information to influence the equity return and variance based on various firm characteristics – size, dividend yield and industry.

We use modified GJR-GARCH model (as equation xiii, xiv, and xv) to explore the influence of information across firm levels and to capture the asymmetry in their volatility except third sized portfolio and miscellaneous sector. For these two later groups we use GARCH (1,1) model, because it is reported in Table 6.2 that the joint test of Engle and Ng (1993) is not significant, that means no asymmetry in volatility. We include dummy variables in each of these GARCH family models for apprehending the influence of macro and non-macro information around the structural break dates as shown in previous literatures, e.g. Ehrmann and Fratzscher (2004), Basistha and Kurov (2008), Cenesizoglu (2011). Due to data limitation, as mentioned earlier, our sample period is restricted to 2000-2012, therefore, based on Table 6.3e we include one dummy (for structural break in 2005) in return equation and four dummies (for structural breaks in 2000, 2004, 2007 and 2010) in volatility equation. Finally, however, to analyse the reaction of stock returns to news we do not distinguish between different states of the economy.

Table 6.6 presents the reaction of return and volatility on the ten size-sorted, two dividends sorted and sector sorted portfolios to macro and non-macroeconomic information. Results show that all portfolios react to news except eighth-sized firm. Most of the dummies are found not statistically significant up to 10 percent level for these eight-sized firms. In line with arguments from earlier literatures, it is documented in Table 6.6 that information related to monetary policy, fiscal policy, government policy and political uncertainty are significant, however, disproportionately influence each of the portfolio. The sign of their relationship with each portfolio is very important.

The theory on credit channel of monetary policy implies that the effect of monetary policy on firms tends to be asymmetric (Ehrmann and Fratzscher, 2004). Particularly, firms those are in financial constrained are likely to be affected more by monetary policy shocks (see Gertler and Gilchrist, 1994; Ehrmann and Fratzscher, 2004). Here, we can use firm size as a proxy of credit constrained as suggested in Perez-Quiros and Timmermann (2000). A closer look at the reaction of the size-sorted portfolios of DSE to sudden contractionary monetary policy of 2005 reveals important asymmetries between large and small stocks returns (see Panel A). Surprisingly, largest and smallest twenty percent are found statistically significant. However, the impact is greater and negative on smaller firms (-0.06 and -0.09 percent respectively for ninth and tenth size portfolios), whereas, the coefficients are 0.03 and 0.07 percent respectively for first and second size portfolios. These results are consistent with the finding of, e.g. Basistha and Kurov (2008), Thorkecke (1997) and Gertler and Gilchrist (1994). They claim unexpected monetary shocks or tight credit conditions have stronger influence on small firms than big stocks. To explain the possible reasons it is being argued that small firms typically do not have nearly as much as collateral as large firms and will not have the same ability to raise external funds (see Perez-Quiros and Timmermann, 2000), therefore, largely affected by the tight monetary policy.

A similar response we get from portfolio based on dividend yield, firms with low dividend yield has got negative and significant effect in their return due to changes in monetary policy (see Panel B of Table 6.6). The coefficients for monetary policy dummy are respectively 0.02 and -0.03 percent for high-yield and low-yield firms. Although, the difference of coefficient values are not mathematically large but only low-yield firms' value is found significant at the 99 percent confidence level. This is may be because - dividend yield is a good proxy of business conditions (see Fama, 1990), can predict the stock return (see Fama, 1990; Jensen et al., 1996) and has relationship with monetary policy (see Booth and Booth, 1997). In their study, Booth and Booth (1997) report stock returns are generally higher during expansionary monetary policy than restrictive, thus we could expect a negative association of tight monetary policy on portfolio with low dividend yield as their returns are more sensitive. Additionally, it is argued that due to structural changes stock prices should reflect expectations of future dividend, interest rate and risk premia, which in turn depend on macroeconomic conditions (see Campbell and Shiller, 1988; Moore and Wang, 2007), such as, tight or easy monetary policy.

Table 6.6: Impact of macroeconomic news on return and volatility

	α_0	ϑ_1	ω_0	ξ_1	ξ_2	ξ_3	ξ_4	α_1	β_1	γ_1	$\alpha_1+\beta_1$
Panel A: Frim Size											
First	-0.0005***	0.0003*	4.16e-05***	-3.10e-05***	-2.10e-05**	7.18e-06	-7.84e-06	0.2704***	0.6388***	-0.0373	0.9092
	(0.0001)	(0.0002)	(1.04e-05)	(9.80e-05)	(9.94e-05)	(1.09e-05)	(-0.7293)	(0.0415)	(0.0343)	(0.3897)	
Second	-0.0006***	0.0007***	4.53e-05***	-2.91e-05***	-3.38e-05***	-2.73e-05***	-2.28e-05**	0.1762***	0.7152***	0.0221	0.8914
	(0.0002)	(0.0003)	(1.14e-05)	(1.04e-05)	(1.07e-05)	(1.05e-5)	(1.08e-05)	(0.0300)	(0.0338)	(0.0353)	
Third	-0.0005	0.0002	7.68e-06***	1.037e-06	5.50e-06**	2.31e-05***	1.88e-05***	0.1945***	0.7104***		0.9049
	(0.0001)	(0.0002)	(2.16e-06)	(2.07e-06)	(2.96e-06)	(5.22e-06)	(5.35e-06)	(0.0288)	(0.0328)		
Fourth	-0.0003***	-2.98e-05	2.49e-05***	-1.50e-05*	9.72e-06	2.82e-05*	4.77e-05***	0.4586***	0.6033***	-0.2443***	1.1893
	(6.55e-05)	(0.0001)	(8.89e-06)	(8.70e-06)	(1.01e-05)	(1.12e-05)	(1.70e-05)	(0.0713)	(0.0332)	(0.0725)	
Fifth	-0.0004***	-1.73e-05	3.03e-06***	2.80e-07	3.51e-06**	1.44e-05***	1.54e-05***	0.2000***	0.7649***	-0.0303	0.9649
	(0.0002)	(0.0003)	(1.25e-06)	(1.22e-06)	(1.50e-06)	(3.56e-06)	(4.63e-06)	(0.0250)	(0.0244)	(0.0295)	
Sixth	-0.0004***	0.0002	2.79e-06***	3.22e-07	1.20e-06	8.16e-06***	1.49e-05***	0.1995***	0.7730***	-0.0052	0.9725
	(0.0002)	(0.0002)	(1.14e-06)	(1.15e-06)	(1.29e-06)	(2.41e-06)	(5.18e-06)	(0.0240)	(0.0205)	(0.8556)	
Seventh	-0.0005***	0.0002	2.25e-05***	-1.39e-05***	-1.49e-05***	1.94e-05**	2.74e-06	0.3154***	0.6209***	-0.0891*	0.9363
	(0.0002)	(0.0002)	(4.39e-06)	(4.03e-06)	(4.20e-06)	(8.07e-06)	(6.32e-06)	(0.0475)	(0.0372)	(0.0521)	
Eighth	-0.0003***	9.34e-05	3.58e-06*	-1.35e-06	-1.20e-06	1.21e-06	4.07e-06*	0.1726***	0.8747***	-0.1224***	1.0473
	(4.54e-05)	(6.39e-05)	(2.14e-06)	(2.05e-06)	(2.06e-06)	(2.27e-06)	(2.86e-06)	(0.0271)	(0.0143)	(0.0274)	
Ninth	-0.0010***	-0.0008***	6.53e-06***	4.46e-06*	3.78e-06	4.18e-06	-5.12e-06**	0.3346***	0.7016***	-0.2130***	1.0362
	(0.0002)	(0.0002)	(2.62e-06)	(2.74e-06)	(2.93e-06)	(2.78e-06)	(2.56e-06)	(0.0431)	(0.0307)	(0.2130)	
Tenth	-8.02e-05***	-0.0009***	3.10e-05***	-1.39e-05	-2.71e-05**	-2.83e-05**	-3.09e-05***	0.4763***	0.6229***	-0.3171***	1.0992
	(1.15e-05)	(1.18e-05)	(1.25e-05)	(1.23e-05)	(1.24e-05)	(1.24e-05)	(1.25e-05)	(0.1275)	(0.0408)	(0.1281)	
Panel B: Divided Yield											
High yield	-0.0006***	0.0002	6.18e-06***	-3.22e-06*	-1.72e-06	9.20e-06***	7.98e-06***	0.2097***	0.7251***	-0.0430	0.9348
	(9.86e-05)	(0.0002)	(2.01e-06)	(1.86e-06)	(1.90e-06)	(2.77e-06)	(3.31e-06)	(0.0274)	(0.0290)	(0.0324)	
Low yield	-0.0005***	-0.0003***	4.36e-06***	9.32e-07	4.29e-07	6.15e-06***	8.41e-06***	0.3711***	0.5981***	-0.1009*	0.9692
	(8.61e-05)	(0.0001)	(1.40e-06)	(1.35e-05)	(1.47e-06)	(1.88e-06)	(2.92e-06)	(0.0500)	(0.0327)	(0.05780)	
Panel C: Industry											
Financial	-0.0008***	0.0004*	1.00e-05***	-4.77e-06**	1.45e-06	1.87e-05***	1.95e-05***	0.1572***	0.7450***	0.0084	0.9022
	(0.0001)	(0.0002)	(2.55e-06)	(2.24e-06)	(2.86e-06)	(4.76e-06)	(6.80e-06)	(0.0276)	(0.0315)	(0.8045)	
Service	-0.0005***	0.0003	2.68e-05***	-1.80e-05***	-1.31e-05**	1.35e-05	8.96e-06	0.4301***	0.6372***	-0.1493**	1.0673
	(6.54e-05)	(0.0001)	(6.88e-06)	(6.75e-06)	(6.85e-05)	(9.16e-06)	(1.10e-05)	(0.0655)	(0.0281)	(0.0712)	
Manufacturing	-0.0005***	-0.0004***	5.32e-06***	-1.49e-06	-2.49e-06**	1.39e-06*	2.51e-06**	0.2418***	0.7292***	-0.0593	0.9710

	(0.0001)	(0.0002)	(1.37e-06)	(1.14e-06)	(1.24e-06)	(1.57e-06)	(1.96e-06)	(0.0347)	(0.0291)	(0.0378)	
Miscellaneous	-0.0004***	0.0001*	4.94e-06***	-1.26e-06	-1.08e-06	1.72e-06	-2.82e-06	0.2153***	0.6733***		0.8886
	(4.61e-05)	(5.84e-05)	(2.04e-06)	(2.03e-06)	(2.04e-06)	(2.13e-06)	(2.04e-06)	(0.0318)	(0.0264)		

Note: The table reports results of GJR-GARCH (1,1) model for each of the category following equation – xiii, xiv and xv. There is no lag value is applied in GJR-GARCH (1,1) model, as our filter return series don't find serially correlated in Table 2. In each of the model, we include dummy variables in return and volatility equation as a proxy of structural breaks respectively (as reported in Table 3e) to investigate the influence of macroeconomic news on each portfolio created on different firm characteristics. However, for third sized portfolio and miscellaneous sector we use symmetric GARCH (1,1) model [$R_t = \alpha_0 + \varepsilon_t, h_t = \omega_0 + \beta_1 h_{t-1} + \alpha_1 \varepsilon_{t-1}^2$], since in Table 2, we don't get joint test of Engle and Ng (1993) statistically significant up to 10 percent level. Standard errors are in brackets. ***, ** and * are significant at 1%, 5% and 10% levels.

In Panel C, industries are showing a fair amount of heterogeneous impact to monetary policy changes in 2005. We see returns of financial, manufacturing and miscellaneous sector are significantly affected by the information, whereas, coefficient for service sector is not statistically significant. Results indicate, financial and miscellaneous sectors of DSE are positively (0.04 and 0.01 percent) and manufacturing industry is negatively (i.e. -0.04 percent) influenced by the sudden contractionary monetary policy of 2005. As noted in previous section, from late 2004 till early 2005, economy is in expansionary mood, government reduces its' debt to give more opportunity for private sector. Nonetheless, overall the economic picture is not very promising - GDP growth has lowered, commodity price in international market is increasing and creating pressure on balance of payment, remittance drops, topped on the Corruption Perception Index (see Riaz, 2005). Thus, central bank is under pressure to control inflation and apply several monetary instruments, such as, increasing CRR, SLR and higher rate of treasury bill/bonds. That affects most of the industries and their stock price in DSE.

Our results reported in Panel C of Table 6.6 are consistent with earlier literature. For example, Ehrmann and Fratzscher (2004) assert cyclical and capital-intensive industries, such as, basic materials, industrial and financial sectors are affected most by monetary policy shocks. Peersman and Smets (2005) and Dedola and Lippi (2005) find that the impact of monetary policy is stronger in industries that produce durable goods. In particular, the impact on industries producing durable goods is almost three times higher than the impact on non-durable goods (see Peersman and Smets, 2005). In addition, firms have greater financing requirements (working capital) and smaller borrowing capacity (i.e. smaller firm size and leverage ratio) also influenced largely by monetary policy (see Dedola and Lippi, 2005).

In volatility equation, the sign and magnitude for each of the macroeconomic information are different across the firms' characteristics (see column five to eight of Tale 6.6). Results show that the expansionary fiscal policy in 2000 and political uncertainty in 2004 and 2007 do not homogenously influence size, divided and sector-sorted firms. From Panel A, large and mid-size portfolios are significantly and negatively (see column five) affected by the government decision of financing expenditure through debt from commercial banks. Rashiduzzaman, (2001) reports the size of the public debt is increased to 31.3%, mostly borrowing from commercial banks and thus money supply increases to 18.6% in 2000 from 12.8% in 1999. We find a similar response in dividend yield-shorted portfolios, only the coefficient of high-yield firms (see Panel B) is statistically significant and it is negative too. Combined, the results indicate possible 'crowding out' effect, that means government borrowing creates competition for private savings where business firms suffers from lack of credit opportunity (see Fisher, 1998). In addition, smaller firms always have limited access to bank loans (see Perez-Quiros and Timmermann, 2000) and hence, 'crowding out' may influence larger firms strongly.

Out of four categories of industry, the volatility of financial and service sector is found significantly and negatively influenced by the expansionary fiscal policy (see Panel C). From DSE, most of the firms in topped 20% size-sorted portfolios and high-yield firms are commercial banks, other non-bank financial institutions (NBFIs), fuel & power, and telecommunication. That means either they belong in financial or in service sector, therefore, findings in all three panels (Panel A, B and C) are in line with each other. Furthermore, in Bangladesh treasury bills/bonds are only sold to commercial banks, which could limit banks' opportunity to investment in capital market and affect the stock price negatively. This could also lead to a *ceteris paribus* increase in aggregate demand of funds and short-term interest rate, which further lead to reduction of expected returns and the price of stocks. Finally, agents' perception about the impact of current fiscal policy on the sustainability of government debt can also be important to explain the effect of fiscal shocks on financial variables (Ardagna 2009). Afonso and Sousa (2011) also report that government spending shocks have a negative effect on stock price, yet, only government revenue shocks contribute to an increase of volatility. Contrary, in our study, we see government spending through borrowing can influence the volatility.

The extent of influence of political uncertainty that happened in 2007 is more comprehensive on the volatility of DSE than the similar event in 2004 (see columns six and seven). In 2004, among size-sorted portfolios the volatility of top 20 percent, seventh and lower 10 percent are negatively, however, third and fifth are positively affected by the political risk, which are also statistically significant. But no effect is found significant for variance of dividend yield and both service and manufacturing sectors' volatility is negative influenced. On the other hand, in 2007 the return variations of most of the size-sorted and both divided yield-sorted firms are affected by the political risk. Except top 10 percent, next 60 percent (i.e. second to seventh) and lowest 10 percent firms' volatility is found significantly affected by political uncertainty. Interestingly, we see the impact of political risk on variance in 2007 are positive except second and lowest ten percent firms. Surprisingly, financial along with manufacturing sector are also positively, which are significant as well, influenced by the non-macro event in 2007.

From these two events, we can conclude that investors of DSE behaved differently to political uncertainty in 2007 than 2004. Bangladesh was in a state of emergency in January 2007 and then new CG (i.e. Caretaker Government) backed by army re-establishes the confidence of economy and therefore, market starts to gain (see Figure 6.1). In 2004, however, due to political violence, religious militancy, governments' vindictive attitude and opposition party's insurgency investors are in doubt about economic future, hence, market starts to fall from early 2005. In Figure 6.2 it is also documented that the depth of market moves to volatile regime frequently in 2004 than 2007. This evidence is reflected in column nine as most of coefficients are positive for 2007 than 2004. Earlier literature, such as, Diamonte et al. (1996), Bilson et al. (2002) and Chau et al. (2014) report that other than monetary and fiscal policy, political risk can influence the market return and impact is more significant for emerging market than developed market, which is very much consistent with our results. For various firm characteristics, Bekaert et al. (2011) claim that a country's political risk profile is statistically and economically significant in explaining the variation in segmentation.

Finally, information that is included in volatility equation is related to the macroeconomic scenario of 2010. It is documented in previous section that the macro and non-macroeconomic dynamics of 2010 are completely different from any earlier dates. Market seems more stable, the regulatory bodies have become more vigilant and concentrated, significant improvement happens in information flows and settlement procedure, more transparent and regular submission of financial statements by the companies. Unfortunately, within such a situation, due to some macro and non-macro factors DSE faces a huge plunge in price. The expansionary monetary policy couple with increase in foreign remittance, government decision about black money and lack of other investment alternatives make huge amount of liquid funds available in the market. Therefore, individual and institutional investors (particularly, banks and NBFIs) take the opportunity of higher returns from equity market (see Table 6.4b and 6.4c) and invest heavily in stocks. In some instance, commercial banks invest more than 80% of their deposits. Over time market becomes over heated, stocks price cross many times of its fundamental value. To avoid the financial crisis, central bank suddenly takes contractionary policy – increase CRR and SLR and issue order for commercial banks to adjust their balance sheet. Price starts to fall and Bangladesh see historic drop in index; regulatory failure and lack of coordination between regulatory institutions also responsible for this surge and plunge.

From column eight of Table 6.6, we see the event of 2010 affect the volatility of all most every firms listed in DSE. Results show that 80% of size-sorted firms are influenced by this macro and non-macroeconomic information. Surprisingly, the coefficient is not statistically significant for first and seventh category of firms (see Panel A). In case of dividend yield-sorted firms, both the coefficients are significant at 99 percent confidence level and they are positively influenced by the event of 2010 (see Panel B). Among industries, the volatility of financial and manufacturing sectors are found significantly (i.e. at 1 and 5 percent level respectively) affected. The interdependence between market and the events of 2010 certainly highlight the influence of monetary policy as mentioned earlier but also focuses on socio-political aspects (see Alexakis and Petrakis, 1991), influence of government policy (see Pastor and Veronesi, 2012) and changes in regulations, regulatory requirements and trading requirements (see Bengtsson et al., 2014; Bekaert, 1995). For example, Alexakis and Petrakis (1991) assert that the behaviour of the share price index is significantly affected by alternative investment opportunities at home and socio-political factors. Further, Pastor and Veronesi (2012) and Bengtsson et al. (2014) claim that the government plays a central role in capital market by changing rules and regulations directly or through SEC. In Bangladesh, similar to those arguments, government allows investment of black money in to stock market, SEC fails to manage book building method, and central bank fails to oversight the excessive involvement of commercial banks in stock market.

Table 6.6 also reports the value of α_1 (or ARCH), β_1 (or GARCH) and leverage effect (γ_1) for each of our GARCH family models in column nine to eleven. The ARCH and GARCH components are all found statistically significant at 99 percent level of confidence. The leverage effect has negative and significant for fourth, seventh, eighth, ninth and tenth size-sorted, low dividend-yield sorted and service sector portfolios. The positive shocks imply a higher next period conditional variance than negative shocks of the same sign. In the final column of Table 6.6 represents the sum of α_1 and β_1, results are around to one, indicates persistent effect of shocks to the conditional volatility. We also check the specification test results for all these GARCH models (which are not reported here). Based on the Ljung-Box Q statistics for serial correlation in residual and square residuals, neither of the two are significant up to 10 lags, that means residuals are white noise. Further, Engle's (1982) ARCH-LM test also indicates that there is no ARCH effect in the residuals up to 10 lags; therefore, models are successfully captured the volatility clustering.

6.5 Chapter Summary

In this study, we have investigated the timing of structural breaks in stock market with the timing of macroeconomic (i.e. monetary, fiscal and other government policy) and non-macroeconomic (i.e. political uncertainty, national election and regulatory changes) information. For detecting the structural breaks endogenously and linking them with domestic information, we start with the pre-whiting process of Gulen and Mayhew (2000) and Chau et al. (2014) by estimating an autoregressive model to remove the effect of worldwide price movement and predictability associated with day-of-the-week effects. Surprisingly, result indicates little evidence for the impact of regional and world market index on DSE, supporting the argument of strong home bias claimed in French and Poterba (1991), Baxter and Jermann (1997), and Bailkowski et al. (2008). Therefore, it is a very attractive diversification play for foreign investors. Rintoul (2012) asserts, foreign investors, such as mutual funds, are starting to look more closely at Bangladesh, e.g. in 2011, funds globally allocated $4.8m to Bangladesh.

Then we apply general framework of Bai and Perron (1998, 2003a, b) and determine unknown structural breaks in return and conditional variance using sequential procedure (i.e. $\sup F_T(\ell + 1|\ell)$) recommended for empirical analysis. There are two and five break points have been identified in returns and conditional variance respectively. Linking those with macro and non-macro information, we find the break dates in equity returns and volatility of DSE are significantly influenced by the timing of monetary policy, fiscal policy, political uncertainty, government policy, national election and electoral system. Specifically, this market is highly sensitive to money growth policy, government debt policy and political risk as documented in previous literature (e.g. Beltratti and Morana, 2006; Ardagna 2009; Chau et al. 2014). For example, Diamonte et al., (1996) assert, in emerging market, if one can forecast changes in political risk, one can forecast stock returns. However, the impact of electoral system (i.e. Caretaker Government in Bangladesh) is new evidence from emerging market, in line with Bialkowshi et al. (2008). Timing of this system improves investors' confidence to the economy and changes their investment behaviour in stock market.

Our results appear to be robust in Markov Regime Switching GARCH model. Based on Davis (1987) upper bound *p*-value along with other specification test DSE fit with two state models. The normality assumption of MS-GARCH successfully captured the empirical kurtosis. MS-GARCH (1) and one state of MS-GARCH (3) are found nonstationary. The two-state model has moderate sum of $\alpha + \beta$ in second regime, but we do not observed a 'switch' of volatility persistent from the GARCH structure to the Markov change, compare to single regime (see Hass et al., 2004 for detail discussion). Nevertheless, the smoothed probabilities provide meaningful turning points, which suggest that switching between regimes seems to be linked with country specific macro and non-macroeconomic events. We see volatility surge in two different periods – 1994-2002 and 2004-2012, however, market enters into more turbulent state since late 2004 compare to previous period.

In final section, we document completely new evidence on the ability of macro and non-macro information to influence the equity price based on firm characteristics – size, dividend yield and sector. Earlier researchers show how macroeconomic news (i.e. monetary, fiscal and other macro policy information) influences the size, dividend yield and sector-sorted firms, e.g. Gertler and Gilchrist, 1994; Ehrmann and Fratzscher, 2004; Dedola and Lippi, 2005; Basistha and Kurov 2008. Yet, empirical substantiations related for the interdependence between firm characteristics and non-macroeconomic information (i.e. political risk, national election, regulatory changes etc.) are rare, particularly from emerging market. Therefore, this study fills that gap in literatures.

We use GARCH family models to account for nonsynchronous trading, conditional heteroskedasticity and asymmetric volatility response. Results present heterogeneous influences on each of the portfolios, for example, largest 20% and lowest 20% of size-sorted firms are more sensitive to any information; smaller firms are significantly affected by monetary policy than larger firms (see e.g. Perz-Quiros and Timmermann, 2000); macroeconomic event of 2010 has greater impact on overall market than other events; between political uncertainty of 2004 and 2007, later event influence more comprehensive; financial and manufacturing sectors are more subtle to both macro and non-macro news; volatilities are persistent and there are asymmetry in volatility.

Based on overall analysis, we can summarize a few other characteristics for DSE. First, financial sector is mostly affected by the information under this study; which is probably due to their strong involvement with the capital market and methods of their business (i.e. Islamic finance). Most of the banks and non-bank institutions of Bangladesh practice banking with Islamic Sharia and it is documented in Chau et al. (2014) that volatility of Islamic stock market index raises during political turmoil. Second, changes in exchange rate regime (i.e. from pegged to floating system in 2003) do not change the price behaviour significantly. However, in earlier studies, e.g. Hau and Rey (2006), Kanas (2002) report the significant impact of exchange rate system on price movement. Third, the impact of CRR is stronger to control the excess money supply in Bangladesh. Particularly, the effect of raising the CRR has a relatively higher impact on investment, such as in capital market. A similar finding is also evident in Were et al. (2014). They examine the effectiveness of monetary policy in Kenya based on policy simulations from a structural macroeconomic model and report higher influence of CRR on aggregate demand of money.

Third, government intervention gives mixed results in Bangladesh. It is claimed in Leblang and Mukherjee (2005) that government attempts to influence stock market to enhance their electoral process. Similarly the government of Bangladesh allows the black money into stock market to satisfy the investors, which initially increases the demand of stocks and the price but, unfortunately, that growth does not sustain in the long run. In addition, government pressure on the central bank and SEC to stabilize the market after plunge of 2010 did not work. Fourth, a huge inflow of foreign remittance and expectation of earing higher return from capital market contribute to an unexpected growth of investors in DSE and also the size of the market. Supporting this idea, Cooray (2012) claims from 94 non-OECD economics that migrant remittance contribute to increase the size and efficiency of the financial market. Unfortunately, in Bangladesh, remittance only raises the size of the market but not the efficiency. Finally, over the time DSE attracts foreign portfolio investments, particularly since the market liberalization of 1990, that improves the price setting process and therefore, specific risk become priced in the market as mentioned in Bekaert et al., (2002).

Our findings raise a number of policy related issues. Such as, in Bangladesh, stock exchange members are simultaneously brokers and dealers and this faulty mechanism has provided brokers with ample scope to exploit investors. Therefore, DSE needs to take appropriate measures for demutualisation in the market through enforcement of appropriate regulations by putting in place restrictions so that owners of brokerage houses cannot become members of DSE management board. This operational aspect is also emphasized in Alexakis and Petrakis (1991). Need good coordination among regulatory bodies – Bangladesh Bank and SEC, while setting policy for money and capital market respectively. Because these two markets are interdependent and any decision from regulators affect both of them via demand and supply channel. The supply side of the market could be reinforced through off-loading shares in stock market by the public enterprises to meet their finance requirements. Market needs better execution of margin loans and lock-in period policy.

Overall, these findings complement to the growing literatures on the relationship between asset price and information, providing evidence on both macro and non-macroeconomic variables other than company specific factors. The lesson can help local and foreign investors, as well as, other emerging and developing countries to deal with their own financial market.

Chapter 7:
Liquidity and Macroeconomic Management

7.1 Introduction

Liquidity in a financial market is the ability to buy or sell large quantities of an asset quickly and at a low cost (Chordia et al., 2005) around a price close to its intrinsic value. Liquidity services serve to "grease to wheel" of the economy by limiting the impact of transaction frictions on the allocation of resources (Jaccard, 2013). This fundamental concept of finance has attracted lots of attention in recent literature (see Goyenko and Ukhov, 2009; Goyenko et al., 2009; Fernández-Amador et al., 2013). Similarly, the role of monetary and fiscal policy to stabilize the financial market (see Almunia et al., 2010) has become another most studied area in contemporary finance research. Particularly, their importance is highlighted since the recent financial crisis, when due to absence of liquidity (Söderberg, 2008; Næs et al., 2011) world faces dramatic fall in stock markets (Blanchard et al., 2010) and all over the world central banks and government have adopted massive monetary and fiscal stimulus to ease the financial markets by raising liquidity (see Woodford, 2011; Fernández-Amador et al., 2013; and Gagnon and Gimet, 2013).

The role of liquidity for stock market and economic development is interesting. Such as Jaccard (2013) finds a small negative liquidity shock can generate a deep recession and a stock market crash. Even during the recent global recession (i.e. 2008-09) the sharp contraction in output was mostly due to a negative liquidity shock originating in the financial sector, he adds. The economic significance of market liquidity is also stressed in Næs et al. (2011). They assert that the stock market liquidity is a very good "leading indicator" of the real economy. In their study findings for the US market document that the market liquidity contain leading information about the real economy, even after controlling for other asset pricing predictors. Harvey (1988) explains one of the possible reasons for this better predicting power of equity market liquidity is that stock price contains a more complex mix of information that blurs the signals from stock returns. In this line of thought, Levine and Zervos (1989) provide cross-country evidence of strong connection between stock market liquidity and both current and future rates of economic growth. For financial markets, liquidity measures are used as proxies for investors' liquidity and transaction cost; the assumption is that the available liquidity proxies capture the transaction costs of market participants (Goyenko et al., 2009). While, Choi and Cook (2006) argue that the unpredictability of market liquidity is an important source of risk for equity investors.

Theoretically, the liquidity of equity market can be influenced by the monetary and fiscal policies. Since the cost of financing and perceived risk of holding securities are influenced by those macroeconomic policies, therefore, should affect equity market liquidity. Based on inventory paradigm stocks are expected to be more liquid if market participants can cheaply finance their holdings and perceive low risk of holding those assets (see Fernández-Amador et al., 2013 for details discussions). In this vein, Brunnermeier and Pedersen (2009) develop a model by linking asset's market liquidity and traders' funding liquidity. They argue, there is a spiral relationship such as, in one hand traders' funding, i.e. their capital and margin requirements, depends on the assets' market liquidity and on the other hand traders provide market liquidity, and their ability to do so depends on their availability of funding. Easy or tight macroeconomic policies, therefore, restrict the traders' funding opportunities and influence market liquidity. Previously with many other, Easley and O'Hara (1987) highlight the information-based approach, which suggest how information affect price setting behaviours of market makers and thus nature of market liquidity. Monetary and fiscal policies are an example of information those affect equity market other than firm specific news (see Birz and Lott, 2011). Finally, due to business cycle movement, we could expect a considerable impact of economic policy on stock market liquidity, where the real economy might serve as the transmission channel (Fernández-Amador et al., 2013).

Surprisingly, on the other hand, there are only few empirical studies available on the relationship between market liquidity and macroeconomic management policies. Their results are not conclusive either. In a seminal study, Chordia et al. (2001) find short-term interest rates significantly affect liquidity for the NYSE-listed stocks. Similarly, Goyenko and Ukhov (2009) also find strong relationship between monetary policy and liquidity for the US markets (NYSE and AMEX). Strong association is further documented in Fernández-Amador et al. (2013) for Germany, France and Italian stock markets. However, for a different time periods Fujimoto (2003) reports mixed influence of non-borrowed reserve and federal funds rate on market liquidity for NYSE and AMEX stocks. In this vein, Söderberg (2008) studies the impact of fourteen macroeconomic variables (including several monetary instruments) on liquidity of three Scandinavian stock exchanges (i.e. Denmark, Norway and Sweden) and provides mixed results. On the contrary, Chordia et al., (2005a) detect monetary policy has modest ability to forecast equity market liquidity for the US market, particularly during the financial crisis. Finally, for the Japanese stock exchanges Choi and Cook (2006) find no effect of money-market variables on market liquidity but claim there is a strong feedback effect between them.

Despite the huge importance of market liquidity and its association with macroeconomic policies, these few academic studies empirically investigate their dynamic linkage. Besides, those papers only examine the influence of monetary policy instruments and provide evidences from developed markets. Until, Gagnon and Gimet (2013), none of the researchers examine the effect of fiscal policy on market liquidity. In this study, Gagnon and Gimet (2013) take data from the US, Euro zone and Canada to explore combine impact of standard monetary and budgetary policy on market liquidity during the credit freeze crisis. They report monetary policies mostly have domestic effect (in North America), government spending shocks can facilitate access to credit for the private sectors (in Europe and Canada) and foreign budgetary shocks (i.e. US and European) have international spillovers. Still, no evidence is available from emerging stock markets on this association; while they have different regulatory and institutional set up than developed markets and liquidity shock is particularly strong (see Bekaert et al., 2007). Bekaert et al. (2007) further mention that the focus on emerging markets should yield powerful tests and useful independent evidences. In addition, the relationship of market liquidity with fiscal policy is ambiguous.

In this chapter, therefore, objective is set to investigate the influence of monetary and fiscal policy variables on the liquidity of an emerging stock market. That means to examine whether monetary policy of central bank and fiscal policy of government are common determinant of stock liquidity. For example, when the central bank pursues an expansionary monetary policy, the increase in funds could cause higher order inflows into stock market and potentially changes in liquidity (see Chordia et al., 2005). Moreover, due to any systematic risk or information shocks (e.g. macroeconomic policy uncertainty) investors probably could change their asset holdings, such as, between stocks and other financial securities. In first step, therefore, we observe the impact of standard monetary and fiscal policies on the aggregate stock market liquidity. In second step, we extend our analysis to look deep into the influence of those policies on the liquidity of individual and sectoral stocks.

In addition, within these objectives we examine whether the effect of macroeconomic policy depends on the size of firms. Because, in earlier study, Amihud (2002) finds that small stocks are more responsive to illiquidity shocks and large firms become more attractive when aggregate liquidity decline. However, in contrast, Fernández-Amador et al. (2013) report smaller firms are more responsive to liquidity shocks and liquidity providing effect of, e.g. a loose monetary policy is stronger for larger firms. In this vein, Næs et al. (2011) assert that the informativeness of stock market liquidity is highest in smaller firms, which are the least liquid. In this study we want to further investigate this linkage for firms listed in emerging stock markets.

There are several significances of this study. First, the influence of market imperfection on security pricing has long been recognized, however, the vast majority of equilibrium asset pricing models do not consider trading and thus ignore the time and cost of transforming cash into financial assets or vice versa (see Chordia et al., 2005). Liquidity shocks are a potential channel through which asset prices are influenced by liquidity, therefore, Chordia et al. (2005) assert this has attracted a lot of attention from traders, regulators, exchange officials and academic. Findings of This study will then add to the existing limited empirical evidences.

Second, the commonality observed in existing literature suggests the assumption that there needs to be at least one common factor that simultaneously determines the liquidity of all stocks in a market, which might be monetary policy (see Fernández-Amador et al., 2013). In vein, Fujimoto (2003) argues the existence of liquidity comovement across individual stocks suggests that some underlying economic forces are responsible for the dynamic of the systematic component of liquidity. Therefore, a sensible next step would attempt to identify specific macroeconomic influences that correlate with time series variation in liquidity (Chordia, 2005). This study will examine the influence of not only monetary policy but also fiscal policy variables on stock market liquidity. In a recent paper, Gagnon and Gimet (2013) claim that budgetary policy has impact on key economic and financial indicator of liquidity. Even in earlier studies, such as, Spilimbergo, Symanky et al. (2009), Blanchard et al. (2010), Woodford (2011) mention about the fiscal stimulus package and its influence on the financial market by injecting liquidity into the banking sector and other distressed sectors.

Third, so far we know very little about the relationship of monetary policy (see Chordia et al., 2005; Fernández-Amador et al., 2013) and budgetary policy (see Gagnon and Gimet, 2013) on stock liquidity. Fujimoto (2003) claim that despite the progress in understanding the effect of systematic liquidity, it remains largely unknown what factor is responsible for the time variation in liquidity, and to what extent. Besides, it is also important to understand the sources of liquidity variation given their pervasive effects on investors' overall welfare. Similarly, Choi and Cook (2006) assert that the unpredictability of market liquidity is an important source of risk for investors. Therefore, identifying the macroeconomic determinants for liquidity of this market will help both local and international investors to create their portfolios. Fourth, this study provide firm and industry level evidences on the linkage of market liquidity and macroeconomic management policy variables. Earlier studies have focused on individual stocks, but this is one of the first initiatives to see the impact of monetary and fiscal policy on different sectoral stocks' liquidity.

Finally, all the existing literatures on this area focus on developed economies, such as, Japan, Canada, Germany, France, Italy, the UK and US. This study, on the other hand, takes a novel initiative to explore the relationship between macroeconomic management and liquidity for an emerging equity market which is Dhaka Stock Exchange (DSE), the main exchange of Bangladesh. Interestingly, the market has potentially different economic and institutional characteristics than other emerging and developed markets. For example, (i) the market is largely dominated by individual investors; (ii) it has low integration with world markets; (iii) it is significantly influenced by political uncertainty; (iv) in this economy stock market performance is considered as an indicator of political success and hence, government frequently intervene into market through central bank and budgetary policies to ensure their core vote; (v) there is a small scale bond market but there are strong alternative investment opportunities (e.g. national saving deposit, wage earners' bond), however, the country has predominantly Muslim population and according to the Islamic faith, *riba* (usury) is prohibited. Thus many Muslim investors consider any fixed interest savings instruments as being unacceptable (see Islam and Khaled, 2005). Given all these facts Bangladesh is an ideal emerging market to investigate the impact of macroeconomic policies on market liquidity and we could expect a positive concurrent relationship between these variables. For example, during the equity market crisis, Bangladesh government allow 'Black Money' (undisclosed earnings) into stock market, Security Exchange Commission (SEC) increases the margin loan, and central bank defers the deadline to adjust commercial banks' excessive investment into market. Indeed, all these have been done by the central bank and the government to ensure enough liquidity in equity market. In addition, the sample period in this study includes both bull and bear market (e.g. 2009-10 and 2010-11 respectively) for DSE. Thus, the study could provide detail behavioural dynamics of liquidity and trading activity for this stock market. Since, rising market attract more investors and liquidity, a prolonged bear market, on the other hand, could be subject to falling liquidity (see Chordia et al., 2001) and investment.

The rest of the study designs as follows: section 7.2 reviews the related literature; methodological framework and discussion on the data is given in section 7.3; empirical results are reported in section 7.4 and section 7.5 summarizes the findings and makes concluding remarks.

7.2 Literature Review

The relationship between liquidity and financial markets is well documented in previous literature. For example, theoretical arguments to show the influence and importance of liquidity on financial markets are put forward by Amihud and Mendelson (1986). Within this theoretical set up and alternative test Datar et al., (1998) further suggest that liquidity plays a significant role in explaining the cross-sectional variation in stock returns. Jacoby et al., (2002) report a direct link of liquidity with corporate cost of capital. Amihud (2002) show that liquidity predicts expected returns in the time series. Similarly, Chordia et al., (2002) shed further light on the tripartite association among trading activity, liquidity, and stock market returns. Pástor and Stambaugh (2003) find that expected stock returns are cross-sectionally related to liquidity risk. Similarly, for Treasury bond market, Fleming and Remolona (1999) analyse the price formation and liquidity for US Treasury Bond around the scheduled macroeconomic announcement. Later, Fleming (2003) alone also estimates and evaluates a comprehensive set of liquidity, such as, trading volume, trading frequency, bid-ask spreads, quote sizes, trade sizes, price impact coefficients, and on-the-run/off-the-run yield spreads for US treasury securities. In this line of thought, Brandt and Kavajecz (2004) examine the relationship between liquidity, order flow and the yield curve. The analysis is also extended into foreign exchange market by, e.g. Evans and Lyons (2002). They find that public news have higher impact on price and liquidity in this market, which further depends on trading volume and return volatility.

Besides, only a few empirical studies are available that examines the relationship between monetary policy and aggregate liquidity of market. Even their findings are to some extent ambiguous (Fernández-Amador et al., 2013). In this vein, Chordia et al. (2005) claim earlier works have only examined the effect of monetary policy and funds flow on financial markets, but have not directly addressed their impact on liquidity. For example, Fair (2002), Beltratti and Morana (2006) and Rangel (2011) among many others document that changes in stock price is caused by the monetary policy shocks. Conversely, Edelen and Warner (2001), Watson and Wickramanayake (2012) and Jank (2012) report that there is positive relationship between changes in price and aggregate funds flow into equity market. However, up till now there is little evidence documented to link monetary policy and market liquidity.

One of the possible reasons for not exploring the relationship between liquidity and macroeconomic factors in the past is lack of reliable market-wide liquidity measures that extend over sufficiently long periods (see Fujimoto, 2003). However, using NYSE-listed stocks over an 11-year period, Chordia et al. (2001) examine how aggregate market liquidity varies over time.

This is the first study to include short- and long-term interest rate and major macroeconomic announcements as explanatory variables with default spreads, market volatility, day of the week, and holiday effect. They construct time series indices of market-wide liquidity measures and market-wide trading activity for the sample period from 1988 to 1998. Results indicate short-term interest rates and the term spread significantly affect liquidity as well as trading activity. In addition, trading activity and market depth increase prior to scheduled macroeconomic announcement of GDP and the unemployment rate, whereas they fall back toward normal levels on the announcement day itself. Over all, the determinants investigated in this study explain 18 and 33 percent of daily changes in liquidity and trading activity.

Fujimoto (2003) is also one of the first papers where market liquidity is included into macroeconomic framework. He argues that according to the inventory risk in microstructure literature, changes in economic fundamentals may alter the perceived risk of holding inventory across stocks and hence affect liquidity on the aggregate level. This study constructs three different proxies for monthly aggregate liquidity and applies vector autoregression to investigate the dynamic relation between various macroeconomic factors and liquidity for NYSE and AMEX over a period from 1965 to 2001. For the first half of the sample period (i.e. 1965-1982), market liquidity improves significantly to a positive shock in non-borrowed reserves, whereas it decreases with an increase in the federal funds rate. Nevertheless, during the latter half of his study (i.e. 1983-2001), liquidity has become less responsive and more resilient to both market-level and economy-wide shocks. That means, neither the non-borrowed reserves nor the federal funds rate are able to predict market liquidity at that time.

In an interesting and comprehensive paper, Chordia et al. (2005) examine the influence of monetary stance of central bank on joint dynamics of liquidity, trading activities, returns and volatility in stock and US Treasury bond markets. They assert that there is a good reason to believe that liquidity in the stock and bond markets covaries. It is due to, they argue, strong volatility linkages between them, which can affect liquidity in both markets by altering the inventory risk borne by market-makers agent. In addition, their liquidity may interact via trading activity. For example, they explain, a negative shock in stocks often causes a 'flight of quality' and thus resulting outflow from stocks into Treasury bonds may cause price pressures and also impact stock and bond liquidity. Using data from 17 June 1991 to 31 December 1998, they link micro-structure liquidity with macro-level liquidity as embodied in money flows. Results indicate, first, the time-series properties possess similarities, such as common calendar regularities. Second, the correlations in liquidity and volatility innovations between bond and stock market are positive and significantly different from zero. Third, innovations to stock and Treasury bond flows play a key role in forecasting overall market liquidity. Finally, for monetary policy they find an unexpected loosening of monetary policy, as measured by a decrease in net borrowed reserves, is associated with a contemporaneous increase in stock liquidity and has modest ability to forecast liquidity during crisis time.

On the contrary, Goyenko and Ukhov (2009) document very strong evidence for the US market that monetary policy predict liquidity. They also investigate the joint dynamics of stock and Treasury bond market, however, for longer time span from 1962 to 2003. They report these two markets are not only linked via volatility but via illiquidity as well. Moreover, there is strong lead-lag relationship and bidirectional Granger causality exist between illiquidity of the two markets. For monetary policy, illiquidity of bond market is mostly affected without a lag, while stock illiquidity reacts to monetary shocks with a lag. A tightening monetary policy, as indicated by positive shocks to the federal funds rate and negative shocks to non-borrowed reserves, is shown to increase stock market illiquidity. Surprisingly, they find illiquidity spillover between these markets and bond illiquidity plays an important role as a channel for transmitting monetary shocks into the stock market. Overall, their findings are different from Chordia et al. (2005), since stock and bond market are integrated via liquidity and monetary policy has strong predictive power over financial market illiquidity.

Other than the US financial markets, researchers also provide evidences from international markets on the linkage between macroeconomic management and stock market liquidity. For example, Choi and Cook (2006) examine the interaction between stock market liquidity and the macroeconomy of Japan during the deflationary period from 1975-2001. They find cross-sectional evidence that firms with illiquid balance sheets and illiquid markets for their equity are more exposed to liquidity shocks. In addition, they find that market liquidity is significantly affected by shocks to output and index (i.e. Topix) but not by shocks to money-market variables, call rates, and real balance. However, there exist strong feedback effects that mean exogenous liquidity shocks seem to have a persistent negative effect on money demand and interest rate, as well as some short-term effects on output. Overall, they recognize that providing liquidity to financial markets during panics is an important part of central bank management.

For three Scandinavian stock exchanges (i.e. Denmark, Norway and Sweden), Söderberg (2008) investigates fourteen macroeconomic variables and their relationship with market liquidity over a sample period from January 1993 to June 2005. He evaluates both the in-sample and out-of-sample forecasting ability of those macroeconomic variables to forecast liquidity. He finds that forecasts of liquidity improve significantly with policy rate on Copenhagen, broad money growth on Oslo, and short-term interest rate and net flow from mutual funds on Stockholm. However, no evidence is documented that long-term yield, term spread, default spread, return and volatility of bond market, inflation and funds flow from foreign investors can improve the forecast of monthly changes of liquidity for any of the Scandinavian equity markets. Altogether, he suggests we cannot reject that the liquidity is either affected by the money and bond market, monetary policy and funding liquidity, economic growth, or investor flows.

In a recent study, Fernández-Amador et al. (2013) argues that the recent financial crisis has been characterized by unprecedented monetary policy interventions of central banks with the intention of stabilize financial markets and the real economy by rising liquidity. In This study they thoroughly investigate three different markets (Germany, France, and Italy), seven measures of (il)liquidity (capturing trading activity, price impact and transaction cost) and two monetary policy variables (base money growth and Euro Overnight Index Average interest rate or simply EONIA). For aggregate liquidity they use vector autoregression (VAR) model, but also at the micro level for individual stocks they apply panel regressions. For German market the Granger-causality test results favour the hypothesis that the European Central Bank monetary policy causes the aggregate stock market liquidity and illiquidity, however, they find little evidence for a reverse relationship. For deeper understanding they extend the VAR system to impulse responses and variance decomposition. Impulse responses indicate that overall market liquidity increase with the increase in base money growth and decrease in response of higher EONIA rate. The major conclusions they extract from variance decomposition are that base money growth has greater influence than EONIA and there is a lag impact of monetary policy, which is stronger than other macroeconomic variables.

In their panel estimation for Xetra trading system of Germany, they find an expansionary monetary policy triggers an increase in individual stocks' liquidity and decrease illiquidity. In particular, a loose monetary policy is even stronger for larger firms but smaller firms seem to be more responsive to liquidity effects of monetary policy. Yet, any such restrictive policy tends to be followed by an increase in illiquidity measures. These observations are in line with a scenario in which monetary policy affects funding costs of firms, especially in bank dependent system. Remarkably, they find that similar to the VAR results (i.e. variance decomposition) the economic significance of the influence of the two monetary policy variables on stock liquidity is higher than the impact of the remaining macroeconomic variables, such as inflation and industrial production. The Italian and French stock markets seem to be comparable to the Xetra trading system. The distributions of the cross-sectional liquidity and illiquidity measures have very similar properties and bivariate correlations not only have equal signs, but are also similar in magnitude across markets. However, for aggregate market liquidity the impulse responses of VARs show a bit weaker evidence for an influence of the ECB (European Central Bank) policy interventions on Milan and Euronext Paris stock exchange.

Following the financial crisis of 2008-09, the role of central bank and budgetary policies to influence the stock market have attracted a lot of attention from academics, such as Belo and Yu (2013), Belo, Gala and Li (2013), Pástor and Veronesi (2012). They show the effect of tight and easy fiscal policy shocks related to government spending, deficit financing, tax policy, public sector investment etc. on capital markets. In particular, the role of government policies in raising the access to credit for firms and investors is highlighted in Spilimbergo et al. (2009) and Blanchard et al. (2010). In this line of thought, Gagon and Gimet (2013) assess the combine influence of monetary and fiscal policy for the US, Euro zone and Canadian equity markets. They evaluate the domestic and international impact of lowering short-term interest rate and increasing budget spending on several indicators, such as volatility, credit, economic activity and liquidity. They apply structural autoregressive methodology (SVAR) that relies on Bayesian identification to study and compare these three regions during the 2003-2011 periods. They introduce and examine the measures of the banking sectors' liquidity as well as liquidity and volatility indicators for the financial markets. In this study they also put attention to international channels of transmission of liquidity in the banking sector and their modelling implications. A monthly average of daily bid-ask spreads (as a percentage) on a given country's market index is expressed as liquidity in financial market, however, spread between the prime lending rate and the three-month risk free rate is considered as liquidity measure of banking sector liquidity.

They report several important findings in this study related to stock market and banking liquidity. First, domestic as well as foreign interest-rate shocks are ineffective in creating banking liquidity in all studied countries. Second, monetary policies caused a temporary decrease in volatility and increase in liquidity in North American stock markets; however, the shocks are mainly domestic and ineffective at generating liquidity in the banking sector. Third, increasing government spending can have a positive effect on credit and consumption. Overall, the monetary policies are found to have mostly domestic effects on financial market, whereas, the US and European budgetary policies have international spillover effects particularly on smaller countries.

It is evident that all the above mentioned studies consider market liquidity of developed markets. However, the liquidity effect may be particularly strong in emerging markets (Bekaert, et al.

2007). Poor liquidity is even mentioned as one of the main reasons that prevent the foreign institutional investors from investing in emerging markets (see Chuhan, 1992). Therefore, this study will help foreign portfolio managers to understand the dynamics of liquidity behaviour. In addition, gap exists to analyse the combined effect of monetary and fiscal policy on overall market liquidity and liquidity of individual and sectoral stocks from an emerging equity market. Altogether, findings of this research will help variety of groups, such as investors for setting up investment strategies, regulators for policy making and academics for determining future research agendas.

7.3 Data and Methodology

7.3.1 Data set

Our sample consists of financial and macroeconomic data of Bangladesh for a thirteen year window starting from January 2000 and ending in December 2012, which is 156 months each for the 202 firms. This is equal to sample of 35350 months. The main source of these data is Thomson Reuters Datastream. The macroeconomic variables are also verified against the International Financial Statistics (IFS) database of the International Monetary Fund (IMF) and central bank of Bangladesh. To compute the returns, liquidity and illiquidity measures stocks are included or excluded based on the criteria stated in Chordia et al. (2005) and Fernández-Amador et al. (2013). First, to be included, a stock has to be present at the beginning and at the end of the year; second, have traded more than 100 trading days during the calendar year; third, a stock has to be listed for at least ten years on the exchange; fourth, to avoid the influence of outliers, we exclude the sample company if the price at any month-end during the year is greater than 1000 in local currency; finally, due to their different trading characteristics from ordinary shares, we also exclude assets in the following categories – commercial bonds, treasury bonds, mutual funds (both open and closed end), and preferred stocks.

7.3.2 Liquidity and illiquidity measures

Liquidity is an elusive concept and is not observed directly but rather has a number of aspects that cannot be captured in a single measure (Amihud, 2002). In this study, therefore, we use four different measures to capture the aspects, e.g. trading activity and price impact. Indeed, there are many other measures of liquidity and illiquidity available in literatures, such as, the bid-ask spread (quoted or effective), transition-by-transaction market impact or the probability of information based trading. Nevertheless, they require a lot of microstructure data those are not available for many stock markets and even when available the data do not cover long period of time (Amihud, 2002; Bekaert et al., 2007; Goyenko and Ukhov, 2009). For example, due to the unavailability of data, Eleswarapu and Reinganum (1993) use the average of the bid-ask spread at the beginning and at the end of the year as a proxy for the liquidity of a stock. In this vein, Bekaert et al. (2007) use liquidity measures that rely on the incidence of observed zero daily return rather than transaction data to link returns with liquidity of emerging markets. Similarly, the market under this study does not have high frequency microstructure data to compute effective and quoted spreads or transaction-by-transaction market impact, hence, we follow the procedures of, e.g. Goyenko and Ukhov (2009), Amihud (2002) and Datar et al. (1998). The importance of this alternative procedure is also stress in Peterson and Fialkowski (1994). They show that the quoted spread is a poor proxy for the actual transaction cost for investors and thus recommend an alternative proxy be used to measure the market liquidity of an asset.

The first proxy of liquidity for an asset that we use in this study is turnover rate (TR), as suggested in Datar et al. (1998). The turnover rate of a stock is the number of shares traded divided by the number of shares outstanding in the stock. This is an intuitive metric of the liquidity of the stock. The relationship between trading volume and market liquidity is highlighted in many previous literatures, such as, Amihud and Mendelson (1980), Lo and Wang (2000). Fernández-Amador et al. (2013) assert that the stock turnover can be interpreted as the reciprocal of the average holding period, which means stocks with higher turnover are on average held for shorter time periods and thus, exhibit an increased trading activity. The second variable we use as a proxy of liquidity is traded volume (TV). The relationship is documented in Brennan et al. (1998) – higher trade volume implies increased liquidity. They find a robust effect of trading volume with the presence of both risk-adjusted and unadjusted returns, which support the notion that this variable is acting as a proxy for the liquidity of the market in the firm's share (see Brennan et al., 1998 for a detailed discussion).

The mathematical measure for each category (i.e. TR and TV) of liquidity proxies can be expressed as following:

$$TR_{iym} = \frac{\sum_{d=1}^{D_{iym}} VO_{iymd}}{NSO_{iym}} \qquad \text{(i)}$$

where TR_{iym} is the turnover rate of stock *i* in month *m* of year *y;* $\sum_{d=1}^{D_{iym}} VO_{iymd}$ is the monthly sum of the daily number of shares traded and NSO_{iym} is the number of shares outstanding.

$$TV_{iym} = ln\left(\sum_{d=1}^{D_{iym}}\left(VO_{iymd}\, P_{iymd}\right)\right) \quad \text{(ii)}$$

where TV_{iym} is the traded volume of stock *i* in month *m* of year *y*; VO_{iymd} is the number of daily traded shares and P_{iymd} is the daily price of each share. Therefore, traded volume is calculated by taking the natural logarithm of the monthly sum of the daily product of the number of shares traded and their respective market price. Both TR and TV are based on trading activities and we can interpret them as liquidity proxies as higher values are associated with more liquid assets.

On the other hand, price impact indicates the responsiveness of price to order flow and can be considered as illiquidity proxies, since an increase in these variables is associated with less liquid stocks (Fernández-Amador et al., 2013). Amihud (2002) asserts that a positive relationship between the orderflow or transaction volume and price change is commonly known as price impact. There are many early studies available, such as Brennan and Subrahmanyam (1996) who measure stock illiquidity by a similar price impact method. In this study, therefore, we follow Amihud's (2002) illiquidity ratio (ILLIQ) to measure illiquidity for the market. This ratio gives the absolute (percentage) price changes, e.g. per dollar of daily trading volume, or the daily price impact of the order flow. Among many, Goyenko et al. (2009) support the adequacy of this approach for measuring illiquidity. Our second and final measure of illiquidity is turnover price impact ratio (TPI), proposed and developed by Florackis et al. (2011). The ratio can be defined as the returns impact of a one percent stock turnover. It has several appealing characteristics compared to Amihud's (2002) illiquidity ratio. It is free from size bias and considers trading frequency rather than volume, thus is less related to market capitalization and can encapsulate stocks' cross-sectional variability (see Florackis et al., 2011 for a detailed discussion). Fernández-Amador et al. (2013) suggest that TPI is more isolated to nominal effect than Amihud's (2002) ILLIQ, therefore can offer different conclusions in an environment where nominal shocks dominate (e.g. an inflationary environment).

The mathematical expressions for ILLIQ and TPI are as follows:

$$ILLIQ_{iyd} = \frac{|R_{iyd}|}{TV_{iyd}} \quad \text{(iii)}$$

where $ILLIQ_{iyd}$ is the illiquidity ratio of security *i* on day *d* of year *y*; R_{iyd} is the return on stock *i* on day *d* of year *y* and TV_{iyd} is the respective daily volume.

$$TPI_{iyd} = \frac{|R_{iyd}|}{TR_{iyd}} \quad \text{(iv)}$$

where TPI_{iyd} is the turnover price impact of security *i* on day *d* of year *y*; TR_{iyd} and R_{iyd} is the turnover rate and daily return of each share respectively. For our empirical models we compute monthly average of the individual liquidity or illiquidity of each stock and also equally weighted cross-sectional averages of the liquidity and illiquidity for vector autoregression model.

7.3.3 Macroeconomic variables

The prime objective of this study is to investigate the relationship of equity market liquidity to monetary policy (MP) and fiscal policy (FP). To achieve this objective we select several monetary and fiscal policy variables in line with previous studies, e.g. Chordia et al. (2001), Chordia et al. (2005), Goyenko and Ukhov (2009). We approximate the monetary policy by using data on the aggregate money supply, bank rate, cash reserve and interest rate. For aggregate money supply we use the rolling twelve month growth rate of base money (BM). Base money includes banknotes and coins in circulation plus any reserves hold by credit institutions. Fernández-Amador et al. (2013) suggest base money is most easily influenced by the central bank. Therefore, we could expect higher growth rate in aggregate money supply under expansionary regime of central bank. In addition, a loose monetary policy may decrease illiquidity and encourage more trading by making margin loan requirement less costly for equity investors (Goyenko and Ukhov, 2009).

Our second and third monetary variables can directly influence the lending capacity of financial institutions (FIs) and thus overall liquidity of the economy. In Bangladesh, bank rate (BR) refers to the rate at which the central bank (i.e. Bangladesh Bank) offer credit to other FIs and cash reserve ratio (CRR) is the rate of cash reserve that FIs need to maintain with central bank. CRR of the commercial banks has a significant potential to regulate money supply through affecting money multiplier. Until 1990, the use of this instrument was virtually non-existent but since then this has been a major instruments for Bangladesh Bank to control aggregate supply of money. In this vein, the impact of federal funds rate and net borrowed reserve is documented in e.g. Chordia et al. (2005) and Fujimoto (2003). A negative shock to BR and CRR should imply tightening monetary policy and thus decrease the liquidity or increase the illiquidity. Finally, we take short-term interest rate (SIR) to consider domestic interest rate shocks on liquidity following the argument of Chordia et al. (2001) and Söderberg (2008). Three-moth Treasury bill rate is used as proxy for this short-term interest rate as suggested in Gagnon and Gimet (2013).

Next to monetary policy, we consider three fiscal policy variables to capture the government's intervention in equity market liquidity. These variables are government expenditures (GE), government borrowing from commercial banks (GB) and credit to the private sector (CP). The recent literature identifies a chain of transmission of budgetary policies to the credit sector (Gagnon and Gimet, 2013). For example, Blanchard (2009) reports that the financial crisis affects the economy through credit rationing, i.e. tightening of lending standards by banks. Credit to private sector, therefore, measure the bank's lending volume and willingness to loosen the credit standard (e.g. margin requirements) following a fiscal policy shock (see Gagnon and Gimet, 2013). For our first fiscal variable, Blinder and Solow (1973) assert that a dollar of additional government spending raise national income not only by the original dollar but this expenditure would have multiplier effects of perhaps several dollars more in the economy. This can facilitate the money flow in the economy and thus any positive shock may increase liquidity. On the other hand, among many others Fisher (1988) states that borrowing from commercial banks by the government can create 'crowding out' effect and thus create competition for private savings where business firms may suffer from lack of credit opportunities.

Other macroeconomic factors, such as unexpected productivity falls and excessive inflationary pressures, are likely to influence illiquidity indirectly by inducing fund outflows, price declines, and increased volatility, exacerbating inventory risk (Goyenko and Ukhov, 2009). Moreover, the interrelationship between various macroeconomic variables and market liquidity is theoretically developed in Eisfeldt (2004). This association is also empirically studied and documented in Söderberg (2008), Næs et al. (2011) and Fernández-Amador et al. (2013). Based on their procedure we include the monthly growth rate of industrial production (IP) and monthly inflation rate (IR) to capture business cycle and inflation development. Further to control individual stock characteristics, following the argument of Fernández-Amador et al. (2013), Brunnermeier and Pedersen (2009) and Copeland and Galai (1983), we include monthly return (RET) and standard deviation (STD). We compute both return and standard deviation from equally weighted average of individual monthly stocks prices. Finally, to control the size effect of firms and cyclical movements of market we consider log value of market capitalization (lnMV) and DSE general index (IDX) respectively in our empirical model (see Fernández-Amador et al., 2013 for detail discussion).

7.3.4 Empirical Models

7.3.4.1 Vector Autoregression Analysis

Our aim is to understand the relationship between equity market liquidity and its primitive drivers, macroeconomic management variables. Therefore, in first step we explore the influence of central bank and government policies on the aggregate liquidity of DSE. It is documented in several papers that the recent financial crisis is characterized as decline of liquidity and subsequent actions of central bank and government are related to stabilize the financial market by injecting liquidity. For example, Garcia (1989) reports that central banks may ease market liquidity during period of crisis by means of monetary policy. On the contrary, Blanchard (2009) asserts due to financial crisis banks may follow credit tightening policy. Whichever it is, market liquidity is affected by regulatory policies and in recent years this kind of role of monetary and fiscal policies on stock market has clearly gained importance.

Based on earlier studies, we could expect possible endogenous associations between market liquidity, monetary, fiscal and other macroeconomic policies. However, there is a good reason to assume bidirectional causality among various market characteristics and liquidity (Chordia et al. 2005). They explain liquidity may impact stock returns through a premium for greater trading cost and returns may also influence future trading behaviour, which may, in turn affect liquidity. Similarly, increased returns volatility implies increased inventory risk and hence a higher bid-ask spread. In the reverse direction, decreased liquidity could increase asset price fluctuations. In this line of thought, there could be causality and reverse causality between liquidity and monetary, fiscal and other macroeconomic policies (see Chordia et al., 2005; Fernández-Amador et al., 2013; Gagnon and Gimet, 2013). For example, it is further reported in Chordia et al. (2005) that due to reduced liquidity and increased volatility a central bank may soften its monetary policy. On the other hand, an expansionary monetary policy increase stock prices in the short run and thus lowers expected returns.

Given these bidirectional causalities, we investigate the association between macroeconomic management variables and market liquidity using the vector autoregression procedure employed in Chordia et al. (2005) and Goyenko and Ukhov (2009). Here, the following system is considered:

$$\mathrm{X_t = c + \sum_{j=1}^{k} B_{1j}\, X_{t-j} + u_t} \qquad \text{(v)}$$

where $\mathrm{X_t}$ is a vector that represents endogenous variables - liquidity, returns, volatility, industrial production, inflation, monetary and fiscal policy instruments; ***c*** is the vector of intercept, ***B*** is a $\mathrm{six} \times \mathrm{six}$ coefficients matrix (for the monetary and fiscal policy variables), and $\mathrm{u_t}$ labels the vector of residuals. The number of lags is estimated based on Akaike information criterion and the Schwarz information criterion. Where they indicate different lag lengths, we choose the lesser lag length for parsimony (see Chordia et al. 2005). The augmented Dickey-Fuller (1979) test is used to check the non-stationarity of the variables. Finally, to check the influence of recent financial crisis (2008-09) on each liquidity measures we add a dummy variable for crisis in our VAR system.

7.3.4.2 Panel regression for individual stocks

Having assessed the impact on overall market liquidity, in our second step we look into the influence of monetary and fiscal policy stance on liquidity of individual firms and sectoral stocks. For this purpose, we combine time-series and cross-sectional data of liquidity, returns, volatility, industrial production, inflation, monetary and fiscal policy instruments to estimate panel regressions as suggested in Fernández-Amador et al. (2013). The liquidity ($\mathrm{LIQ}_{\mathrm{i,t}}$) of stock $\boldsymbol{i}$ in month $\boldsymbol{t}$ is modelled as a function of the one-month lagged macroeconomic management variables and other lagged control variables. We model separately for monetary (i.e. equation vi) and fiscal policy (i.e. equation vii) and the models are:

$$LIQ_{i,t} = c + \alpha_1 LIQ_{i,t-1} + \alpha_2 MP_{t-1} + \alpha_3 Int_{i,t-1} + b_4 Y_{i,t-1} + \alpha_5 Z_{i,t-1} + c_i + u_{i,t} \text{ (vi)}$$

$$LIQ_{i,t} = c + \alpha_1 LIQ_{i,t-1} + \alpha_2 FP_{t-1} + \alpha_3 Int_{i,t-1} + b_4 Y_{i,t-1} + \alpha_5 Z_{i,t-1} + c_i + u_{i,t} \text{ (vii)}$$

where $LIQ_{i,t}$ is the dependent variable and represents four (il)liquidity ratios. To account the possible autocorrelation induced by a dynamic relationship in stock liquidity, we include one-month lagged (il)liquidity measures $LIQ_{i,t-1}$as a regressor. MP_{t-1} and FP_{t-1} are monetary policy and fiscal policy variables respectively. We consider an interaction term $Int_{i,t-1}$ in both equations that indicates whether the influence of monetary policy or fiscal policy depends on size of firm as a measured by logged market capitalization, $lnMV_{i,t-1}$. Therefore, the interaction term is $(MP * lnMV_{i,t-1})$ in equation (vi) and $(FP * lnMV_{i,t-1})$ in equation (vii). However, we do not use any such interaction term in our models for sectoral stocks. The vector $Y_{i,t-1}$ denotes lag value of our other control variables for stock characteristics; they are monthly returns $(RET_{i,t-1})$, monthly standard deviation of daily stock returns $(STD_{i,t-1})$ and natural logarithm of market capitalization $(lnMV_{i,t-1})$. The macroeconomic variables to capture cyclical variation, such as monthly growth rate of industrial production $(IP_{i,t-1})$, inflation rate $(IR_{i,t-1})$ and DSE all-share price index $(IDX_{i,t-1})$ are represented by the vector $Z_{i,t-1}$. As recommended in Fernández-Amador et al. (2013), to account for time-invariant stock specific determinants of liquidity, we use the fixed-effect (within) estimator and c_i is the fixed-effect in this cross-section. Finally, $u_{i,t}$ is the residual in our models. The number of lag order for each variable is selected based on whether any autocorrelation exist in residuals.

7.4 Empirical results

The empirical results on the association of market liquidity with monetary and fiscal policy variables are reported in this section. Section 7.4.1 presents the preliminary statistics of our cross-sectional and time series data, bivariate cross-sectional correlation among mean of time series data and panel cointegration between macroeconomic management variables and stock price. Section 7.4.2 discusses the influence of monetary policy, fiscal policy and recent financial crisis (i.e. 2008-09) on aggregate market liquidity. Finally, firm and industry level evidences on the connection between liquidity and macroeconomic variables are explained in section 7.4.3.

7.4.1 Preliminary statistics

We present the summary statistics in Table 7.1 and 7.2, where Table 7.1 shows the statistics for cross-sectional variables those we use in our panel estimations and Table 7.2 includes descriptive statistics related to time-series variables. However, our particular interest is to see the bivariate correlation between VAR endogenous variables and average monthly values of four (il)liquidity ratios. The results are given in Table 7.3. It is obvious that one could expect cross-sectional correlation between the trading activity measures (i.e. TR and TV) and the price impact ratios related to illiquidity (i.e. ILLIQ and TPI). Fernández-Amador et al. (2013) assert this observation is intuitive, since higher trading activity translates into more liquid stocks, whereas higher levels of price impact or transaction costs indicate less liquid stocks. For DSE, we find positive correlation respectively between trading activity and price impact ratios and yet, their cross-sectional relationships are found to be negative as expected. For example, among these four liquidity measures, highest correlation is reported between turnover rates (TR) and trading volume (TV), which is positive (0.32). Similarly, negative and positive correlations are identified between Amihud's (2002) illiquidity ratio (i.e. ILLIQ) separately with trading volume (-0.20) and turnover price impact (0.17). These results are statistically significant at 1 percent level.

Other than the bidirectional correlation between liquidity measures, Table 7.3 also reports their relations with return (RET), volatility (STD) and market capitalization (lnMV). The positive (negative) correlation between market value of firms and liquidity (illiquidity) suggests that stocks of larger firms tend to be more liquid (see Fernández-Amador et al., 2013). In DSE, e.g. we find lnMV and TR are positively (0.64) and lnMV and ILLIQ are negatively (-0.16) related to each other; however, the sign of association between lnMV and TPI is not found as expected. Since the large firms are likely to be more liquid, therefore, we would expect a negative correlation between market capitalization and illiquidity measures.

Table 7.1: Descriptive statistics for cross-sectional variables

	Mean of monthly mean	Median of monthly mean	Max. of monthly mean	Mini. of monthly mean	Mean of monthly σ	Mean of monthly skewness
TR	1.331443	1.017623	4.61409	0.037002	0.95918	1.058913
TV	15.06019	14.99542	19.13875	9.292186	2.65675	-0.28245
ILLIQ	8.42E-02	6.72E-02	3.34E-01	4.23E-04	7.65E-02	1.145646
TPI	0.015868	0.011186	0.09048	0.002265	0.0146	2.669989
RET	0.000734	0.000799	0.018531	-0.02306	0.004308	-1.01378
STD	0.024534	0.022983	0.055255	0.01128	0.008155	0.877739
lnMV	22.75097	22.99435	31.21160	0.000000	3.793166	-3.96279

Note: Each variable is calculated for each stock in each month across stocks admitted to the sample in that year, and then the mean, standard deviation and skewness are calculated across stocks in each year. The table represents the mean over the thirteen years of the monthly mean, standard deviations and skewness and the median of the monthly mean, as well as the maximum and minimum monthly mean. Statistics for monthly average Market capitalizations (MV) of each stock are calculated based on its natural log values. For meaningful results, we multiply the ILLIQ ratio by 10^5 for this study.

Table 7.2: Descriptive statistics for time variable

	IP	IR	lnIDX
Mean	2.243151	6.360577	7.405416
Median	0.348445	6.655000	7.304255
Maximum	221.7054	10.96000	8.872790
Minimum	-17.90780	1.470000	6.182990
Std. dev.	18.61931	2.611026	0.732449
Skewness	10.47248	-0.243263	0.234928

Note: Statistics of stock index (IDX) of DSE is based on log values.

Table 7.3: Correlation matrix of time-series means of the monthly bivariate cross-sectional correlation

	TR	TV	ILLIQ	TPI	RET	STD	lnMV
TR	1.0000						
TV	0.3238***	1.0000					
	(29.2977)						
ILLIQ	-0.0996***	-0.2008***	1.0000				
	(-8.5730)	(-17.5488)					
TPI	-0.1086***	-0.02404**	0.1669***	1.0000			
	(-9.3554)	(-2.0591)	(14.4956)				
RET	0.1902***	0.0716***	-0.0237**	-0.0210*	1.0000		
	(16.5890)	(6.1443)	(-2.0261)	(-1.8020)			
STD	0.1413***	0.3164***	0.1659***	0.1203***	0.1341***	1.0000	
	(12.2211)	(28.5569)	(14.4032)	(10.3777)	(11.5870)		
lnMV	0.1407***	0.6351***	-0.1591***	0.0591***	0.0135	0.1467***	1.0000
	(12.1645)	(70.3911)	(-13.8000)	(5.0708)	(1.1585)	(12.6981)	

***, ** and * are significant at 1%, 5% and 10% levels. *t-statistics* are in parenthesis.

Similar to the previous studies, such as Chordia et al. (2005) and Goyenko and Ukhov (2009) the average correlation of standard deviation with each of the liquidity measure of DSE is strong and statistically significant. All results are positive and the strongest association is found with trading volume (0.32). In addition, there is a positive correlation (0.13) between return and standard deviation among the sample companies over the sample periods. This suggests investors of this market could earn higher returns from risky investments. Surprisingly, magnitude of correlations between some liquidity measures is relatively small, e.g. TV and TPI or TR and ILLIQ. This highlight the fact that the several (il)liquidity measures used in the analysis are not representing the same information, but different aspects of the broad concept of market liquidity (see Fernández-Amador et al., 2013).

We also check whether any long-run association exist between price of each stock and macroeconomic management policies applying 'cross-sectional cointegration' framework. We do this because when time series are cointegrated there must be at least one Granger causal flow in the system; moreover, the causal flow may exist because they have some other common feature (see Alexander, 2008). That means when some variables are cointegrated with each other, they may also influence some further dynamics within those series. For example, when money supply and price series are cointegrated then the changes in money supply (growth rate) may influence the stocks spread (i.e. bid-ask difference), returns or volatility. Among others, Chordia et al. (2005) have documented a relationship between money supply, bid-ask spread, returns and volatility. In addition, higher money supply can increase investors' ability to buy or sell large quantity of assets (see Chordia et al., 2001; Goyenko and Ukhov, 2009). Therefore, overall, having long-run linkage with market price, macroeconomic variables may create impact on market liquidity or may have causal association among them. Here, we apply Pedroni (1999, 2004) and Kao's (1999) approach to explore the panel cointegration.

Brooks (2014) assert that most of the work on panel cointegration so far has relied upon a generalization of the single equation methods of the Engle-Granger type following the pioneering work by Pedroni (1999, 2004). Pedroni (1999, 2004) proposes several tests for cointegration that allow for heterogeneous intercept and trend coefficients across cross-sections. He states that the first step is to compute the regression residuals form the hypothesized cointegration regression and the most general case, this may take following:

$$y_{i,t} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \cdots + \beta_{Mi} x_{Mi,t} + e_{i,t} \qquad \text{(viii)}$$

for $t = 1, \dots, T; i = 1, \dots, N; m = 1, \dots, M$; where, T refers to the number of observations over time, *N* refers to the number of individual members in the panel, and *M* refers to the number of regression variables. *y* and *x* are assumed to be integrated of order one, e.g. I(1). The parameters α_i and δ_i are individual and trend effects.

The residuals from this regression, $e_{i,t}$ are then subject to separate auxiliary (e.g. Augmented Dickey-Fuller type) regression for each group of variables to determine whether they are I(1), such as:

$$e_{i,t} = \rho_i e_{i,t-1} + \sum_{j=1}^{p_i} \psi_{i,j} \Delta e_{i,t-1} + v_{i,t} \tag{ix}$$

The null hypothesis is that the residuals from all of the test regressions are unit root processes $(H_0: \rho_i = 1)$, and therefore that there is no cointegration. Pedroni (1999, 2004) proposes two alternative hypotheses: the homogenous alternative, $(\rho_i = \rho) < 1$ for all *i* (within-dimension test), and the heterogeneous alternative, $\rho_i < 1$ for all *i* (between-dimension test). He shows that the standardized panel cointegration statistics (i.e. $\aleph_{N,T}$) is asymptotically normally distributed:

$$\frac{\aleph_{N,T} - \mu\sqrt{N}}{\sqrt{v}} \Rightarrow N(0,1) \tag{x}$$

Where, μ and v are Monte Carlo generated adjustment terms.

Kao (1999) essentially develops a restricted version of Pedroni's (1999, 2004) approach, but is the first author to suggest the test for cointegration in homogeneous panels. In Kao's (1999) approach, the slope parameters in equation (viii) are assumed to be fixed across the groups, although the intercepts are still permitted to vary (see Brooks, 2014). Then Dickey-Fuller (DF) or Augmented Dickey-Fuller (ADF) test regression is run on a pooled sample assuming homogeneity in the value of ρ. The ADF version of test is:

$$ADF = \frac{t_\rho + \frac{\sqrt{6N}\hat{\sigma}_v}{2\hat{\sigma}_{0v}}}{\sqrt{\frac{\hat{\sigma}_{0v}^2}{2\hat{\sigma}_v^2} + \frac{3\hat{\sigma}_v^2}{10\hat{\sigma}_{0v}^2}}} \tag{xi}$$

Kao (1999) showed that the asymptotic distribution of all tests converge to a standard normal distribution as $T \longrightarrow \infty$ and $N \longrightarrow \infty$. The long run covariance is estimated using the usual Kernel estimator.

The results of Pedroni's (1999, 2004) panel cointegration are presented in Table 7.4 and Kao's (1999) in Table 7.5. We have checked each variable for non-stationarity using panel unit root test suggested by Levin et al. (2002) and Pesaran (2007) and drop those which are stationary at level. Table 7.4 separately reports the cointegration between market price and monetary policy variables and between price and fiscal policy variables. For price and monetary policy, five out of eight statistics are found significant at 1 percent level under homogeneous alternative and one out of three is found significant under heterogeneous alternatives. On the other hand, for price and fiscal policy, six statistics are significant from 1 to 10 percent level under within-dimension and one statistics is significant at 5 percent level under between-dimension. In fact, the statistical significance implies that we can reject the null hypothesis of no cointegration, therefore, long-run association exist among respective monetary and fiscal policy variables with the monthly price of each stock in our sample.

We combine the macroeconomic variables as well as macroeconomic management variables to run Kao's (1999) panel cointegration with monthly price series, which is reported in Table 7.5. Here, the macroeconomic management includes both monetary and fiscal policy variables; however, we include industrial production and inflation rate along with monetary and fiscal policy variables in macroeconomic model. The corresponding probability of Augmented Dickey-Fuller (ADF) test statistics indicates that we can accept the alternative hypothesis of integration among the price series and those exogenous variables at 95 percent level of confidence. Overall, we can say that monthly stock price of DSE and macroeconomic variables are tied together in the long term, which means in the short term they can drift apart, but over a period of time they must drift back together (see Alexander, 2008). Thus, this accentuates that there could have causal flows between these series and their underlying characteristics, such as liquidity and growth rate may be interlinked. In the following two sections, we check that linkage using VAR system and panel regression models.

Table 7.4: Results of Pedroni (Engle-Granger residual based) panel cointegration test

	Monetary policy variables				Fiscal policy variables			
Alternative hypothesis: common AR coefficients (within-dimension)								
			Weighted				Weighted	
	Statistic	P value	Statistic	P value	Statistic	P value	Statistic	P value
Panel v-Statistic	3.1306***	0.0009	3.7780***	0.0001	0.8792	0.1896	1.3981*	0.0810
Panel rho-Statistic	1.2548	0.8952	-6.5914***	0.0000	-1.5800**	0.0571	-5.5693***	0.0000
Panel PP-Statistic	2.4455	0.9928	-5.6259***	0.0000	-0.6258	0.2657	-5.5118***	0.0000
Panel ADF-Statistic	3.3525	0.9996	-5.0432***	0.0000	-2.1086***	0.0175	-5.0440***	0.0000
Alternative hypothesis: individual AR coefficients (between-dimension)								
	Statistic	P value			Statistic	P value		
Group rho-Statistic	-2.4480***	0.0072			-1.6702**	0.0474		
Group PP-Statistic	-1.1003	0.1356			-1.0349	0.1504		
Group ADF-Statistic	-0.6353	0.2626			-0.5362	0.2959		

Note: Pedroni (1999, 2004) residual cointegration test (Engle-Granger based) with null hypothesis, no cointegration. Assumption includes no deterministic trend and lag length is automatically selected based on SIC (Schwarz information criterion) with a max lag of 13. The Newey-West bandwidth is used with Bartlett kernel type. Each variable (for monetary and fiscal policy) is checked for non-stationarity using Levin et al. (2002) and Pesaran (2007). Only bank rate (BR) and short-term interest rate (SIR) reject the null of a unit root and are therefore dropped from the models.

***, ** and * are significant at 1%, 5% and 10% levels.

Table 7.5: Results of Kao (Engle-Granger residual based) panel cointegration test

	Macroeconomic variables		Macroeconomic management variables	
	t-Statistic	Prob.	t-Statistic	Prob.
ADF	-1.735**	0.0414	-1.744**	0.0406
Residual variance	4196.007		4198.661	
HAC variance	3847.752		3851.527	

Note: Kao (1999) test also follow Engle-Granger residual based cointegration approach with a null hypothesis of no cointegration. We apply similar assumptions for these models as Pedroni. Here, macroeconomic variables includes industrial production (IP), inflation rate (IR), monetary (MP) and fiscal policy (FP). Macroeconomic management variables only include monetary (MP) and fiscal (FP) policy. ***, ** and * are significant at 1%, 5% and 10% percent levels.

7.4.2 Influence on aggregate market liquidity

This section reports results related to influence of macroeconomic variables on overall liquidity of DSE using vector autoregression (VAR) framework of equation (v). We use Granger causality, impulse response function and variance decomposition associated with monetary policy, fiscal policy and recent financial crisis (i.e. 2007-08) shocks. The Augmented Dickey-Fuller (1979) test is used to check for non-stationarity of the variables. For the bank rate (BR), cash reserve ratio (CRR), short-term interest rate (SIR), trading volume (TV) and illiquidity ratio (ILLIQ) we do not reject the null of a unit root. Therefore, to ensure that the variables are in order of integration we employ the first difference of these three monetary variables and two liquidity measures. Each of the VAR model is estimated with two lags, as it is optimal according to the Bayesian Schwartz criterion.

7.4.2.1 Impact of monetary policy shocks

We estimate total of 16 different VAR models for each of the four (il)liquidity measures and four monetary policy variables considered in our analysis. In order to interpret the results of estimated VAR models we present the Granger causality test (see Granger, 1969) in Table 7.6 as suggested in Chordia (2005) and Goyenko and Ukov (2009). This table shows the pairwise Granger causality tests between endogenous variables of the VAR. The null hypothesis we test that the lagged endogenous variables of interest (i.e. monetary policy or liquidity measures) do not Granger cause the dependent variable of interest (again, either market liquidity or monetary policy variables). The cell associated with the row variable and the column variable shows the χ^2 statistics and corresponding *p-values* are given in parentheses.

Table 7.6: Granger Causality Tests for monetary policy variables

	RET	STD	BM	BR	CRR	SIR	TR	TV	ILLIQ	TPI
RET		0.12 (0.735)	0.00 (0.943)	0.01 (0.937)	1.07 (0.303)	0.21 (0.648)	2.72 (0.101)	1.81 (0.181)	0.28 (0.595)	0.043 (0.511)
STD	0.00 (0.991)		6.06 (0.015)	2.85 (0.093)	0.04 (0.850)	0.01 (0.924)	0.63 (0.429)	7.24 (0.008)	0.02 (0.900)	2.54 (0.113)
BM	0.49 (0.485)	2.19 (0.141)		0.054 (0.817)	0.00 (0.976)	5.68 (0.018)	0.32 (0.569)	3.01 (0.058)	0.53 (0.467)	0.19 (0.667)
BR	0.12 (0.733)	0.04 (0.833)	2.35 (0.127)		0.03 (0.868)	0.05 (0.825)	0.378 (0.539)	0.17 (0.683)	14.98 (0.002)	0.59 (0.440)
CRR	2.62 (0.108)	3.71 (0.056)	1.39 (0.239)	0.04 (0.833)		1.30 (0.255)	6.04 (0.015)	0.02 (0.894)	0.03 (0.859)	2.06 (0.153)
SIR	3.62 (0.059)	0.81 (0.369)	0.66 (0.417)	0.00 (0.995)	0.87 (0.354)		2.53 (0.114)	0.21 (0.649)	0.03 (0.859)	0.00 (0.947)
TR	3.67 (0.057)	1.13 (0.289)	3.40 (0.067)	0.73 (0.395)	4.03 (0.047)	0.01 (0.949)		2.12 (0.147)	0.13 (0.715)	0.12 (0.729)
TV	0.22 (0.637)	1.89 (0.172)	1.24 (0.267)	0.04 (0.849)	0.29 (0.591)	0.16 (0.689)	3.89 (0.050)		4.59 (0.034)	1.55 (0.215)
ILLIQ	0.00 (0.957)	4.75 (0.031)	5.10 (0.025)	5.21 (0.024)	0.04 (0.842)	1.44 (0.231)	0.88 (0.349)	1.67 (0.198)		3.18 (0.077)
TPI	6.39 (0.013)	1.12 (0.291)	0.00 (0.999)	0.60 (0.442)	0.14 (0.703)	0.01 (0.919)	1.41 (0.237)	2.09 (0.150)	1.39 (0.240)	

Note: in order to test for pairwise Granger causality we consider two series a_t and b_t, then estimate the equations:
$\Delta a_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta a_{t-1} + \sum_{i=1}^{m} \beta_{2i} \Delta b_{t-1} + \varepsilon_{1t}$ and $\Delta b_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta b_{t-1} + \sum_{i=1}^{m} \delta_{2i} \Delta a_{t-1} + \varepsilon_{1t}$,
we run an F-test for joint significance of the coefficient assuming null hypothesis that a_t does not Granger cause b_t and vice versa. A rejection of the null hypothesis shows the presence of Granger causality. Each result indicates the row variable does or does not Granger cause the column variable. *p-values* are in first bracket.

The results indicate that some monetary policy variables Granger cause both market liquidity and illiquidity. In particular, as expected, base money growth significantly Granger causes the trading volume. Similarly, cash reserve ratio Granger causes the other market liquidity measure - turnover rate, which is statistically significant at 1 percent level as well. That means our trading activity related liquidity measures are significantly influenced by the central bank policies. On the other hand, only the first difference of Amihud's (2002) illiquidity ratio is Granger caused by the central bank rate. However, short-term interest rate is not found to Granger cause any of the liquidity measures and turnover price impact is not Granger caused by any of the monetary policy. Interestingly, the results of Granger causality test also show evidences of bidirectional relationship. For example, turnover rate and Amihud's (2002) illiquidity ratio Granger cause the base money growth and results are significant at 10 and 5 percent level respectively. Overall, our findings support the cointegration reported in previous section and favour the hypothesis that the central bank monetary policy causes the aggregate market (il)liquidity or alternatively that market (il)liquidity causes central bank monetary policy.

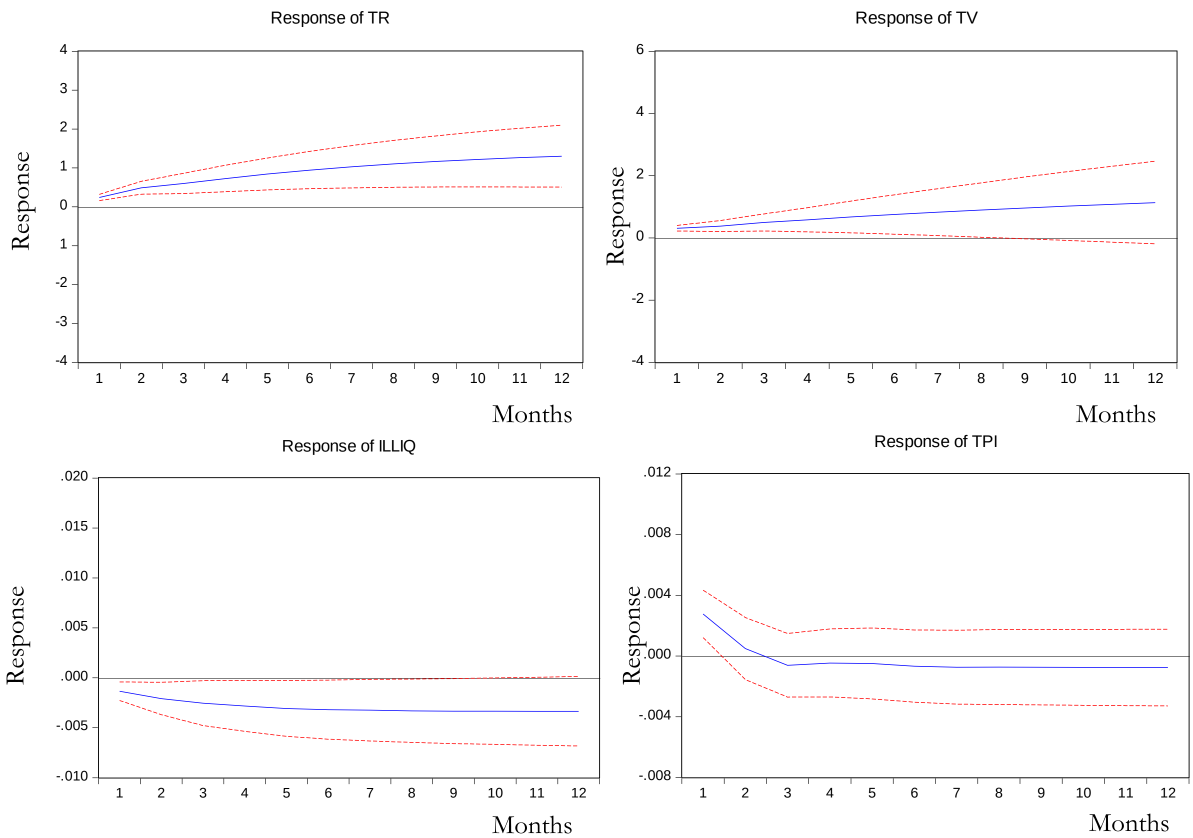
The reminder of Table 7.6 presents the interaction of liquidity measures with other endogenous variables. We find that in DSE, there is one-way causation between stock volatility and the market liquidity (i.e. turnover volume) and the result is significant at 99 percent level of confidence. Results further indicate strong bidirectional causality between Amihud's (2002) illiquidity measure and the equity volatility. For the stock returns, we see it has two-way causation with turnover rate. In addition, a reverse causality exists between turnover over price impact and return. Our results are therefore consistent with those of Chordia et al. (2005) and Goyenko and Ukhov (2009) that stock return and volatility concurrently Granger cause market liquidity and illiquidity. For example, Chordia et al. (2005) find significant two-way causality between volatility and spread and one-way causality between return and spread. For the reverse relationship, Amihud (2002) shows that liquidity predicts expected return in the time series, which is in line with our findings. Finally, other than the liquidity variables monetary policy has causal association with stock returns and volatility. For example, the short-term interest rate significantly Granger causes the stock returns and the cash reserve ratio Granger causes both returns and volatility. However, on reverse direction only volatility has a one-way causation with monetary policy, i.e. broad money growth and bank rate.

For a deeper understanding of the dynamics of liquidity and its interaction with monetary policy within the VAR system we also report the impulse response functions (IRFs) and variance decomposition as suggested in earlier studies, e.g. Chordia et al. (2005), Goyenko and Ukhov (2009), Gagnon and Gimet (2013). The Granger causality results are based on the analysis of the coefficients from a single equation and do not account for the joint dynamics implied by the VAR system and thus a clear picture can potentially emerge by the use of impulse response functions (Goyenko and Ukhov, 2009). The IRF traces the impact of a one-time, unit standard deviation, positive shock to one variable on the current and future values of the endogenous variables. Results from the IRFs and variance decompositions are generally sensitive to the specific ordering of the endogenous variables (see Chordia et al., 2005 for a detailed discussion). Therefore, in choosing an ordering, we rely on the prior evidence of Chordia et al. (2005), Goyenko and Ukhov (2009), and Fernández-Amador et al. (2013). We order our variables as follows: macroeconomic variables, IP, IR and MP first, followed by STD, RET and (il)liquidity. We put liquidity and illiquidity at the end of the VAR ordering in our estimates to gain stronger statistical power (see Goyenko and Ukhov, 2009).

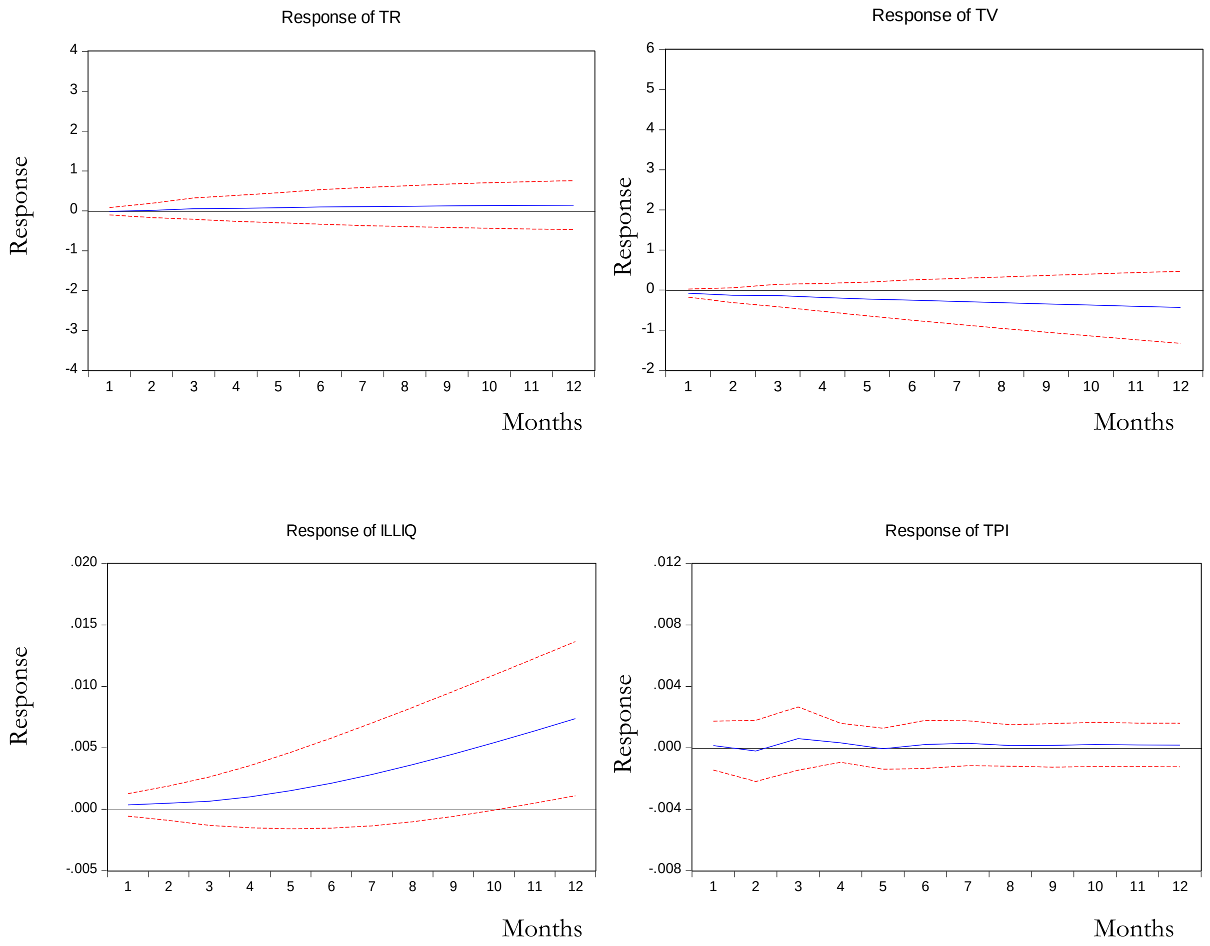
The accumulated responses of market (il)liquidity to a unit standard deviation innovation in monetary policy shocks are presented in Figure 7.1 (from Group A to D), traced forward over a period of 12 months. Each of the graphs under each Group shows the response of two liquidity and two illiquidity measures to monetary policy variables. Here, responses are measured using standard Cholesky decomposition of the VAR residuals. Bootstrap 95 percent confidence bands are provided to gauge the statistical significance of the responses. Group A of Figure 1 illustrate the aggregate response of four (il)liquidity to one-time shock in base money growth and the signs are in line with our hypothesis and significant. Here, following the base money growth shocks the turnover rate increase at a decreasing rate and trading volume ratio increase at an increasing rate. In between Amihud's (2002) illiquidity ratio and turnover price impact of Florackis et al. (2011), the response to money growth shocks is stronger for Amihud's (2002) illiquidity ratio. Similarly, we found the expected signs for the bank rate (Group B), cash reserve ratio (Group C) and short-term interest rate shocks on four (il)liquidity measures, however, their magnitudes are different.

Figure 7.1: Impulse Response of Monetary policy shocks

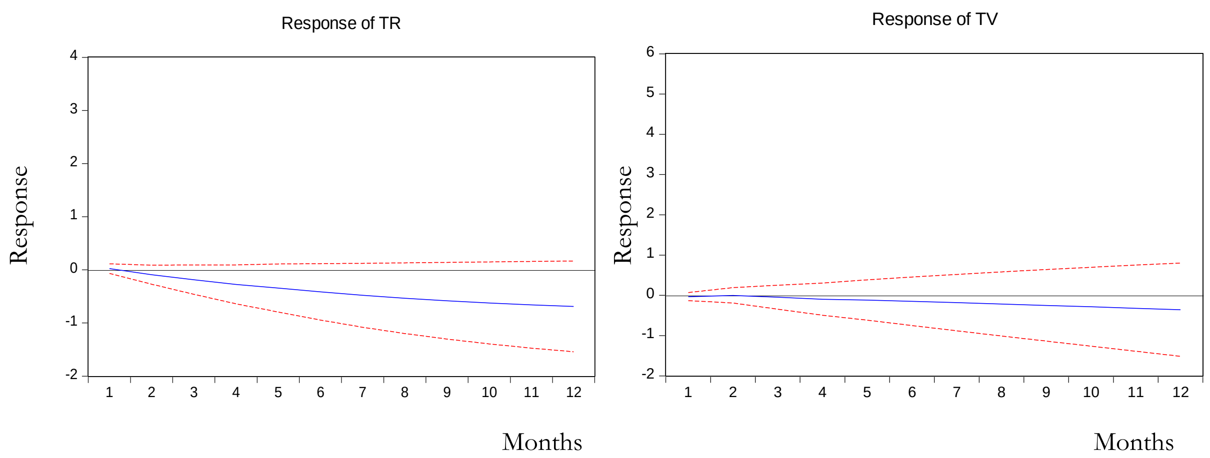
Group A: Accumulated response of (il) liquidity variables to Cholesky One S.D. Base money growth innovation

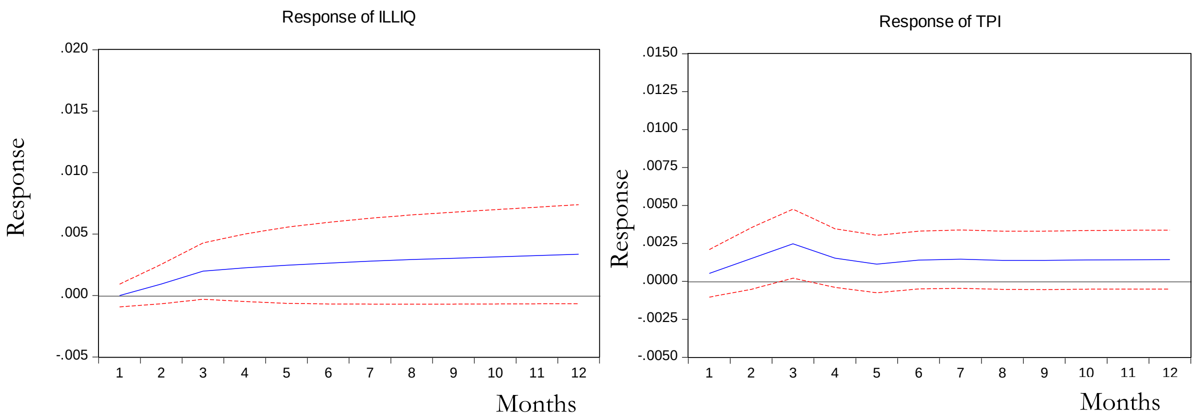


Group B: Accumulated response of (il) liquidity variables to Cholesky One S.D. Bank Rate innovation



Group C: Accumulated response of (il) liquidity variables to Cholesky One S.D. Cash Reserve Ratio innovation





Group D: Accumulated response of (il) liquidity variables to Cholesky One S.D. Short-term Interest rate innovation

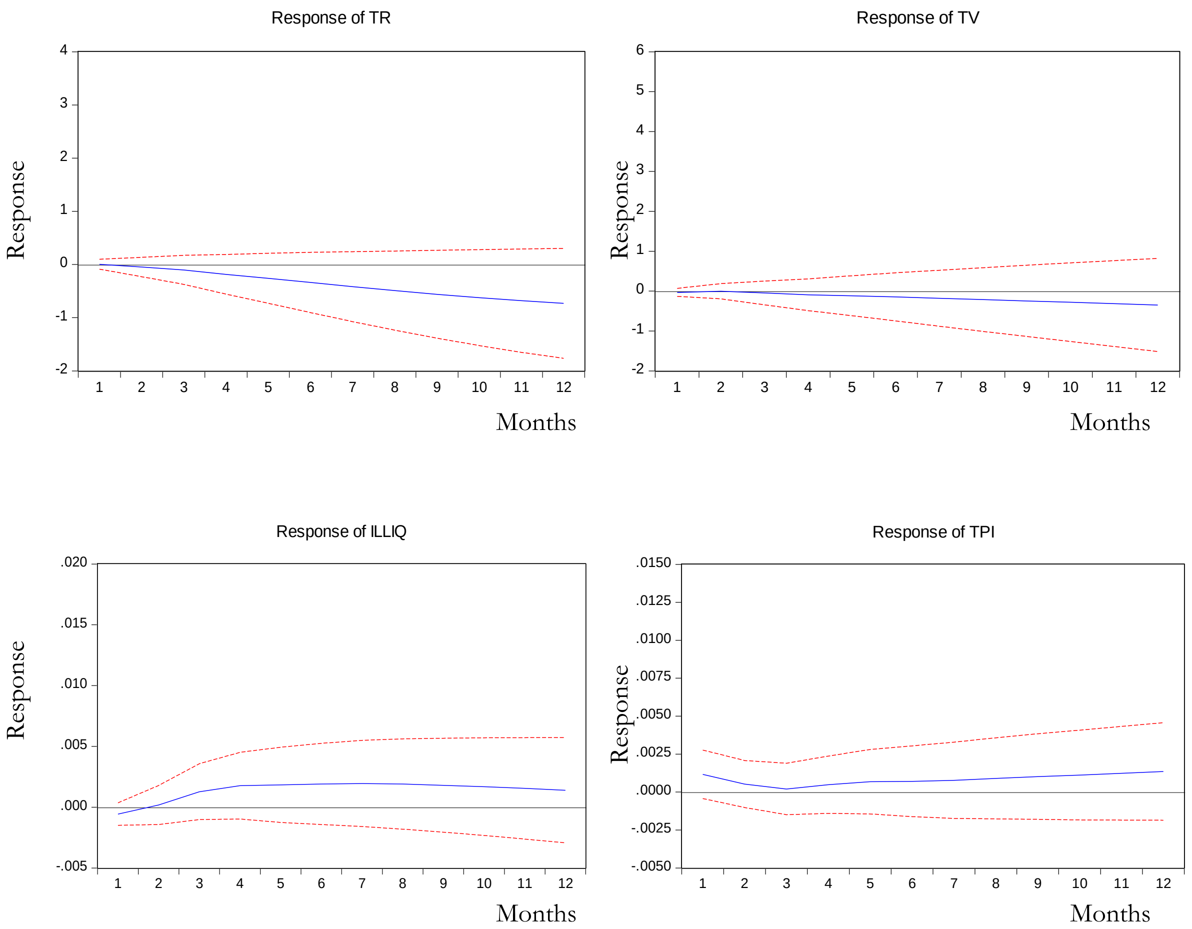


Figure 7.1: Impulse response of monetary policy shocks. Each group shows the accumulated response of each monetary policy variable on (il)liquidity measures. The X-axes represents time (which is in month) and Y-axes represents the impulse response to shocks.

The impulse responses in Group B, C and D suggest that Amihud's (2002) illiquidity ratio is more sensitive to bank rate and cash reserve ratio changes. Besides, changes in short-term interest rate and cash reserve ratio strongly influence overall turnover rate in DSE. Surprisingly, the turnover price impact is least sensitive to changes in any of the monetary policy variables. Therefore, based on overall impulse responses, we can conclude that stock market liquidity (illiquidity) tends to rise (decline) as the base money growth increases. Conversely, market illiquidity (liquidity) tends to rise (decline) as the bank rate, cash reserve ratio and short-term interest rate increases. That means expansionary (contractionary) monetary policy of Bangladesh bank increases (decreases) the liquidity in DSE. The results are consistent with previous studies, such as Chordia et al. (2005), Goyenko and Ukhov (2009) and Fernández-Amador et al. (2013). For example, Chordia et al. (2005) report that an unexpected loosening of monetary policy, as measured by a decrease in net borrowed reserves, is associated with a contemporaneous increase in stock liquidity. Goyenko and Ukhov (2009) find that stock illiquidity is positively associated with a positive shock to Federal fund rate and decreases in response to positive shock to non-borrowed reserves.

As an alternative measure recommended in many others including Chordia et al. (2005), we consider the variance decomposition (presented in Table 7.7) of the liquidity measures to disentangle the information contributed by monetary policy measures. The results indicate that the base money growth and bank rate respectively can explain more than 10 percent variance of trading volume and Amihud's (2002) illiquidity ratio. Their effects also stabilize after 3 and 6 months respectively. The results further show that the cash reserve ratio and base money growth have significantly more power to explain the respective variance of four (il)liquidity measures rather than other two monetary policy variables. However, the percentage explained by the base money growth is larger than the cash reserve ratio (see Fernández-Amador et al., 2013). The short-term interest rate has weak power to explain the variance of any four (il)liquidity measures. For other macroeconomic variables, we find inflation rate has greater effect than industrial production (results are not reported). Own-market volatility (up to 20 percent) and returns (up to 21 percent) are other important variables (not shown) that can significantly explain the variance of market (il)liquidity (see Chordia et al., 2005).

Table 7.7: Variance decomposition associated with monetary policy shocks

	Group A: Base Money growth shocks				Group B: Bank Rate Shocks			
Period	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
1	0.929	6.663	3.363	0.122	0.034	1.529	0.079	0.021
2	1.930	7.534	5.818	0.650	0.110	1.610	2.938	0.137
3	2.557	10.216	6.707	0.762	0.404	1.248	8.595	0.698
4	3.308	10.137	6.642	0.814	0.359	1.338	9.654	0.762
5	4.004	10.360	6.669	0.815	0.361	1.304	9.731	0.885
6	4.615	10.561	6.725	0.825	0.382	1.230	10.196	0.949
7	5.124	10.674	6.729	0.825	0.376	1.211	10.244	0.955
8	5.543	10.742	6.729	0.825	0.373	1.199	10.266	0.973
9	5.876	10.792	6.731	0.825	0.375	1.175	10.296	0.973
10	6.128	10.820	6.731	0.825	0.374	1.159	10.297	0.975
11	6.313	10.830	6.731	0.825	0.372	1.147	10.299	0.975
12	6.441	10.828	6.731	0.825	0.372	1.135	10.301	0.975
	Group C: Cash Reserve Ratio Shocks				Group D: Interest Rate shocks			
1	0.166	0.083	3.275	0.289	0.006	0.575	1.724	0.247
2	2.797	0.284	5.288	1.144	0.564	0.436	1.882	0.267
3	3.679	0.231	6.197	1.922	0.929	0.630	1.930	0.451
4	4.336	0.200	6.166	2.687	1.840	0.529	1.955	0.458
5	4.502	0.270	6.100	2.806	2.399	0.564	1.967	0.651
6	4.849	0.274	6.115	2.864	2.989	0.592	1.968	0.650
7	5.104	0.279	6.116	2.867	3.581	0.619	1.975	0.655
8	5.265	0.284	6.113	2.871	4.096	0.654	1.989	0.654
9	5.381	0.290	6.113	2.870	4.520	0.705	2.003	0.654
10	5.468	0.296	6.114	2.871	4.866	0.767	2.016	0.655
11	5.529	0.301	6.113	2.871	5.143	0.838	2.030	0.657
12	5.571	0.306	6.113	2.870	5.359	0.917	2.044	0.658

7.4.2.2 The impact of fiscal policy shocks

For fiscal policy and liquidity measures, we have run 12 different VAR models and Table 7.8 shows the pairwise Granger causality between endogenous variables associated with those VAR models. Here, the null hypothesis we test is that the lagged endogenous variables of interest (i.e. fiscal policy or liquidity measures) do not Granger cause the dependent variable of the interest (again, either market liquidity or fiscal policy variables).The results shows that fiscal policy variables have causal and reverse-causal associations with both liquidity and illiquidity measures.

For example, government expenditure has significant causality with trading volume. Similarly, Amihud's (2002) illiquidity measure is Granger caused by government borrowing and public borrowing; the coefficients are statistically significant at 5 and 10 percent respectively. However, we see there is only one reverse-causality between turnover rate and private borrowing. Altogether, results support the long-run cointegration between liquidity measures and fiscal policy variables for DSE as expected in section 7.4.1.

Table 7.8: Granger Causality Test (For fiscal policy variables)

	RET	STD	GE	GB	PB	TR	TV	ILLIQ	TPI
RET		0.12 (0.735)	0.14 (0.706)	0.06 (0.813)	1.55 (0.215)	2.72 (0.101)	1.81 (0.181)	0.28 (0.595)	0.043 (0.511)
STD	0.00 (0.991)		3.26 (0.073)	3.26 (0.073)	1.47 (0.226)	0.63 (0.429)	7.24 (0.008)	0.02 (0.900)	2.54 (0.113)
GE	3.92 (0.049)	0.32 (0.570)		0.39 (0.530)	2.64 (0.107)	0.35 (0.555)	2.61 (0.097)	0.05 (0.815)	0.73 (0.394)
GB	1.41 (0.236)	0.18 (0.669)	1.30 (0.257)		4.83 (0.029)	0.27 (0.606)	1.51 (0.221)	3.98 (0.047)	0.06 (0.811)
PB	0.37 (0.543)	1.23 (0.268)	2.93 (0.089)	5.50 (0.020)		0.15 (0.697)	2.10 (0.149)	2.74 (0.100)	1.89 (0.171)
TR	3.67 (0.057)	1.13 (0.289)	0.27 (0.606)	0.06 (0.805)	4.96 (0.023)		2.12 (0.147)	0.13 (0.715)	0.12 (0.729)
TV	0.22 (0.637)	1.89 (0.172)	0.29 (0.592	0.19 (0.659)	0.42 (0.518)	3.89 (0.050)		4.59 (0.034)	1.55 (0.215)
ILLIQ	0.00 (0.957)	4.75 (0.031)	1.25 (0.265)	0.52 (0.472)	1.08 (0.300)	0.88 (0.349)	1.67 (0.198)		3.18 (0.077)
TPI	6.39 (0.013)	1.12 (0.291)	0.49 (0.485)	0.13 (0.722)	1.48 (0.225)	1.41 (0.237)	2.09 (0.150)	1.39 (0.240)	

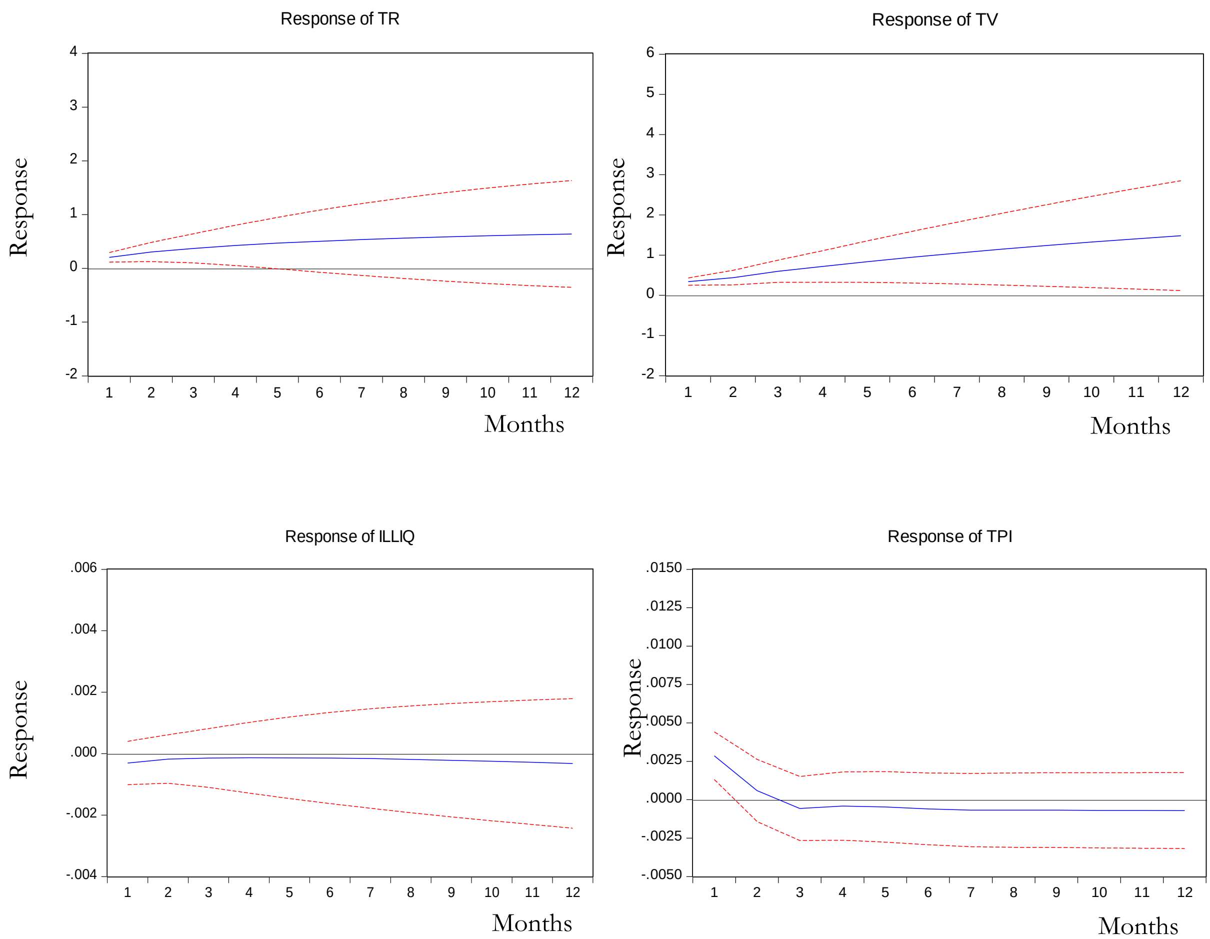
Note: we follow a similar approach as Table 8.6 to measure the Granger causality between fiscal policy and market liquidity. Each result indicates row variable does or does not Granger cause column variable. Some of the results in Table 8.6 and this Table (8.8) are similar as they represent same exogenous variables, such as causality between RET, STD and liquidity measures. However, we include them to present each policy's results. *p-values* are in brackets below in each cell.

Table 7.8 further shows important results related to two-way causation between fiscal policy and other endogenous variables of the VAR. For example, government expenditure has one-way causation with market returns and this association is statistically significant at 5 percent level. In addition, market volatility significantly Granger causes the government expenditure and government borrowing. That implies, sometime market characteristics can influence the government's fiscal decision and there are empirical evidences available on this relationship. For example, Tagkalakis (2011) reports that changes in equity price have impact on government expenditure and revenue.

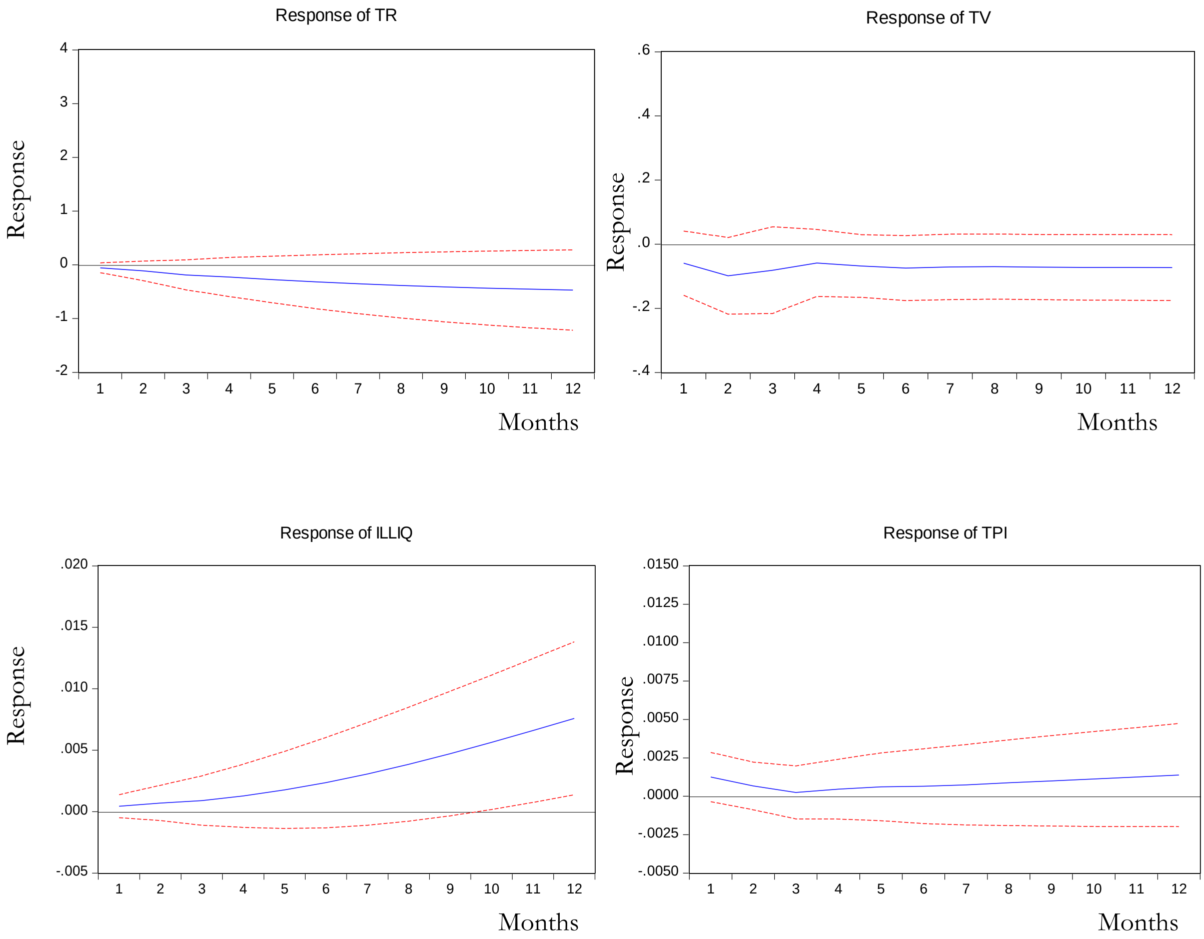
Similar to the monetary policy influences and the recommendation of Gagnon and Gimet (2013), we report the impulse response functions and variance decomposition to better understand the dynamics of fiscal policy within VAR system. We order our variables as follows: macroeconomic variables, IP, IR and FP first, followed by STD, RET and (il)liquidity. The accumulated responses of market liquidity to a unit standard deviation innovation in fiscal policy shocks are presented in Figure 7.2 (from Groups A to D), traced forward over a period of 12 months. In each group four graphs represents two liquidity and two illiquidity measures to fiscal policy variables. The responses are estimated using standard Cholesky decomposition of the VAR residuals and the bootstrap 95 percent confidence bands gauge the statistical significance of the responses.

Figure 7.2: Impulse Response of Fiscal Policy shocks

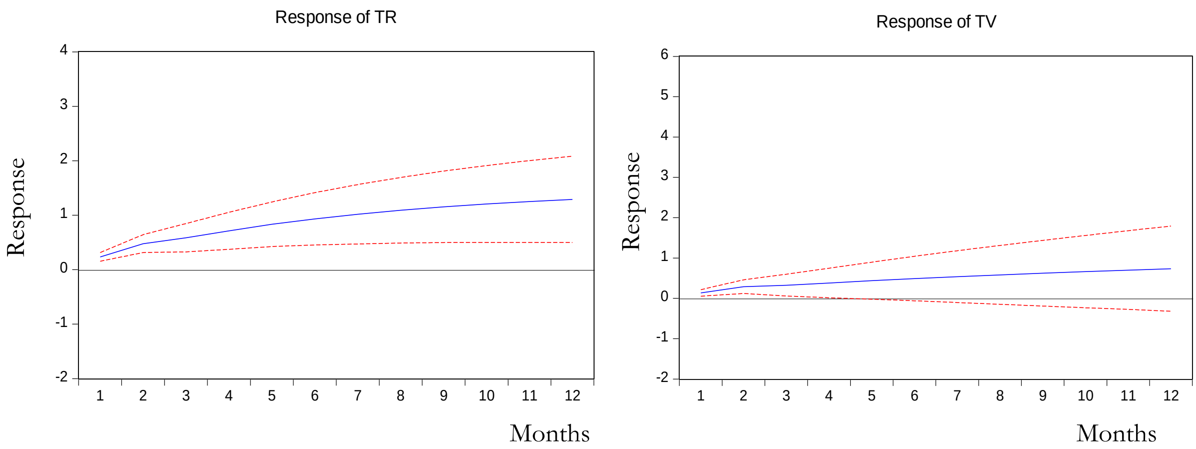
Group A: Accumulated response of (il) liquidity variables to Cholesky One S.D. Government Expenditure shocks



Group B: Accumulated response of (il) liquidity variables to Cholesky One S.D. Government Borrowing shocks



Group C: Accumulated response of (il) liquidity variables to Cholesky One S.D. Private Borrowing shocks



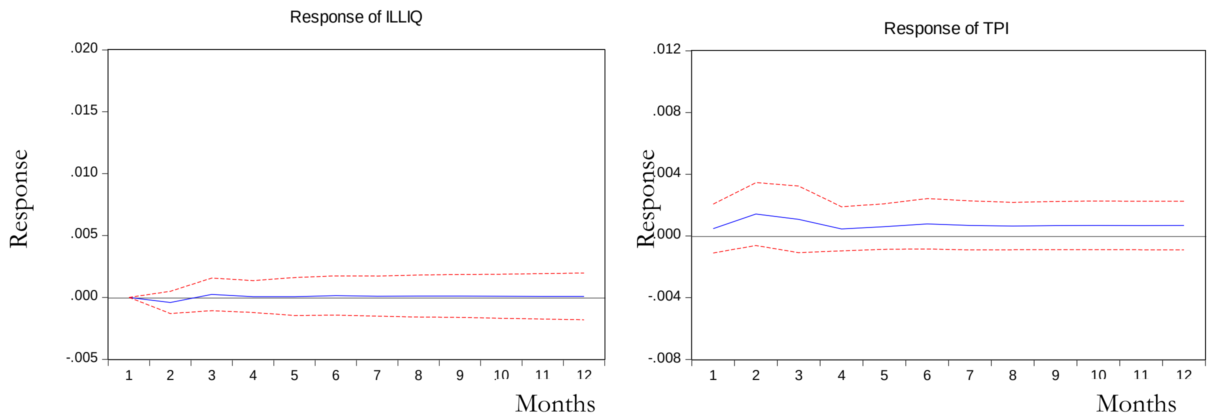


Figure 7.2: Impulse response of fiscal policy shocks. Each group shows the accumulated response of each fiscal policy variable on (il)liquidity measures. The *X-axes* represents time (which is in month) and *Y-axes* represent the impulse response to shocks.

The accumulated responses (from Group A to C) show that market liquidity increases following government expenditure and private borrowing shocks. In particular, turnover rate increases at a decreasing rate over the 12 months period due to any changes in government expenditures or private borrowing. However, the influence is strongly positive for private borrowing than government expenditure. On the contrary, trading volume significantly increases due to any shocks from government expenditure than private borrowing. Therefore, we can assert that expansionary (contractionary) fiscal policy increase (decrease) the market liquidity of DSE. In vein, it is documented in earlier literatures that fiscal shocks or large budgetary stimulus can facilitate access to credit for the private sector (see Blanchard, 2009; Gagnon and Gimet, 2013) and this credit could channel to the stock market to boost liquidity.

On the other hand, as expected, government borrowing significantly influences the Amihud's (2002) illiquidity ratio and turnover price impact (Group B). In addition, impulse responses show that the government borrowing also reduces the liquidity related ratios. Combined, these results support 'crowding out' effect in this economy created by the government and thus business firms suffer from lack of credit opportunity (see among many, Fisher, 1988). Interestingly, we find minimum effect of government expenditure and private borrowing on illiquidity measures.

The variance decomposition results of liquidity measures associated with fiscal policy variables are reported in Table 7.9. We can make several conclusions from these results. Firstly, government expenditure and borrowing have greater power than private borrowing to explain the variation in liquidity and illiquidity. For example, government expenditure can explain 6 percent of the variance in turnover rate and 11 percent in trading volume. Government borrowing, on the other hand, can contribute around 16 percent information to Amihud's (2002) illiquidity ratio and around 8 percent information to turnover price impact of Florackis et al. (2011). Secondly, at short horizon private borrowing significantly influences market liquidity (i.e. turnover rate by 13.41 percent), however, that decreases and stabilizes after six months. Thirdly, the percentages explained by fiscal policy measures stabilize after 3 to 6 months periods. Fourth, the effect of fiscal policy is comparable to or even larger than other macroeconomic variables, such as industrial production and inflation rate (not show). However, own-market returns and standard deviation are often important factors for explaining the liquidity variances (not reported). Finally, the amount of information contributed by fiscal policy in liquidity measures variance is higher than the monetary policy variables.

Table 7.9: Variance decomposition associated with Fiscal Policy shocks

	Group A: Government Expenditures				Group B: Government borrowing				Group C: Private borrowing			
Period	TR	TV	ILLIQ	TIP	TR	TV	ILLIQ	TIP	TR	TV	ILLIQ	TIP
1	0.883	8.539	3.247	0.062	0.920	4.130	13.375	6.139	13.407	4.172	0.118	0.236
2	1.823	8.805	4.898	0.708	1.280	3.298	15.036	5.690	10.969	3.414	3.037	1.021
3	2.371	8.827	5.721	0.706	1.920	6.135	15.851	7.483	9.587	6.394	2.985	1.074
4	3.084	9.048	5.679	0.912	1.896	6.208	15.809	7.646	8.790	6.500	3.856	1.394
5	3.734	9.923	5.651	0.925	1.988	6.215	15.782	7.745	8.215	6.500	4.555	1.407
6	4.298	9.999	5.677	0.943	2.084	6.219	15.808	7.747	7.843	6.507	4.582	1.433
7	4.774	10.268	5.680	0.943	2.135	6.219	15.811	7.749	7.598	6.507	4.623	1.441
8	5.169	10.650	5.678	0.944	2.169	6.219	15.808	7.749	7.433	6.506	4.679	1.442
9	5.483	10.116	5.679	0.944	2.200	6.219	15.809	7.749	7.324	6.506	4.685	1.443
10	5.723	10.639	5.679	0.944	2.223	6.218	15.809	7.748	7.252	6.506	4.685	1.443
11	5.901	10.206	5.679	0.944	2.239	6.218	15.809	7.746	7.204	6.506	4.689	1.443
12	6.026	11.806	5.679	0.944	2.251	6.218	15.809	7.745	7.174	6.505	4.689	1.443

Interestingly, it is documented from the results of impulse responses (Figure 7.1 & 7.2) and variance decomposition (Table 7.7 & 7.9) that the liquidity measures of DSE not only influenced by monetary policy but fiscal policy variables also have significant effect. Nevertheless, there is little empirical evidence available in this area except Gagnon and Gimet (2013). In their paper, Gagnon and Gimet (2013) report government spending has a positive impact on credit and consumption. Earlier studies, e.g. Spilimbergo et al. (2009), Blanchard et al. (2010), and Eggertsson and Krugman (2012) support this idea and suggest that tax breaks, fiscal stimulus and expansionary fiscal policy can increase firms' and investors' access to credit. In particular, Spilimbergo et al. (2009) assert that tax breaks can strengthen consumers' and companies' financial health, which would in turn increase their access to credit and thus enhance liquidity.

Beside this limited empirical documentation on liquidity, there is much evidence available on the relationship between fiscal policy and financial markets from both developed and emerging economies. For example, Darrat (1988) finds that fiscal deficit exerts a highly significant negative impact on current stock market of Canada. Using a panel of OECD countries, Ardagna (2009) reports that fiscal adjustments based on expenditure reductions are related to an increase in stock market price. Montes and Tiberto (2012) provide evidence from Brazil and their results suggest that the efforts of both fiscal and monetary authorities have been essential for macroeconomic stability and thus, to stimulate the stock market. Similarly, from multi-country data set Chatziantoniou et al. (2013) report that both fiscal and monetary policy influence the stock market, via direct or indirect channels. Recently, Belo et al. (2013) claim government spending has an impact on expected firm cash flows. In addition, the uncertainty about the impact of government policies can affect the rate at which future cash flows are discounted. Earlier, Pástor and Veronesi (2012) comment, governments shape the environment in which the private sector operates and stock prices should fall on the announcement of policy changes, on average.

Sometime the impact of monetary policy depends on fiscal policy, e.g. Jansen et al. (2008) maintain that the effect of monetary policy on the stock market varies, depending on the fiscal policy stance. Moreover, when the equity market is influenced by both policies, as happens in DSE, the direction of final interaction between these two variables is important. This is because when the central bank formulates disinflationary policies while the government is engaged in expansionary strategies then the ultimate outcome will deviate significantly from the desired objective (see Dixit and Lambertini, 2003). For investors our findings have significant implications. They have to understand the relationship between macroeconomic variables and stock market performance while making their investment decisions. They should consider cyclic association between fiscal and monetary policy rather than the isolated impact on the DSE.

7.4.2.3 The Impact of financial crisis 2008-09

It is documented in earlier literature that at financial crisis market conditions can be severe and liquidity can decline or even disappear (see Chordia et al., 2005). They suggest that such liquidity shocks are a potential channel through which asset prices are influenced by liquidity. In this vein, Næs et al. (2011) mention a possible causal link between a decline in the liquidity of financial assets and economic crises. Many other empirical papers, such as Amihud et al. (1990), Liu

(2006), Brunnermeier and Pedersen (2009), Rösch and Kaserer (2013) and Gagnon and Gimet (2013) have highlighted the relationship between equity market liquidity and various financial crises. We, following these earlier studies, therefore, investigate the influence of the recent financial crisis (i.e. 2008-09) on the liquidity measures of this newly emerging stock market. As the crisis expanded and become global, emerging markets, too, began to experience liquidity strains (Yehoue, 2009). Similarly, Blanchard (2009) mentions that by 2008 the credit freeze crisis had spread internationally, causing a dramatic global decrease in stock markets and a fall in consumers' and firms' confidence. Previously, on emerging markets liquidity, Lesmond (2005) and Yeyati et al. (2008) have examined the impact of financial crises. However, Lesmond (2005) show the impact of the Asian and Russian crises and Yeyati et al. (2008) consider the crisis episodes over the period from April 1994 to June 2004.

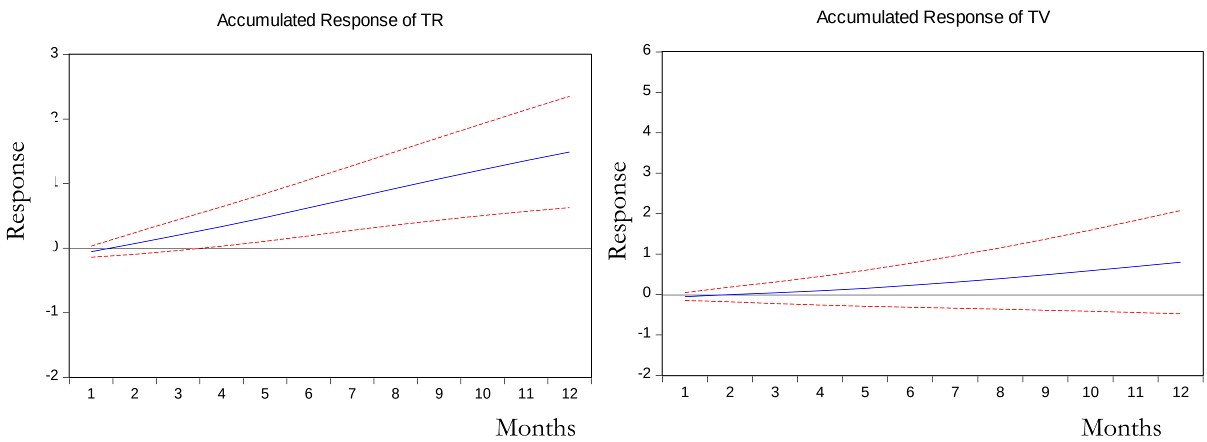
Table 7.10 reports the Granger causality between market liquidity measures and the recent financial crisis. The results show that the 2008-09 crisis has one-way causality with turnover rate and trading volume. Here, we can reject the null hypothesis that crisis does not Granger cause turnover rate at 1 percent level and at 10 percent level for trading volume. That means during recent financial crisis trading activities in DSE have been significantly affected. Earlier, a similar link between trading activity and crises has been identified by Yeyati et al. (2008) in their emerging market's sample. We do not find any reverse-causality between market illiquidity and crisis. These results, thus, deny the argument of Amihud and Mendelson (1986) and Næs et al. (2011) and imply that in DSE illiquidity does not lead crisis or a decline in the liquidity of financial assets of DSE is not Granger cause an economic crisis. It is obvious because the source of crisis 2008-09 was the US market (see, Cornett et al., 2011) and the role of DSE in international financial flows is still limited.

Table 7.10: Granger causality between liquidity and financial crisis of 2008-09

	TR	TV	ILLIQ	TPI
Panel A: Crisis does not Granger cause (il)Liquidity				
	15.3218***	3.3185*	0.0062	0.0973
	(0.0001)	(0.0705)	(0.9376)	(0.7555)
Panel B: (il)Liquidity does not Granger cause Crisis				
	0.2081	0.0213	0.0062	0.0777
	(0.6489)	(0.8841)	(0.9376)	(0.7809)

The impulse responses and variance decomposition in our VAR system are reported in Figure 7.3 and Table 7.11 respectively. Figure 7.3 shows the accumulated responses of market liquidity to a unit standard deviation innovation in crisis, traced forward over a period of 12 months. Similar to previous sections (i.e. 7.4.2.1 & 7.4.2.2), the responses are estimated using standard Cholesky decomposition of the VAR residuals and the bootstrap 95 percent confidence bands gauge the statistical significance of the responses. We see both the liquidity related measures (i.e. turnover rate and trading volume) increase following the crisis shock. Here, an innovation to crisis is strongly significant on turnover rate with response peaking from period one. However, the trading volume starts to increase from fourth month following an innovation to crisis. Our results are consistent with other emerging markets, e.g. finding of Lesmond (2005) and Yeyati et al. (2008). Analysing 23 emerging markets Lesmond (2005) show that bid-ask spread and several other liquidity measures sharply increase during the Asian and Russian financial crisis. Yeyati et al. (2008) also find initial increase in trading activity during crisis period by examining seven different countries and 52 different stocks. The variance decomposition (Table 7.11) further shows that the financial crisis can explain around 27 percent error variance of turnover rate and around 5 percent of trading volume during that periods. However, both the impulse responses and variance decomposition explain that in DSE there is little relationship exists between financial crisis and market illiquidity.

Figure 7.3: Accumulated response of (il) liquidity variables to Cholesky One S.D. crisis 2008-09 shocks



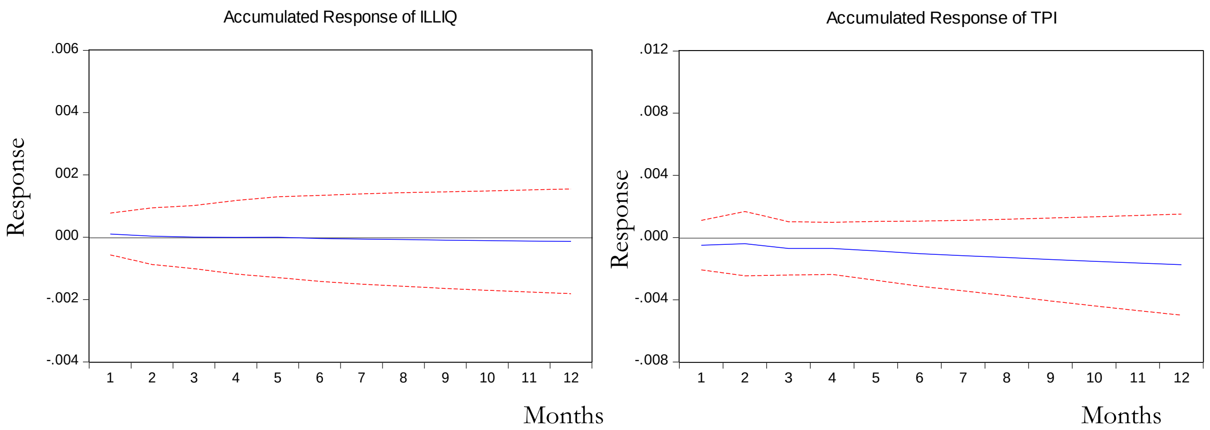


Figure 7.3: Impulse response of crisis 2008-09 shocks. Each graph shows the accumulated response of financial crisis 2008-09 on (il)liquidity measures. The *X-axes* represents time (which is in month) and *Y-axes* represent the impulse response to shocks.

Table 7.11: Variance decomposition associated with financial crisis

Period	TR	TV	ILLIQ	TPI
1	1.000316	0.753618	0.244947	0.010279
2	4.366475	1.061212	0.232255	0.354659
3	6.84131	1.101586	0.301277	0.644446
4	9.147535	1.256838	0.300297	0.646622
5	11.61933	1.521987	0.320229	0.640519
6	14.27196	1.906438	0.348202	0.653554
7	16.86161	2.34483	0.361971	0.653577
8	19.28124	2.825471	0.373787	0.653654
9	21.51867	3.341251	0.387753	0.655044
10	23.54498	3.87664	0.400045	0.655179
11	25.3446	4.41956	0.41021	0.655613
12	26.92426	4.962394	0.419321	0.656028

It is interesting that when the world financial markets were hit by the credit crunch, Bangladesh experienced two major political changes that brought a huge difference in its economic prospects at that period. First, power was taken by the Caretaker Government (i.e. a form of non-political government) backed by military in early 2007 and second, a general election in December 2008, followed by a new political government in power. Both the events were significantly boosted the economic confidence and the confidence of investors. We saw the reflection of this confidence in the performance of DSE, market index was increased by 66% alone in 2007, which was a ten-year high since 1996 (i.e. before the first stock market crash in Bangladesh). Following this surge the number of individual and institutional investors in the equity market was also rise significantly. The growth and future prospects of the economy and equity market got an international reputation. For example, J.P. Morgan named this country as one of the 'Frontier Five' and Merrill Lynch described Bangladesh as being 'probably the most reform story in Asia' (see Thakur, 2007). However, the economy slowed down during the middle of 2008 but momentum resumed when a new political party formed the government following a general election at the end of 2008. Momen (2010) asserts that despite the global recession, the FDI (foreign direct investment) inflow in 2009 increased to $1.09 billion, crossing the billion-dollar mark for the first time. The currency rate against the dollar remained stable, inflation came down and a growth of 18.7 percent was reported in domestic credit flow (see Momen, 2010). In addition, to promote private investment, government included provision in budget for a three-year amnesty to allow black money into mainstream economy. As a result, e.g. about 4.27 billion (in local currency) of 'black money' flowed into stock market in just one year (i.e. 2009-10 financial year).

Altogether, we can make three major conclusions from the results of financial crisis shocks and macroeconomic events during that time. First, DSE is not highly integrated with world market and hence it has received minimum negative effect from the recent financial crisis. Therefore, foreign investors have found this market as a good diversification opportunity and as an indicator FDI has increased significantly following the global recession. Second, this market is strongly sensitive to local economic and political information rather than international macroeconomic news. This market jumped positively with the onset of the new Caretaker and political government beside the global stock market crash. Supporting this behaviour, The Economist (2011) reports, since 2007, the DSE has been outperforming almost all the world's markets and gaining by as much as 410% in value over the period till 2010. Finally, due to crisis and three-year amnesty, black money owners may be redirected their investments from developed market to local equity market, which has subsequently increased the trading flow in DSE. Because it is evident from the Granger causality, impulse responses and variance decomposition that only measures related to liquidity (i.e. TR and TV) have Granger causality with financial crisis and positively influenced by the crisis shocks. Yet none of the illiquidity related ratios are found statistically significant.

7.4.3 Firm and industry level evidence

In line with our second objective this section provide evidences related to influence of monetary and fiscal policy variables on liquidity of individual firms traded in DSE. Using equation (vi) and (vii), in first step, we run panel regressions on respective firms and then in second step, panel regressions on major industries to see the impact of macroeconomic management policy. The outcomes are reported in Table 7.12 through 7.15. The interaction term $(Int_{i,t-1})$ in our models for individual firms indicates whether the influence of monetary (MP) or fiscal policy (FP) depends on firm size as measured by logged market capitalization. However, there is no such term in our second models, i.e. panel estimation for industries (Table 7.15), since firms are not sorted by size rather they are sorted by sector. We test for stationarity applying the panel unit root test developed by Levin et al. (2002) and Pesaran (2007). For market capitalization (MV) we do not reject the null of a unit root, therefore, use first difference which further minimize the multicollinearity problem. In order to account for heteroskedasticity, all *p-values* are based on robust standard errors. The lag order for each variable is selected based on whether any autocorrelation exists in the residuals.

7.4.3.1 Macroeconomic management and individual firms

We estimate panel regressions for each of the four (il)liquidity measures and the four monetary and three fiscal policy variables. Table 7.12 (Groups A and B) presents the influence of monetary policy and other macroeconomic variables on (il)liquidity measures. The impact of fiscal policy as well as other control variables on (il)liquidity of DSE are reported in Table 7.13. Due to the use of interaction term, it is convenient to evaluate the effects of the monetary and fiscal policy at different percentiles of the sample distributions for the interaction variable (market capitalization) (see Fernández-Amador et al., 2013). The impact of monetary and fiscal policy is evaluated at the minimum 20%, 40%, 60%, 80% and maximum. Here, we report the sign, magnitude and significance of interaction term for each of these size-based portfolios in Table 7.14. The results given in Table 7.12 and 7.13 are the marginal effects at the median of the distributions.

The first four columns of Group A in Table 7.12 depict the estimation results when measuring monetary policy by the rolling twelve-month growth rate of base money. Results are significantly positive for turnover rate and trading volume. Thus, as hypothesized, an increase in growth rate of base money leads to a rise in trading activity, while illiquidity declines. This implies that an expansionary (contractionary) monetary policy increase (decrease) in individual stocks' liquidity (illiquidity). However, our particular interest is to see the results of interaction terms, i.e. whether the impact of money supply growth depends on size of firms. The estimations show (Table 7.14) that the liquidity measures (i.e. TR and TV) of smaller firms (i.e. bottom 20%) and illiquidity ratios (i.e. ILLIQ and TPI) of larger firms (i.e. top 20%) are significantly influenced by the money supply growth rate. However, the coefficient of Amihud's (2002) illiquidity ratio for smallest 20 percent of firms (-0.6140) is higher than the same coefficient of largest 20 percent firms (-0.0497). In addition, sign of liquidity measures for largest portfolio is negative but is positive for smallest portfolio, which indicates with the increase in market liquidity investors prefer to invest more into smaller firms. This result is consistent with the behaviour of DSE investors, as short-term investment is more profitable than long-term investment and average returns from smaller firms (which are generally category z in DSE) are higher than average returns from larger portfolios (see Table 6.4c in Chapter 6).

The rest of the results in Table 7.12 are related to panel estimations where central bank policy is approximated by the bank rate, cash reserve ratio and short-term interest rate. We see in each model coefficients of monetary policy are negative for liquidity measures and positive for illiquidity measures. For example, the impact of bank rate is positive and statistically significant on Amihud's (2002) illiquidity ratio and turnover price impact. Similarly, cash reserve ratio and short-term interest rate have significant negative influence on turnover rate. These results are well in line with our hypothesis that any such restrictive monetary policy decreases the liquidity and increases illiquidity for overall equity market. The interaction term (Group A of Table 7.14) generally confirms the empirical pattern observed in base money growth with slight differences. Top and bottom 20 percent portfolios are more sensitive to monetary policy and respectively illiquidity and liquidity ratios are highly influenced by those policy variables. We find that increase in bank rate and short-term interest rate increase (decrease) the liquidity of larger firms (smaller firm). That means during restrictive monetary policy investors prefer larger firms than smaller. This is because restrictive times lead to contraction in liquidity and it is expected that trading activity during those periods will be confined to the largest stocks (as they will be enjoying the least liquidity risk). In particular, this is important for individual investors, as they will have to focus on liquid stocks in order to sell them when they underperform. In addition, changes in cash reserve ratio negatively affect the liquidity of larger firms. But any changes in CRR increase (decrease) the liquidity (illiquidity) for smaller portfolios in DSE. Finally, it is interesting that regardless of the size of firms, the trading volume ratio is influenced by all four central bank policies and their coefficients are also statistically significant.

Remarkably, Table 7.14 (Group A) provides mixed results on size-based portfolios compared to the empirical evidence. Here, we find both smaller and larger firms are sensitive to monetary policy changes. However, Amihud (2002) reports that small stocks are more responsive to illiquidity shocks, while large stocks become more attractive when aggregate liquidity decline. That means expansionary policy reduces the illiquidity for smaller firms significantly than larger firms and thus during restrictive period larger firms become preferable. On the other hand, Næs et al. (2011) and Fernández-Amador et al. (2013) also assert that smaller firms are more responsive to liquidity shocks, which implies contractionary policy has greater impact on smaller firms. Besides, we would expect the liquidity variation of small firms to be higher than the liquidity variation of large firms (Næs et al., 2011).

In particular, Fernández-Amador et al. (2013) report that the liquidity-providing effect of a loose monetary policy (i.e. higher money supply) is stronger for larger firms, but the impact of restrictive monetary policy (i.e. higher EONIA) tends to decrease with increasing firm size both for liquidity and illiquidity measures. In this line of thought, Næs et al. (2011) comment that variation in market liquidity is caused by portfolio shifts, from illiquid and more risky assets to safer and more liquid assets, due to changing expectations about economic fundamentals or binding funding constraints. For DSE we find slightly different outcomes and can make following conclusion based on our findings. First, these are strong and positive impacts of money supply growth rate on smaller firms with a negative effect on larger stocks. Second, restrictive central bank policies have differential impacts on smaller and larger portfolios. For example, bank rate negatively affects the liquidity and illiquidity of smaller stocks, but it has positive and negative effect on liquidity and illiquidity respectively of larger firms. However, cash reserve ratio has completely the reverse impact on the top (negatively) and bottom 20 (positively) percent size-based portfolios.

Table 7.12: Panel estimation for monetary policy impact on individual firms

Group A: Monetary Base and Bank Rate

	Monetary Base				Bank Rate			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
$\text{Dependent variable}_{t-1}$	0.6405***	0.6783***	0.3449***	0.5632***	0.6397***	0.6674***	0.3161***	0.5547***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$\text{Monetary policy}_{t-1}$	0.0413*	0.0354**	0.0027	0.0002	-0.0723	-0.1610	0.0243***	0.0061**
	(0.0630)	(0.0429)	(0.1663)	(0.5584)	(0.3788)	(0.2382)	(0.0056)	(0.0527)
$\text{Interaction term}_{t-1}$	-0.0018	1.0490***	-0.0027	0.0002	-0.0004	-0.0322***	-0.0000	-0.0002
	(0.4204)	(0.0000)	(0.1257)	(0.2934)	(0.5587)	(0.0000)	(0.2108)	(0.1277)
Return_{t-1}	14.9472*	4.0640**	-0.2530	-0.1587	12.1612	2.6103**	-0.1090	-0.1496
	(0.1016)	(0.0203)	(0.5432)	(0.3639)	(0.1572)	(0.0171)	(0.7617)	(0.4376)
$\text{Standard deviation}_{t-1}$	-7.1457***	-12.6898***	-0.2850*	-0.1796**	-6.9082***	-12.7507***	-0.2990*	-0.1983***
	(0.0051)	(0.0014)	(0.1083)	(0.0126)	(0.0066)	(0.0011)	(0.0784)	(0.0062)
$\text{Ln(Market value)}_{i,t-1}$	-0.0690	-0.0224	-0.0003	0.0000	-0.0587	-0.0193	-0.0026	-0.0001
	(0.4512)	(0.6240)	(0.7446)	(0.8482)	(0.4766)	(0.6775)	(0.8068)	(0.8047)
$\text{Industrial production}_{t-1}$	0.0011	0.0022	-0.0001	0.0000	0.0015	0.0039*	0.0000	0.0000
	(0.7224)	(0.3850)	(0.6450)	(0.5459)	(0.4469)	(0.1037)	(0.7481)	(0.5005)
Inflation_{t-1}	-0.0452	0.0292	-0.0020	0.0004	-0.0879***	0.0175	0.0014**	0.0015**
	(0.1900)	(0.4530)	(0.1212)	(0.2169)	(0.0335)	(0.6338)	(0.0326)	(0.0507)
Stock index_{t-1}	0.2722**	0.6078***	-0.0165*	-0.0002	0.2204*	0.5614***	-0.0072	0.0013
	(0.0169)	(0.0000)	(0.0152)	(0.8949)	(0.0948)	(0.0000)	(0.1761)	(0.6653)
R	0.5750	0.8003	0.2486	0.3882	0.5756	0.7997	0.2563	0.3916

***, ** and * are significant at 1%, 5% and 10% levels.

Group B: Cash Reserve Ratio and Short-term Interest Rate

	Cash Reserve Ratio				**Short-Term Interest Rate**			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
Dependent variable$_{t-1}$	0.6387***	0.6792***	0.3446***	0.5574***	0.6314***	0.6786***	0.3365***	0.5568***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Monetary policy$_{t-1}$	-0.3498**	-0.1124	0.0136	0.0113***	-0.1030***	-0.0172	0.0001	0.0027***
	(0.0491)	(0.5253)	(0.2939)	(0.0071)	(0.0006)	(0.6586)	(0.4949)	(0.0031)
Interaction term$_{t-1}$	-0.0007	0.0562***	-0.0002	0.0000	0.0008	0.0451***	-0.0001	0.0000
	(0.6021)	(0.0000)	(0.1635)	(0.1964)	(0.6614)	(0.0000)	(0.1140)	(0.2287)
Return$_{t-1}$	8.6337	1.9284**	-0.2420	-0.1171	11.7852	2.9142**	-0.2060	-0.1322
	(0.2031)	(0.0216)	(0.6077)	(0.4145)	(0.1942)	(0.0118)	(0.5193)	(0.4013)
Standard deviation$_{t-1}$	-6.9690***	-12.8486*	-0.2990*	-0.1717**	-7.3263***	-12.8944***	-0.2950	-0.1749**
	(0.0062)	(0.0011)	(0.1044)	(0.0120)	(0.0039)	(0.0011)	(0.1511)	(0.0146)
Ln(Market value)$_{i,t-1}$	-0.0655	-0.0251	-0.0009	0.0000	-0.0724	-0.0314	-0.0009	-0.0001
	(0.4739)	(0.6231)	(0.7870)	(0.8356)	(0.4269)	(0.6188)	(0.7831)	(0.6847)
Industrial production$_{t-1}$	0.0012	0.0035	0.0000	0.0000	0.0012	0.0037	0.0000	0.0000
	(0.6684)	(0.1461)	(0.8874)	(0.7450)	(0.5464)	(0.1277)	(0.7607)	(0.6767)
Inflation$_{t-1}$	-0.0025	0.0477	-0.0013	-0.0003	0.0680	0.0551	-0.0021**	-0.0004
	(0.2991)	(0.1285)	(0.2279)	(0.1646)	(0.1291)	(0.2655)	(0.0201)	(0.7210)
Stock index$_{t-1}$	0.4668***	0.6819***	-0.0170*	-0.0069**	0.0226	0.5576***	-0.0183*	0.0050
	(0.0020)	(0.0000)	(0.1010)	(0.0797)	(0.7091)	(0.0023)	(0.0602)	(0.1569)
R	0.5797	0.8002	0.2480	0.3909	0.5752	0.8007	0.2477	0.3930

***, ** and * are significant at 1%, 5% and 10% levels.

Third, supporting the arguments of Amihud (2002) and Næs et al. (2011) investors may shift to more liquid (larger firms) portfolio during contractionary period. Fourth, since smaller firms are more dependent on bank lending than larger firms thus a restrictive monetary policy (i.e. higher short-term interest rate) may increase the cost of funds for them to a greater degree (see Fernández-Amador et al., 2013). Fifth, the influence of central bank policy on (il)liquidity of DSE largely depends on instruments used and therefore, investors and policy makers must be careful in measuring their impact on overall market. Finally, emerging market can yield spectacular returns that can easily exceeds 90% in any given year (Lesmond, 2005) and in the DSE this chance of earning is even higher from smaller stocks and hence, any changes in liquidity related monetary policy affect the smaller firms significantly.

Table 7.13 depicts the results of panel estimations of (il)liquidity measures where fiscal policy is approximated by government expenditure, government borrowing and private borrowing. Results indicate liquidity of individual firms is significantly and positively influenced by government expenditure and private borrowing, but negatively by government borrowing. On the other hand, government and private borrowing both affect Ahmihud's (2002) illiquidity ratio. While higher government borrowing increases illiquidity, private borrowing reduces it. These results are consistent with our hypothesis; expansionary (contractionary) fiscal policy by the government increases (decreases) the market liquidity at the firm level. For interaction terms (Group B of Table 7.14), we find a similar response to that of monetary policy – liquidity of smaller stocks and illiquidity of larger stocks are more sensitive to fiscal information. In addition, each policy variable creates differential impact on (il)liquidity measures, however, trading volume is affected significantly by all three fiscal policy across all firm size.

From Table 7.14, we see that the government expenditure increases trading activity for all size-portfolios except the largest 20 percent of stocks, which is negatively affected. Smaller firms are more sensitive to fiscal policy shocks on the DSE and their liquidity rise and illiquidity decline significantly. We find very consistent results of government borrowing with our hypothesis. Liquidity (illiquidity) of both smaller and larger firms reduces (increases) due to borrowing by the government from banking sector in Bangladesh. However, the magnitude of impact is higher for smallest portfolios. This result supports the argument of Fisher (1988) and Fernández-Amador et al. (2013). When government borrows from banking sector, business firms suffer and since smaller firms depend more on bank credit, they suffer more than others do.

Table 7.13: Panel estimation for Fiscal policy impact on individual firms

	Government Expenditure				Government Borrowing				Private Borrowing			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
Dependent variable$_{t-1}$	0.6395***	0.6785***	0.3447***	0.5627**	0.6396***	0.6798***	0.3445***	0.5629***	0.6404***	0.6780***	0.3444***	0.5629***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Fiscal policy$_{t-1}$	-0.0074	0.0206**	-0.0003	0.0002	-0.0063**	-0.0099	0.0003**	0.0000	0.0002	0.0131**	-0.0018**	-0.0004
	(0.6360)	(0.0200)	(0.5726)	(0.5289)	(0.0312)	(0.3886)	(0.0210)	(0.8416)	(0.5351)	(0.0245)	(0.0139)	(0.4364)
Interaction term$_{t-1}$	-0.0001	0.0252***	-0.0001	0.0000	0.0001	0.0642***	0.0000	0.0000	-0.0007	0.3964***	-0.0011	0.0001
	(0.4535)	(0.0000)	(0.1302)	(0.2526)	(0.4343)	(0.0000)	(0.1284)	(0.2688)	(0.4282)	(0.0000)	(0.1278)	(0.2706)
Return$_{t-1}$	13.0605	3.2367**	-0.2110	-0.1795	12.9848	3.1437**	-0.2090	-0.1774	13.3659	4.3561**	-0.1840	-0.1710
	(0.1495)	(0.0220)	(0.5596)	(0.3521)	(0.1520)	(0.0241)	(0.5403)	(0.3580)	(0.1286)	(0.0282)	(0.6028)	(0.3758)
Standard deviation$_{t-1}$	-7.0774***	-12.8089***	-0.2990*	-0.1811**	-7.0926***	-12.9506***	-0.2960*	-0.1789**	-7.0768***	-12.9706***	-0.3050*	-0.1797**
	(0.0055)	(0.0012)	(0.1060)	(0.0118)	(0.0054)	(0.0010)	(0.1092)	(0.0129)	(0.0055)	(0.0010)	(0.1054)	(0.0119)
ln(Market value)$_{i,t-1}$	-0.0667	-0.0266	-0.0009	0.0000	-0.0673	-0.0262	-0.0009	0.0000	-0.0667	-0.0271	-0.0009	0.0000
	(0.4649)	(0.6372)	(0.7862)	(0.8452)	(0.4622)	(0.6218)	(0.7867)	(0.8490)	(0.4438)	(0.5979)	(0.8063)	(0.8454)
Industrial production$_{t-1}$	0.0017	0.0045	-0.0001	0.0000	0.0017	0.0040*	0.0000	0.0000	0.0015	0.0040*	0.0000	0.0000
	(0.3830)	(0.6510)	(0.7390)	(0.5000)	(0.3803)	(0.0963)	(0.7736)	(0.5881)	(0.4785)	(0.0967)	(0.7830)	(0.5298)
Inflation$_{t-1}$	-0.0421	0.0328	-0.0020	0.0004	-0.0437	0.0316	-0.0020	0.0004	-0.0474	0.0272	-0.0022	0.0004
	(0.2154)	(0.4222)	(0.1150)	(0.2307)	(0.2143)	(0.4385)	(0.1125)	(0.2237)	(0.1862)	(0.5067)	(0.1387)	(0.2090)
Stock Index$_{t-1}$	0.2849**	0.6083***	-0.0163**	-0.0002	0.2835***	0.6096***	-0.0164**	-0.0002	0.2962**	0.6349***	-0.0147**	-0.0005
	(0.0172)	(0.0000)	(0.0210)	(0.8892)	(0.0167)	(0.0000)	(0.0209)	(0.9013)	(0.0183)	(0.0000)	(0.0362)	(0.8394)
R	0.5743	0.8001	0.2478	0.3881	0.5743	0.7997	0.2478	0.3883	0.5745	0.7997	0.2489	0.3898

***, ** and * are significant at 1%, 5% and 10% levels.

Table 7.14: Results of Interaction Term (lnMV*MP) or (lnMV*FP) based on Firm Size

Firm Size	**Top 20%**		**20%**		**20%**		**20%**		**Bottom 20%**	
	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*	Coefficient	*P-value*
Group A: Monetary Policy Variables										
Monetary Base (lnMV*MB)										
TR	-0.2331	0.3742	-0.0291	0.8346	-0.0018	0.9789	0.0368	0.4204	0.8901*	0.0823
TV	-0.4197*	0.0882	0.4553***	0.0021	1.1467***	0.0000	1.0490***	0.0000	2.9598***	0.0000
ILLIQ	-0.0497***	0.0017	-0.0027	0.6784	0.0027	0.4860	0.0079	0.1257	-0.6140***	0.0000
TPI	0.0197***	0.0005	0.0052	0.1708	-0.0003	0.8885	0.0002	0.2934	-0.0069	0.6506
Bank Rate (lnMV*BR)										
TR	0.0087	0.2830	0.0023	0.5982	-0.0003	0.8696	-0.0009	0.5587	-0.0288*	0.0767
TV	0.0135*	0.0743	0.0132***	0.0037	-0.0353***	0.0000	-0.0322***	0.0000	-0.1070***	0.0000
ILLIQ	-0.0013***	0.0074	-0.0000	0.9522	0.0001	0.5004	0.0002	0.2108	-0.0208***	0.0000
TPI	-0.0007***	0.0001	-0.0002	0.1134	0.0000	0.8732	0.0000	0.1277	-0.0005	0.2715
Cash Reserve Ratio (lnMV*CRR)										
TR	-0.0073	0.6021	-0.0009	0.9003	-0.0007	0.8466	0.0016	0.5125	0.0544*	0.0550
TV	-0.0211	0.1115	-0.0245***	0.0020	-0.0617***	0.0000	0.0562***	0.0000	0.1570***	0.0000
ILLIQ	-0.0027***	0.0016	-0.0002	0.6406	0.0002	0.4349	0.0004	0.1635	-0.0365***	0.0000
TPI	-0.0010***	0.0008	0.0003	0.1964	0.0000	0.9865	0.0000	0.1427	-0.0008	0.3264
Short-term Interest Rate (lnMV*SIR)										
TR	0.0084	0.4537	0.0008	0.8966	-0.0003	0.9194	-0.0009	0.6614	0.0351	0.1104

TV	0.0176*	0.0972	0.0221***	0.0005	-0.0502***	0.0000	-0.0451***	0.0000	-0.1278***	0.0000
ILLIQ	-0.0020***	0.0027	-0.0001	0.6585	0.0001	0.5003	0.0003	0.1140	-0.0257***	0.0001
TPI	-0.0008***	0.0008	0.0002	0.2287	0.0000	0.9342	0.0000	0.1723	-0.0002	0.8149
Group B: Fiscal Policy Variables										
					Government Expenditures (lnMV*GE)					
TR	-0.0054	0.3942	-0.0007	0.8442	-0.0001	0.9664	0.0008	0.4535	0.0216*	0.0790
TV	-0.0100*	0.0915	0.0108***	0.0022	0.0277***	0.0000	0.0252***	0.0000	0.0697***	0.0000
ILLIQ	-0.0012***	0.0017	-0.0001	0.6591	0.0001	0.4777	0.0002	0.1302	-0.0143***	0.0001
TPI	0.0005***	0.0005	0.0001	0.1713	0.0000	0.8963	0.0000	0.2526	-0.0001	0.6834
					Government Borrowing (lnMV*GB)					
TR	-0.0035	0.3953	-0.0004	0.8467	0.0001	0.9607	-0.0006	0.4343	-0.0140*	0.0779
TV	-0.0064*	0.0927	-0.0070***	0.0021	0.0179***	0.0000	-0.0163***	0.0000	-0.0449***	0.0000
ILLIQ	0.0008***	0.0017	-0.0000	0.6621	-0.0000	0.4843	0.0001	0.1284	0.0093***	0.0001
TPI	0.0003***	0.0005	-0.0001	0.1723	-0.0000	0.8860	0.0000	0.2688	0.0001	0.6974
					Private Borrowing (lnMV*PB)					
TR	-0.0844	0.3938	-0.0104	0.8434	-0.0007	0.9773	0.0136	0.4282	0.3382*	0.0806
TV	0.1590*	0.0859	0.1713***	0.0021	0.4348***	0.0000	0.3964***	0.0000	1.1165***	0.0000
ILLIQ	-0.0188***	0.0017	-0.0011	0.6635	0.0010	0.4856	0.0030	0.1278	-0.2160***	0.0001
TPI	-0.0075***	0.0005	0.0020	0.1723	-0.0001	0.8932	0.0001	0.2706	-0.0018	0.7529

Note: This table summarize the interaction term $(Int_{i,t-1})$ found in each panel estimation for each (il)liquidity model using equation 6 and 7. ***, ** and * are significant at 1%, 5% and 10% levels.

Under expansionary fiscal policy, government intervenes directly or indirectly to increase market liquidity and further to increase investors' and firms' access to credit (see Spilimbergo et al., 2009; Blanchard et al., 2010). Private borrowing, therefore, is a direct measure of the banking sector's ability and willingness to loosen credit standards following a budgetary shock (Gagnon and Gimet, 2013). Our results for private borrowing are very much in agreement with all these empirical arguments. In DSE, liquidity (i.e. trading volume) across all portfolios significantly increases due to higher private borrowing opportunity. Similarly, Amihud's (2002) illiquidity significantly decreases for larger and smaller stocks.

Table 7.12 and 7.13 also report the results of other macroeconomic and control variables. Results indicate in terms of economic significance, the influence of monetary and fiscal policy variables on stock liquidity is higher than the impact of remaining macroeconomic variables, i.e. industrial production and inflation. Only in some instances, industrial production has positive and significant impact on liquidity; besides inflation affect the liquidity measures negatively, but we see it has mixed influence on illiquidity. However, both liquidity and illiquidity measures are found strongly affected by own-lagged value, volatility and market index, which are consistent with Chordia et al. (2005) and Fernández-Amador et al., (2013).

7.4.3.2 Influence of monetary and fiscal policy variables on Industries

In this final section, we investigate the influence of macroeconomic management policy variables on (il)liquidity at industry level. Surprisingly, a gap in our knowledge exists in this area of relationship; however, earlier studies have shown the impact of monetary and fiscal policy on other characteristics of various industries. For example, Ehrmann and Fratzscher (2004) show that there are strong industry-specific effect of monetary policy and the effect on market returns is likely to differ across industries due to various reasons. Firms in cyclical industries, capital-intensive industries, and industries those are relatively open to international trade tend to be affected more strongly. They further added that interest rate, exchange rate, and cost of capital affect the expected future earnings in different ways across industries. In a subsequent study, Dedola and Lippi (2005) find that the impact of monetary policy is stronger in industries that produce durable goods, have greater financing requirement, and lower borrowing capacity. Similarly, in many recent studies, such as Belo et al. (2013) and Aghion et al. (2014) explain and document the impact of fiscal policy on different industries.

In Table 7.15, we presents the panel estimation for (il)liquidity measures classified into three major industries traded on the DSE, namely financial, manufacturing and service sectors. To explain the influence of monetary and fiscal policy on each (il)liquidity ratio, we report the median values under each category. That means we run panel regressions for four (il)liquidity measures and four monetary policy variables (i.e. base money, bank rate, cash reserve ratio and short-term interest rate) and report their median values. Similarly, we show the median values of panel regressions for three fiscal policy variables (i.e. government expenditure, government borrowing and private borrowing) and four (il)liquidity measures.

Group A of Table 7.15 details the results related to financial industries. We see all four monetary policy variables are statistically significant for all four (il)liquidity measures, however, none of the fiscal variables are found significant. That indicates changes in monetary policy exert stronger impact on the liquidity and illiquidity of financial sector in DSE. This is in line with our hypothesis and empirical evidence. As suggested in Blanchard et al. (2010), expansionary policy can influence the liquidity of bank and non-bank institutions. From an investment perspective, this can further increase the borrowing capacity of investors (see Spilimbergo et al., 2009; Gagnon and Gimet, 2013) as credit constraints are minimized and loose monetary policy enhance the ability of banks to generate more loan to private sector. In addition, as investors, financial institutions also invest a part of their deposit into capital markets and in country like Bangladesh, banks and non-bank institutions invest heavily into stock market for higher profit growth. Therefore, any news related to central bank policy should influence the market liquidity in DSE for financial institutions. The sensitivity of bank liquidity to the central bank's interest rate policy is also highlighted in Freixas et al. (2011).

In particular, the results of Group A shows that on average liquidity related measures (i.e. turnover rate and trading volume) are negatively affected by the changes in monetary policy. In a similar fashion, Amihud's (2002) illiquidity and turnover price impact are positively related to central bank policy changes. Panel regressions not reported show the association of TR is negative with all four monetary policy variables and coefficients are significant at 1 to 10 percent level. Besides, TV is significantly influenced by bank rate, cash reserve ratio and short-term interest rate. On the other hand, illiquidity of financial sectors is positively related with monetary policy variables except money supply growth rate. Altogether, these are further in line with results from previous section. First, monetary policies have heterogeneous impact on market liquidity and the impact largely depends on which policy is being employed. Second, in DSE, financial institutions are mostly the larger firms (e.g. as of December 2012, the market capitalization of this sector is more than 41 percent of the total) and Table 8.14 shows that larger firms are negatively associated with money supply growth and cash reserve ratio. Finally, in this market contractionary monetary policies have greater impact on liquidity of financial sectors than expansionary monetary policy.

Group B and C of Table 7.15 respectively summarize the average results of panel estimations of (il)liquidity measures related to manufacturing and service sector of DSE. Results indicate manufacturing sector is most sensitive to any policy changes by the government and central bank among all three industrial categories, yet service sector is least sensitive. Group B shows that fiscal policy variables significantly influence all four (il)liquidity measures of manufacturing sector and monetary policy influence turnover rate and turnover price impact. Individually (which is not reported), both the liquidity measures (i.e. turnover rate and trading volume) are positively influenced by the government expenditure and private borrowing, however, negatively affected by the government borrowing. As expected, Amihud's (2002) illiquidity and turnover price impact are positively related to government borrowing and negatively to government expenditure and private borrowing. Therefore, expansionary (contractionary) fiscal policy increases (decreases) market liquidity for the manufacturing sector on the DSE. On the other hand, turnover rate and turnover price impact of this sector are significantly affected by cash reserve ratio and short-term interest rate. We find these two monetary policy variables affect liquidity negatively and illiquidity positively. Overall, the liquidity behaviour of manufacturing sector of DSE is very much consistent with our hypothesis - liquidity rises with expansionary shocks and decline with contractionary shocks.

Earlier researchers have explained the possible linkage between monetary policy, fiscal policy and companies listed as manufacturers, e.g. Ehrmann and Fratzscher (2004), Dedola and Lippi (2005) and Aghion et al. (2014). They all mention various firm specific characteristics where monetary policy has stronger influence, such as capital intensity, produce durable goods, export oriented, greater financing needs (working capital), smaller size, lower asset tangibility. Supporting their arguments, in DSE manufacturing sector mostly includes firms – pharmaceutical, garments, engineering, leather, foods products, which are capital intensive, goods are durable, involve in international trade and in need of more funds as working capital. In addition, more than 80% of smaller firms are manufacturers, thus following previous section they are affected significantly by policy changes. During expansionary periods investors prefer to invest in smaller company portfolios for greater price growth and we have seen the effect is even higher for fiscal policy changes (see Table 7.14). Finally, expansionary fiscal policy reduces the 'crowding out' effect, making funds available for private firms (funds also become cheaper) and thus as asserted in Spilimbergo et al. (2009) enhance the financial health of companies.

On the DSE the service sector mostly includes IT systems, telecommunication, real estate, and travel and leisure companies. Group C of Table 7.14 reports that on average illiquidity measures are affected by monetary policy, however, trading volume and Amihud's (2002) illiquidity are influenced by fiscal policy. The coefficients are also statistically significant for them at different levels up to 10 percent. From respective panel estimations (not reported), we see surprising results. The broad money supply positively and bank rate negatively affecting the Amihud's (2002) illiquidity ratio for this sector. That implies contractionary (expansionary) monetary policy reduces (increases) the illiquidity for service sector stocks in DSE. This is may be due to investors' (particularly individual investors) preference to smaller stocks. As most services companies are upper middle sized firms, therefore, during expansionary monetary policy investors switch to portfolios with smaller firms (i.e. risky but profitable). We find similar response from TPI to bank rate and short term interest rate, but when the monetary policy is measured by cash reserve ratio, illiquidity is positively associated with policy changes. That means when the central bank increases CRR, it reduces overall funds flow into market and service sector become strongly affected. In addition, from borrowers' perspective, BR and STR directly affect the cost of capital, thus when these rates increase investors switch back to less risky investments and liquidity of service sector increases. This switching behaviour is also documented in Næs et al. (2011). Moreover, costs increase more for smaller firms (as they are risky) than middle sized firms. Finally, the impact of monetary policy is largely depends on the liquidity measure we use and the policy we apply (see Fernández-Amador et al., 2013), hence firms and investors need to be very careful before setting up any investment strategies.

The last four columns of Group C illustrate the results of panel estimations of fiscal policy impact. The results are consistent with our previous sections and hypotheses. Expansionary (contractionary) government policies increase (decrease) the liquidity (illiquidity) of the service sector on the DSE. From individual ratios, such as on trading volume, we find that government and private borrowing respectively have negative and positive influences. On the other hand, Amihud's (2002) illiquidity is significantly affected by government expenditure and borrowing. In effect, government expenditure reduces the illiquidity and borrowing increases it for this sector. Therefore, regardless of the firm and industry, government borrowing creates a 'crowding out' effect in this emerging equity market.

Table 7.15: Influence of macroeconomic management variables on industries

Group A: Financial Industries

	Monetary policy variables				Fiscal policy variables			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
Dependent variable	0.6925*** (0.0000)	0.7520*** (0.0000)	0.3261*** (0.0000)	0.5747*** (0.0000)	0.7008*** (0.0000)	0.7524*** (0.0000)	0.3284*** (0.0000)	0.5821*** (0.0000)
Policy variable	-0.2588*** (0.0003)	-0.1466** (0.0564)	0.0068** (0.0300)	0.0056*** (0.0004)	-0.0090 (0.3802)	-0.0108 (0.3332)	-0.0003 (0.5768)	-0.0001 (0.6849)
Return	11.5453* (0.0682)	-1.8862 (0.7214)	-0.1975 (0.5715)	-0.0952 (0.4721)	12.5743** (0.0471)	-0.9992 (0.8501)	-0.1880 (0.5797)	-0.1278 (0.3332)
Standard deviation	-9.7621*** (0.0001)	-11.4323*** (0.0000)	-0.2390* (0.0829)	-0.1522*** (0.0042)	-10.0395*** (0.0001)	-11.4897*** (0.0000)	-0.2410* (0.0804)	-0.1515*** (0.0043)
ln(Market value)	-0.1431* (0.0617)	-0.0227 (0.7279)	-0.0004 (0.9241)	0.0004 (0.8230)	-0.1420* (0.0643)	-0.0241 (0.7118)	-0.0002 (0.9545)	0.0004 (0.8271)
Industrial production	0.0015 (0.5678)	-0.0022 (0.3181)	-0.0004 (0.4205)	0.0000 (0.5685)	0.0018 (0.4879)	-0.0016 (0.4634)	-0.0007 (0.6428)	0.0000 (0.4363)
Inflation	-0.0122* (0.0876)	0.0840*** (0.0021)	0.0028 (0.3795)	0.0005** (0.0538)	-0.0523* (0.0720)	0.0713*** (0.0039)	0.0004 (0.7901)	0.0011* (0.0702)
Stock index	0.1868 (0.1473)	0.7568*** (0.0000)	-0.0411*** (0.0000)	0.0062*** (0.0126)	0.2398** (0.0211)	0.7945*** (0.0000)	-0.0377*** (0.0000)	0.0048** (0.0275)
R-Squared	0.58	0.78	0.21	0.40	0.59	0.78	0.21	0.40

***, ** and * are significant at 1%, 5% and 10% levels.

Group B: manufacturing industries

	Monetary policy variables				Fiscal policy variables			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
Dependent variable	0.5659***	0.7593***	0.4350***	0.4261***	0.5668***	0.7590***	0.4348***	0.4282***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Policy variable	-0.0548*	0.0159	0.0065	0.0020*	0.0004*	0.0187*	-0.0013***	-0.0001***
	(0.1021)	(0.5902)	(0.4897)	(0.0791)	(0.0749)	(0.0671)	(0.0038)	(0.0173)
Return	6.5682**	1.8373	-0.3110	-0.2221***	7.0100**	1.7967	-0.0382	-0.2363***
	(0.0512)	(0.6819)	(0.6296)	(0.0171)	(0.0366)	(0.6877)	(0.6372)	(0.0107)
Standard deviation	-4.0689***	-7.7282***	-0.0132***	-0.1063***	-4.1968***	-7.7463***	-0.0132***	-0.1058***
	(0.0068)	(0.0003)	(0.0000)	(0.0123)	(0.0052)	(0.0003)	(0.0000)	(0.0126)
ln(Market value)	-0.0329	-0.0531	-0.0106	-0.0023	-0.0330	-0.0550	-0.0103	-0.0024
	(0.6641)	(0.6053)	(0.4712)	(0.2694)	(0.6629)	(0.5918)	(0.4835)	(0.2645)
Industrial production	0.0038**	0.0065***	0.0002	0.0000	0.0044***	0.0070***	-0.0002	0.0000
	(0.0110)	(0.0014)	(0.9316)	(0.5167)	(0.0038)	(0.0006)	(0.9404)	(0.4403)
Inflation	-0.0365***	0.0272	-0.0070**	0.0007	-0.0459***	0.0295	-0.0064**	0.0010**
	(0.0135)	(0.2553)	(0.0570)	(0.2921)	(0.0059)	(0.1873)	(0.0470)	(0.0243)
Stock index	0.3305***	0.5162***	-0.0357***	0.0002	0.3332***	0.5358***	-0.0340***	-0.0002
	(0.0000)	(0.0000)	(0.0088)	(0.4037)	(0.0000)	(0.0000)	(0.0033)	(0.9064)
R-Squared	0.48	0.78	0.37	0.37	0.48	0.78	0.37	0.37

***, ** and * are significant at 1%, 5% and 10% levels.

Group C: Service Industries

	Monetary policy variables				Fiscal policy variables			
	TR	TV	ILLIQ	TPI	TR	TV	ILLIQ	TPI
Dependent variable	0.6848***	0.9630***	0.3790***	0.3061***	0.6847***	0.9652***	0.3797***	0.3092***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Policy variable	-0.0529	-0.0950	0.0005*	-0.0000*	0.0094	0.0061*	-0.0015**	-0.0002
	(0.2076)	(0.2893)	(0.1050)	(0.0610)	(0.5984)	(0.0771)	(0.0213)	(0.1998)
Return	7.6288*	7.1729	-0.0687*	-0.1062*	7.7774*	7.2167	-0.0661*	-0.1075***
	(0.1008)	(0.3991)	(0.0747)	(0.0075)	(0.0948)	(0.3971)	(0.0834)	(0.0064)
Standard deviation	-5.9823**	-13.5997***	-0.0182	-0.0325	-6.0974***	-14.0565***	-0.0174	-0.0318
	(0.0225)	(0.0089)	(0.3849)	(0.1296)	(0.0197)	(0.0063)	(0.4059)	(0.1389)
ln(Market value)	-0.0220	-0.0440	-0.0004	0.0000	-0.0229	-0.0470	-0.0004	0.0000
	(0.3008)	(0.2840)	(0.8234)	(0.8792)	(0.2818)	(0.2491)	(0.8442)	(0.9157)
Industrial production	0.0049***	0.0042	-0.0001	0.0000	0.0051***	0.0042	-0.0002	0.0000
	(0.0040)	(0.1908)	(0.3400)	(0.3618)	(0.0028)	(0.1933)	(0.1899)	(0.2512)
Inflation	0.0207	0.0533	0.0041**	0.0003	0.0176	0.0483	0.0046***	0.0005***
	(0.3319)	(0.2464)	(0.0486)	(0.1295)	(0.3735)	(0.2141)	(0.0063)	(0.0019)
Stock index	0.1035	0.0642	-0.0019***	-0.0003	0.1250*	0.0889	-0.0015***	0.0000
	(0.1480)	(0.6582)	(0.0061)	(0.4233)	(0.0687)	(0.5055)	(0.0111)	(0.9433)
R-Squared	0.55	0.94	0.19	0.19	0.55	0.94	0.19	0.19

***, ** and * are significant at 1%, 5% and 10% levels.

The panel estimations detailed in Table 7.15 further show that other macroeconomic and control variables have significant impact on market liquidity measures across industries in this market. For example, financial institutions are strongly influenced by the inflation and industrial production has greater impact on manufacturing sector. Particularly, liquidity ratios of manufacturing sector have positive association with the industrial production, yet the inflation creates mixed effect on the (il)liquidity measures of financial sector. Interestingly, the (il)liquidity of both the industries depend on cyclical movement of the market (i.e. measured in market index, INX_{t-1}) and most of the cases, positively with liquidity and negatively with illiquidity. Moreover, lagged dependent variable, own-return and volatility are the other factors influencing the (il)liquidity of each industrial category. Altogether, our results are consistent with the relationship between macroeconomic variables, market specific variables and (il)liquidity measures discussed in Eisfeldt (2004), Chordia et al. (2005), Söderberg (2008), and Næs et al. (2011).

7.5 Chapter Summary

This study sheds light on the role of monetary and fiscal policy as a potential determinant of liquidity for an emerging stock market, the Dhaka Stock Exchange. We investigate whether an expansionary (contractionary) policy of the central bank and government increases (decreases) the liquidity of stocks both at an aggregate and firm level over the period from 2000 through 2012. We also look at the market liquidity during the global financial crisis of 2008-09. Thus, this study helps to understand the dynamic relationship between macroeconomic management policies and market liquidity in an emerging market. The growing body of research on liquidity focuses primarily on developed or the most liquid markets, whereas the liquidity effect is particularly strong in emerging markets (see Bekaert et al. 2007) but studies are limited. Moreover, the empirical evidence on linking the market (il)liquidity with both monetary and fiscal policy variables are rare.

In order to measure (il)liquidity we employ four different variables that capture trading activity and price impact, i.e. turnover rate (Datar et al., 1998), trading volume (Brennan et al., 1998), illiquidity ratio (Amihud, 2002) and turnover price impact (Florakis et al, 2011). Monetary policy is approximated by the base money supply growth rate, bank rate, cash reserve ratio and short-term interest rate. Fiscal policy is measured by government expending, borrowing and private borrowing. We have used several other macroeconomic and control variables following the suggestions of Chordia et al. (2005), Söderberg (2008), Goyenko and Ukhov (2009), and Fernández-Amador et al. (2013), such as industrial production, inflation, stock index, and market returns and volatility.

Our major findings are as follows: First, the daily price index of stocks has a long-run association with monetary and fiscal policy variables. Using Pedroni's (1999, 2004) and Kao's (1999) cross-sectional cointegration approach this study finds that the monthly price of our sample stocks are associated with macroeconomic management variables. Second, the Granger-causality test shows that both central bank and government policy cause stock market liquidity. However, the reverse causality is not that strong. In particular, we find money supply growth, cash reserve ratio and government expenditure show significant Granger-causality on the liquidity of the DSE. On the other hand, illiquidity of this market is significantly caused by the bank rate, government borrowing and private borrowing. Third, the sign of impulse responses are well in line with our hypothesis, expansionary monetary and fiscal policy increase the overall market liquidity. However, the impact of some innovations on market (il)liquidity measures is minimal.

Fourth, the results of variance decompositions implies that there may be significant 'crowding out' and 'cost of funds' effect in DSE. For example, bank rate can explain a large fraction of the error variance of Amihud's (2002) illiquidity. This is probably due to switching from risky to secure investments by investors as suggested in Næs et al. (2011). This is because a higher bank rate means higher cost of funds and thus banks rather than lending money to individuals provide more trading loans to institutions. Similarly, government borrowing creates competition for bank loans and thus private firms suffer. In Bangladesh, government frequently borrows from the banking sector. Fifth, the recent global financial crisis had a positive impact on market liquidity. Fortunately, the political and economic conditions of Bangladesh during this global crisis period were favourable. This indicates that in an emerging market local macroeconomic information is more important to investors than global news. In addition, the market has a low level of integration with world equity markets. For emerging equity markets a similar finding is also reported in Bekaert et al. (2007).

Sixth, our panel estimations on the liquidity of individual firms report that both large and small firms are sensitive to changes in monetary and fiscal policy variables. Most importantly, the impact of expansionary or contractionary policy largely depends on the instrument used by the central bank or government. For example, money supply growth, cash reserve ratio and government expenditure particularly increase the liquidity of smaller firms. Interestingly, we see the market capitalization play a role in this relationship. The liquidity of firms sorted on size show significant heterogeneous response to macroeconomic factors. Seventh, when firms are classified into industrial categories, which have not been considered by previous studies, we find heterogeneous impact of monetary and fiscal policy. The liquidity of manufacturing firms is mostly affected by changes of any policy variables, whereas financial institutions are only influenced by monetary policy. Surprisingly, other macroeconomic variables are also found to be statistically significant when we sort the portfolios into sector rather than size. For example, financial institutions and the manufacturing sector are strongly associated with inflation and industrial production respectively. Overall, monetary interventions of the central bank and fiscal interventions of the government should be considered as a determinant of individual and sectoral stocks liquidity, which may help to explain observed commonality in liquidity and variations in liquidity at the aggregate market level. Finally, as asserted in Chordia et al. (2005) monthly innovations in volatility and liquidity explain a large fraction of the error variance in forecasting liquidity, suggesting past volatility and liquidity are the most important variables in forecasting future liquidity.

Our results are important for risk management officers and regulators. The former should be care about the fact that (il)liquidity is negatively related to market volatility and to market returns. The effect is mostly pronounced on the largest and smallest firms and financial sector. Moreover, the global financial crisis had a minimal effect on this market and (il)liquidity is mostly affected by the local macroeconomic news. Regulators, on the other hand, may use this study as evidence that (il)liquidity spirals are driven by monetary and fiscal policy variables. In particular, the impacts are not homogenous and largely depend on the instruments used by the regulator. Therefore, they should be careful about applying their policy and consider the possible effect on the equity market while formulating those policies.

There are number of interesting ways in which our results could be developed. (i) Little empirical work has been done on liquidity in an emerging equity market and linking liquidity with monetary and fiscal policy. (ii) As suggested in Chordia et al. (2005) and Goyenko and Ukhov (2009) research is required on linking movements in liquidity across equity and fixed income markets. This is because, the ultimate impact of any policy changes on liquidity depends on the relative attractiveness of other asset markets (see Fernández-Amador et al., 2013). (iii) This study assumes fixed effects and includes an interaction of policy variables (i.e. monetary and fiscal policy) and market capitalization of stocks in panel estimations. However, other issues of cross-sectional homogeneity of the slope parameters in the panel models need to be investigated and tested in future work (see Fernández-Amador et al., 2013).

Chapter 8:
Summary and Conclusion

8.1 Introduction

This chapter presents a summary of the research findings and discusses the application of the results regarding the dynamics and performance of Dhaka Stock Exchange. The chapter is organized into eight sections. The next section summarises the background and objectives of the study. Section 8.3 provides a brief description of the methodologies used in this study. A summary of our major findings are described in section 8.4. Sections 8.5 and 8.6 respectively present the implications and contributions of the study. Section 8.7 describes the main limitations. Finally, this chapter concludes with an outline of potential future research.

8.2 Research background and objectives of the study

Over the past few decades, the world has witnessed a spectacular growth and plunge in stock indices which has heightened the pace of globalization and increased the level of integration among the stock markets and economies. The level of integration influences the markets to transmit information from one to another (see Bekaert et al., 2005). The transmission of disturbances is extensively investigated and documented between stock markets (see Hamao et al., 1990; Ng, 2000; Balli et al., 2013), between foreign exchange markets (see Antonakakis, 2012), between futures markets (see Gannon, 2005), between bond markets (see Skintzi and Refenes, 2006; Duncan and Kabundi, 2013) and between swap markets (In, 2007) to name but a few. On the other hand, the growth and fall in stock markets have also emphasised the role of central banks and governments. Particularly, their importance is highlighted since the recent financial crisis, when due to absence of liquidity (Söderberg, 2008; Næs et al., 2011) the world faced a dramatic fall in stock markets (Blanchard et al., 2010) and all over the world central banks and government adopted massive monetary and fiscal stimulus to ease the financial markets by raising liquidity (see Woodford, 2011; Fernández-Amador et al., 2013; and Gagnon and Gimet, 2013).

From a theoretical perspective, based on the Efficient Market Hypothesis, stock prices should rapidly incorporate and reflect all publicly available information (see Fama, 1970). Gergoriou et al. (2009) assert that among asset prices, stock price are typically closely monitored and are commonly regarded as being highly sensitive to economic news. Following the multifactor asset pricing model, both monetary and fiscal policies simultaneously affect firms' balance sheets, cash flow, risk-adjusted discount rate and altogether the price of stocks (see Flannery and Propapadakis, 2002; Bernanke and Gertler, 1995). Since all the macroeconomic variables are interrelated, when the government and the central bank use these policies, they affect everything from commodity markets to financial markets (Stevenson et al., 1988). Earlier theorists also illustrate how information related to monetary policy (Hume, 1952), money supplies (Friedman, 1968), and fiscal policy (Keynes, 1936) and the rational expectations model (Muth, 1961; Lucas, 1976) influence financial markets through different channels (see Tobin, 1969; Blanchard, 1981; Fischer and Merton, 1984).

This study broadly examines the connection of the stock market with macroeconomic management variables, i.e. monetary and fiscal policies. It is further extended to empirically investigate some other related issues as well. The influence of various macro and non-macroeconomic factors including monetary and fiscal policy variables on stock markets have been studied rigorously in earlier literature, such as Fama (1981), Pearch and Roley (1985), Chang, (2009) Belo and Yu (2013). Nevertheless, some areas of related issues have been ignored or little empirical evidence is available, In particular documentation from emerging markets is rare. Therefore, Dhaka Stock Exchange (DSE), the main equity market of Bangladesh, has been selected for investigation and these objectives are identified: (i) investigate differences in the nature of information processing by the individual investors versus institutions and their trading after the weekend. (ii) How volatility from other stock markets located in various time-zones affects the daily volatility of an emerging equity market. (iii) In this vein, the combined impact of macro and non-macroeconomic events on returns and volatility of firms sorted on different characteristics – size, dividend yield and sector. (iv) The association of market and firm level liquidity with changes in monetary and fiscal policy variables.

The economy of Bangladesh is growing faster and has been listed as one of the upcoming economic giant, such as 'Next-11' and 'Frontier Five'. The Guardian reports that Bangladesh is among a number of emerging countries that could overtake the west by 2050. Similarly, the stock market DSE has been nominated as Asia's best performing market several times. Unfortunately, due to conflicting policies of the central bank and government, the DSE has been experienced significant rises and falls in the index over recent decades. A lack of coordination between regulatory bodies and their asynchronous expansionary or contractionary policies have created inflationary pressure, lack of liquidity, minimal investment opportunities, a crowding-out effect and excessive supply of funds (i.e. the market becomes overheated). Contradictions include allowing black money (undisclosed earnings) into the stock market versus increasing the cash reserve ratio; increasing the money supply versus expansion in government expenditure; expansion (contraction) of domestic credit versus rising (decreasing) government debt from the banking sector; a reduction in savings and investment rate versus a surging cash reserve ratio and statutory liquidity reserve ratio. However, there is little or no empirical evidence available on this relationship for this stock market. Therefore, this study takes a novel initiative to rigorously investigate various micro and macro perspectives on the DSE. In addition, the market has some unique characteristics, which makes the study more interesting. Indeed, results from this study should draw the attention of academics, investors, policy makers and regulatory bodies.

8.3 Summary of Research Methodology

This study is an empirical study by nature and follows a quantitative approach to carry forward the research process. For the purpose of analysis, we have used secondary data, e.g. daily share price, daily market value, dividend yield, international trade, money supply, inflation, short-term interest rate, government expenditure, government and private borrowing. These data have been collected mainly from Thomson Reuters Datastream, however, macroeconomic information was also collected from International Financial Statistics (IFS) of International Monetary Fund (IMF) and Bangladesh Bank (central bank of Bangladesh). Stock related data were also cross-checked with the main board of the Dhaka Stock Exchange.

In investigating the influence of investors' behaviour, international information spillover and local macroeconomic news on the stock market, this research has applied several time-series based econometric methods. For example, to see the weekend effect and spillover effect in volatility we have used non-linear GARCH family models – GARCH, GJR-GARCH, CGARCH, and EGARCH. This is because, volatility is not directly observable (Tsay, 2010) and linear structural models are unable to explain a number of important features of volatility that are commonly seen in financial returns, including leptokurtosis, volatility clustering or volatility pooling and leverage effects (see Brooks, 2014; Tsay, 2014). In addition, Hinich and Patterson (1985) assert that there is non-linear dependence in financial asset returns series and that the dependence is best characterised by a GARCH-type process. In a similar vein, among many others, Koutmos and Booth (1995) document the asymmetric innovations in the volatility transmission between the US, UK and Japanese stock markets.

We have applied Bai and Perron (1998, 2003a,b) and MS-GARCH approaches to measure the structural changes and breaks in stock returns and volatility. It is stressed in Eizaguirre et al. (2004) that the location of endogenous structural breaks in time series has been a matter of intense research in the recent decade. Similarly, Banerjee and Urga (2005) assert that the issue of multiple unknown structural changes or breaks in single equation has generated a great deal of academic interest in financial time series. Besides, Moore and Wang (2007) explain the advantage of Markov Regime Switching GARCH is that it allows the mean and variance of stock returns to switch across different states, taking into consideration any change in the mean and variance over the period. We apply this MS-GARCH model because it is reported in earlier studies that regime switching of an equity market is connected to changes in different macroeconomic events, changes in government policy, financial crisis etc. (among many see Chang 2009). In particular we have applied the model developed by Hass et al. (2004) as their approach is analytically tractable and allow us to drive stationary conditions and to enhance dynamics properties of the process.

In several occasions this study has relied on the vector autoregression (VAR) model of Sims (1980). Such as, investigating the interdependence between conditional variance of different equity markets, and examining the association between market liquidity and monetary and fiscal policy variables. Theoretically, a VAR is a system regression model that can be considered as a kind of hybrid between the univariate time series models and the simultaneous equations models (Brooks, 2014). We have used this VAR approach because there are several advantages described in previous literature (among many see Brooks, 2014; and Eun and Shim, 1989 for detail discussions). For example, first, the researcher does not need to specify which variables are endogenous or exogenous. Second, this allows the value of a variable to depend on more than just its own lags or combinations of white noise terms, so VARs are more flexible than univariate models. Third, since no restrictions are imposed on the structural relationships among variables, the VAR can be viewed as a flexible approximation to the reduced form of the correctly specified but unknown model of the actual economic structure. Due to all these benefits, therefore, the VAR approach is extensively recommended for empirical analysis, e.g. Chordia et al. (2005), Goyenko and Ukhov (2009), Singh et al. (2010), and Jiang et al. (2012).

In addressing the long-run association of the Dhaka stock market with other international equity markets and between various macroeconomic variables we have applied Johansen's (Johansen, 1988 and 1991) cointegration model and the cross-sectional cointegration of Pedroni (1999, 2004) and Kao (1999). Johansen (1988 and 1991) uses a vector autoregression approach to model the hypothesis of cointegration. This methodology permits more than one cointegration relationship so is more generally applicable than the Engle-Granger test which is based on Dickey-Fuller (or the augmented D-F) test for unit roots in the residuals from a single (estimated) cointegrating relationship. Testing for cointegration as a measure of assessing the degree of market integration or segmentation across international capital markets is also documented in several previous papers, e.g. Chen et al. (1997), Darrat and Benkato (2003) and Gupta and Guidi (2012). On the other hand, the panel cointegration method of Pedroni (1999, 2004) and Kao (1999) are used to check the association of monetary and fiscal policy variables with stock prices on the DSE. However, testing for cointegration in panels is a rather complex issue, since one must consider the possibility of cointegration across groups of variables as well as within the groups (Brooks, 2014). In this regards Pedroni's (1999, 2004) approach has allowed us to see long run associations of both across and within the groups. Kao (1999) has developed a restricted version of Pedroni's (1999, 2004).

In addition to the methodologies which are mentioned above, this study has used some other major empirical approaches, such as Granger causality (1969), the Bai and Perron (1998 and 2003a,b) structural breaks model, panel regression, Engle and Ng (1993) tests for asymmetry in volatility, empirical distribution function test, test of equality in mean and volatility, BDS test, impulse responses, variance decomposition and correlation. By using all these methods as suggested in the previous literature we have investigated the micro and macro dynamics of the Dhaka Stock Exchange.

8.4 Summary of major findings

With the objective of investigating several perspectives of the stock market, this section summarizes the major findings from our analysis of DSE. The study is designed so we can study both micro and macro dynamics for this equity market. For example, we have started by investigating the presence of the weekend effect and the role of individual versus institutional investors. Similarly, macro and non-macroeconomic information are linked with stock prices in the third empirical chapter (i.e. chapter seven). Finally, we have combined the micro and macro characteristics of this market and analysed the influence of monetary and fiscal policy variables on market liquidity. Altogether, our findings clearly indicate that the DSE is sensitive to publicly available information as suggested in the efficient market hypothesis (EMH). However, the specific findings from each empirical chapter are summarized below:

8.4.1 Investors' behaviour and the weekend effect

From the micro perspective of DSE, we have started with testing two of the most credible explanations of the weekend effect evident in earlier studies, the 'information content theory' and the 'information processing hypothesis'. For example, Choudhry (2002) asserts that information that accumulates when financial markets are closed is reflected in prices after the market reopens. In this vein, the information processing hypothesis states that individual investors gather and process information during the weekend and become active traders on the opening day (Lakonishok and Maberly, 1990; Abraham and Ikenberry, 1994). We have arrived at the following conclusions from our test results:

A. Similar to other emerging markets, the DSE is dominated by individual investors. In this equity market the proportion of individual trading accounts is more than 99 percent. Ng and Wu (2007) also report that in Shanghai and Shenzhen stock exchange 99.5% are individuals out of 68.8 million investors. However, there is a reverse phenomenon found in developed markets. For example, Chan, Leung and Wang (2004) report that in US equity markets (i.e. NYSE, Amex and NASDAQ) institutional investors increase from 14.6% (1981) to 31% in 1998.

B. There is a general trend in this equity market to disclose earnings and other macroeconomic announcements on Thursday (last trading day) and over the weekend. Therefore, most investors might prefer to take long or short positions on Wednesday with the expectation of gaining an information advantage.

C. The DSE opens from Sunday to Thursday and the mean returns and variance are not same across the weekdays. Sunday returns are significantly negative compared to other trading days and the variance of Sunday is higher than other days. These results suggest 'information content theory' works and the possible presence of 'Sunday effect' in DSE. Earlier, Chowdhury and Sharmin (2012) also have documented significant negative returns on Sunday in this stock market.

D. Following the GJR-GARCH and CGARCH specifications, we find that Sunday is significant in both return and volatility equations. This conditional variance approach further assures the presence of a 'Sunday effect' in DSE like the 'Monday effect' in many other stock markets. Our results support the arguments of Clark (1973), Kyle (1985), and Schwert (1990) that stock market variance is positively related to trading volume, since the average number of trades on the DSE is highest on Wednesday and Sunday. Possibly, investors take long or short positions on Wednesday to benefit from information over the weekend and then reshuffle their position on Sunday based on actual outcomes.

E. Supporting the 'information processing hypothesis' we find that the trading pattern of individual investors influences the weekend effect in this stock market. We found this result by dividing the firms listed on the DSE according to their market capitalization and dividend yield. Sunday returns tend to be negative for smaller firms and firms with low dividend yield; indeed the equity variance is reported higher and significant on Sunday for those firms. Previously, Keim and Stambaugh (1984), Abraham and Ikenberry (1994) and many other researchers have mentioned that individual investors have greater holding of smaller stocks and firms with low dividend yields.

F. A positive feedback effect is identified on the DSE between Sunday returns and the returns of the previous Thursday. Interestingly, this pattern emerges to be a function of firm size, where small and mid-size firms show stronger conditional effects between Thursday and Sunday. Therefore, as highlighted in Abraham and Ikenberry (1994) and Brusa et al. (2005) our results are robust to individual investors. The feedback effect is also documented between Thursday-Sunday variance.

G. Finally, our robustness test confirms that there is no impact of Ramadan on the weekend pattern of returns and volatility of DSE. The returns and volatilities of Sunday during Ramadan periods are not found statistically different from non-Ramadan periods. In addition, there is no weekend effect reported in DSE 20 index, which is the large cap index of DSE. Even in the GARCH model Sunday returns and volatilities of DSE 20 index are not found statistically significant. This result is in line with our findings that trading of small stocks after the weekend creates the average returns negative and volatility higher on Sunday.

8.4.2 Volatility Spillovers: Time Zone Effect

In our second empirical chapter we further investigated the micro dynamics of DSE by examining the spillover effect on the DSE from seven major international equity markets. Particularly, the number of this kind of research has increased since the US stock market crash of October 1987. Studies extensively examine the volatility transmission between stock markets, foreign exchange markets, future markets, bond markets, and swap markets. However, little attention has been given to time zone variation in volatility transmission. That means combined volatility spillovers from stock markets with synchronous and nonsynchronous trading hours. Moreover, this study provide evidence of daily transmission of disturbances where four markets (i.e. Japan, Hong Kong, China, India) open earlier than DSE and three markets (i.e. US, UK and Canada) open later. The daily dynamics are new evidence as the DSE is opens from Sunday to Thursday rather than the usual Monday-Friday cycle of international equity markets. Following are the major findings from this chapter:

A. Using Granger causality we find causal association in international trade between the domestic country (i.e. Bangladesh) and Canada, China and the US. This relationship could be a possible reason for integration between these stock markets and the transmission of disturbances.

B. Each of the markets has asymmetric innovations in their volatility modelling. For example, the sign is positive for the US market which means positive shocks are followed by higher volatility in this market. However, other markets (i.e. Japan, China, India, Hong Kong, Canada, UK and Bangladesh) report positive leverage effects, which means any negative shocks entail a higher next period conditional variance than positive shocks of the same sign.

C. The results of contemporaneous correlations between pairwise residuals of eight international markets indicate that the correlation is higher between intra-time-zone markets rather than inter-time-zone markets. For example, strong correlations are found between US-Canada, US-UK, Japan-Hong Kong, and India-Hong Kong.

D. From our conditional variance models, we have found that the volatility of DSE is significantly influenced by the residuals of Japan, Hong Kong, Canada and the US. For example, from Monday to Wednesday the volatility spillover take place substantially from Japan and Hong Kong. The US and Canada exert major influence on the opening (i.e. Sunday) and closing (i.e. Thursday) days. These results are consistent with Ng (2000), Singh et al. (2010), and Balli et al. (2013). Investors take regional information from markets in a similar time-zone but adjust world factors from the US and Canada at the beginning and end of the week.

E. As it is suggested in Bekaert et al. (2005) that the existence of volatility spillovers offers direct evidence of whether markets within and across regions are integrated, to check that we applied a Johansen cointegration test. There is no bivariate cointegration reported in our results, but we have found a strong long run association of the DSE with markets in a similar time-zone in a multivariate approach. Previously, Hung and Cheung (1995), and Jong and Roon (2005) also documented significant regional influence and integration within Asian equity markets. In addition, this cointegration provides direct support to these markets regarding their relationship in international trade. For example, Forbes and Chinn (2004) claim that stock markets become increasingly integrated due to the rapid expansion of international trade.

F. We have examined the causal association between conditional variance of international equity markets across time-zone by applying a VAR model. Results suggest that major international stock markets are not segmented, rather strong interdependence exist between them. However, the emerging market (i.e. DSE) has little role in this global comovement and remain segmented. Thus both institutional and individual investors can diversify their portfolio and gain benefits by investing in these kind of emerging markets.

G. Finally, our robustness test confirms that financial crises have little impact on the dynamics of volatility transmission to DSE from other seven international equity markets. We have controlled three financial crises – the Asian crisis, Dot Com crisis and crisis of 2008-09 and found that only Asian crisis is statistically significant impact on daily returns of DSE. However, using the crises filtered residuals and AR(1)-GJR GARCH, we find no significant changes in the nature of spillover effects compare to nonfilterd residuals. Results indicate strong influence of volatility from the US, the UK and Canadian stock markets on the opening (Sunday) and closing (Thursday) days of DSE. But for rest of the weekdays markets from similar time zones are found significant. In addition, to check whether the volatility inter-dependence grow over the periods, we split our sample into pre and post 2000. The results show similar pattern in volatility transmission but more countries become significant in post 2000 compare to pre 2000 periods. That indicates integration is slowly growing between DSE and international markets in recent years.

8.4.3 Market breaks and timing of macro and non-macroeconomic news

We investigated the macro perspectives of the DSE in this empirical chapter. In particular, we examined the timing of structural breaks of this stock market and timing of macro and non-macroeconomic information. The main objective of this empirical chapter is to see whether the stock price behaviour of an emerging market changes over time or switches over states with respect to the timing of monetary policy, fiscal policy and some of the non-macroeconomic information (i.e. political events, national election, changes in government policies, changes in capital market regulations). We extended our analysis and provide firm-level evidence on whether any of the macro and non-macroeconomic news has specific effects on portfolios with different characteristics, i.e. size, dividend and sector. The summary of major findings is listed below:

A. The results of our pre-whiting process, as suggested in Gulen and Mayhew (2000) and Chau et al. (2014), indicate that the DSE is less sensitive to regional and world market index movements. This support the argument of strong home bias claimed in French and Porteba (1991), Baxter and Jermann (1997) and Bailkowski et al. (2008), particularly by an emerging equity market. Moreover, this is in line with our findings from the previous empirical chapter and thus the DSE would be very attractive to foreign investors, such as mutual funds and portfolio investments.

B. Applying Bai and Perron's (1998, 2003 a, b) framework, we determined two and five break points in returns and conditional variance respectively. By linking them with macro and non-macroeconomic information of Bangladesh, we see equity returns and volatility of DSE are significantly influenced by the timing of monetary policy, fiscal policy, political uncertainty, government policy, national elections and the electoral system. These results are consistent with previous literature, such as Beltratti and Morana (2006), Ardagna (2009) and Chau et al. (2014). Here the impact of the electoral system (i.e. Caretaker Government of Bangladesh) is new evidence from an emerging market.

C. Our results from the structural break model are found to be robust in the Markov Switching GARCH model (MS-GARCH) of Hass et al. (2004). Based on specification tests a two-state model fits our data. The smoothed probabilities provide meaningful turning points, which suggest that switching between regimes seems to be linked with country-specific macro and non-macroeconomic events. Interestingly, two most volatile periods have been identified - 1994-2002 and 2004-2012 from the data, while turbulence in later period is stronger.

D. With the objective of providing firm-level evidence on the influence of macro and non-macro information, we divided all the listed firms in DSE to separate portfolios based on size, dividend yield and sector. The results indicate that the top and bottom 20 percent of firms are more sensitive to any information, however smaller firms are significantly affected by monetary policy; the macroeconomic events of 2010 had greater impact on the overall market; the political uncertainty of 2007 has a comprehensive impact; financial and manufacturing sectors are more subject to both macro and non-macro news. The financial sector is more affected may be due to their method of business (i.e. Islamic finance) as suggested in in Chau et al. (2014).

E. In this market, the CRR (i.e. cash reserve ratio) can strongly control the excess money supply. In particular, the effect of raising the CRR has a relatively larger impact on investment, such as in capital market.

F. Surprisingly, changes in the exchange rate regime have little or no impact on changes in price behavior on the DSE. However, in much previous literature, e.g. Hau and Rey (2006), Kanas (2002), researchers have documented significant influence of the exchange rate system on price movements.

G. Government interventions create a mixed impact on the market. For example, allowing black money into the equity market has initially increased the price but this is not sustained in the long run. Similarly, pressure on SEC and Central bank did not work to stabilize the market after the upsurge in 2010.

H. A huge inflow of foreign remittances and expectations of earning higher returns from the capital market contributes to an unexpected growth of investors in DSE and also the size of the market, particularly in the 2009-10 periods.

8.4.4 Macroeconomic Management and Market Liquidity

In this final empirical chapter we combine the micro and macro perspectives of DSE. We have investigated the interrelationship of market liquidity to monetary and fiscal policy variables. Then we further extend our analysis to look into the influence of those policies on the liquidity of individual and sectoral stocks. We used Granger causality and a vector autoregression approach to explore the impact of monetary and fiscal policy variables on aggregate market liquidity. A panel regression is applied to see the interaction between size and sectoral portfolios and macroeconomic management policies. For analysis we considered two liquidity related measures (i.e. turnover rate and trading volume) and two illiquidity measures (i.e. Amihud's illiquidity and turnover price impact ratio). Our major findings are as follows:

A. Using Pedroni's (1999, 2004) and Kao's (1999) cross-sectional cointegration approach we find that the stock prices of our sample are associated with macroeconomic variables.

B. We find money supply growth, cash reserve ratio and government expenditure have significant Granger-causality with liquidity. Besides, the illiquidity of the DSE is significantly caused by the bank rate, government borrowing and private borrowing. However, there is little evidence of reverse causality.

C. The signs of the impulse responses are well in line with our hypothesis. Expansionary monetary and fiscal policy increases the overall market liquidity. However, the impact of some innovation on market (il)liquidity measures is very minimal.

D. The results from the variance decomposition indicate that there may be significant 'crowding out' and 'cost of funds' effects on the DSE. For example, bank rate can explain a large fraction of the error variance of Amihud's (2002) illiquidity. This is probably due to switching from risky to secure investments by investors as suggested in Næs et al. (2011). Similarly, regular borrowing from the banking sector by the government creates competition for private firms.

E. The market is more sensitive to local macroeconomic news than world factors. The innovation of the recent global financial crisis (i.e. 2008-09) had positive impact on market liquidity.

F. The impact of expansionary or contractionary policy on (il)liquidity of size based portfolios largely depends on the instrument used by the central bank or government.

G. The liquidity of manufacturing firms is mostly affected by changes of any policy variables, whereas financial institutions are only influenced by monetary policy. Moreover, financial institutions and the manufacturing sector are strongly associated with inflation and industrial production respectively.

H. Monthly innovations in volatility and liquidity can explain a large fraction of the error variance in forecasting liquidity.

8.5 Contributions of the Study

The main focus of this study was to examine four key micro and macro dimensions of the Dhaka Stock Exchange over the period from 1990 to 2012. The perspectives we include were analysing the role of individual and institutional investors in the weekend effect, examining the daily volatility spillover from seven international markets, evaluating the timing of market breaks and timing of macro and non-macroeconomic events, and exploring the association of monetary and fiscal policy variables with market liquidity. Although a limited number of studies so far have documented the weekend anomaly in DSE, yet other areas remain open and this is probably the first study that has taken the initiative to investigate them. Moreover, due to the recent financial crisis and changing macroeconomic objectives academics and professionals across the globe have strongly emphasised these areas of research. Particularly, they want to know more about the dynamics of emerging equity markets. Therefore, findings from this study are immensely valuable to academics, practicing managers and policy makers involving in stock markets. A summary of the major contributions of this study is presented below:

First, this study contributes to the on-going literature by reviewing and synthesising the extant literature and the trends of monetary policy, fiscal policy and other economic variables of Bangladesh for a long period of time (from 1990 to 2012) and also by identifying the major characteristics of the market which are of particular important for the enhanced participation of DSE in international markets and economy.

Second, the trading behaviour of individual versus institutional investors as a reason for Monday seasonality is rigorously investigated for equity markets from developed countries; little or no attention has been given to emerging markets. This study has tried to fill this gap and identified that the 'information content theory', the 'information processing hypotheses', and the 'feedback effect' work in this market. The trading pattern of individual investors is mostly responsible for the weekend effect. In addition, this market is operating from Sunday to Friday rather than the usual Monday-Friday cycle, thus this market add new evidence to the existing literature. Moreover, classifying the firms into size and dividend yield based portfolios for identifying trading behaviour of investors, this study further provide empirical substantiation.

Third, one of the popular research areas in finance in recent times is volatility spillovers. In particular, since the US stock market crash, world researchers became interested to see how financial disturbances are transmitted from one market to other. In this line of thought, this study has investigated the combined volatility spillovers on DSE from other international markets located in different time-zones. There is rarely any evidence available in this context. Moreover, this is one of the first attempts to examine the daily dynamics of volatility spillovers where the market has different trading hours. Indeed, the influence of time-zone on various perspectives of stock markets is studied in many previous papers, yet the impact of synchronous and nonsynchronous trading on the daily transmission to variance on an emerging market is extremely scant.

Fourth, this study is the first of its kind to examine the interdependence of an equity market with macro and non-macroeconomic information, such as political uncertainty, national elections, changes in government policies, and changes in capital market regulations. Separate attempts have been made by earlier researchers to explore the influence of various macro and non-macroeconomic news items, yet this study has followed a different approach and looks into the timing of market breaks and those macro and non-macro events from an emerging market context. In particular, the study has identified structural break points in returns and variance of DSE price series and links them with the country's monetary policy, fiscal policy and numerous other pieces of non-macroeconomic information. Furthermore, at micro level the impact of those events is also assessed on portfolios based on different firm characteristics – size, dividend yield and sector. Specifically, several country-specific attributes have made the findings of this empirical section unique as evidence to academics, managers and policy makers.

Fifth, in spite of the huge importance of market liquidity and its association with macroeconomic policies, only a few studies have empirically investigated their linkage. Besides, these studies only focus on monetary policy influence from developed countries. This study has provided evidence from an emerging market and looked at the impact of both monetary and fiscal policy variables. For comprehensive documentation of their linkage, empirical evidence is taken from aggregate market, individual firms and industrial categories. From a theoretical perspective it is said that emerging markets have different regulatory and institutional set ups than developed markets and liquidity shocks are particularly strong (see Bekaert et al., 2007). Therefore, the results of this study are not only important for investors and academics but also for policy makers.

Finally, this study contributes to the argument of the efficient market hypothesis (EMH) that stock prices fully reflect all publicly available information. Earlier research related to macroeconomic events and market efficiency has focused mostly on monetary policy and little attention has been given to fiscal policy (see Belo and Yu, 2013; Afonso and Sousa, 2011; Darrt, 1988). This study, on the other hand, in line with recent trends has combined the monetary and fiscal policy influences on the stock price. Additionally, other macro and non-macroeconomic factors have also been considered. Our results indicate that over time the price setting process has improved on the DSE, particularly since the market liberalization of 1990 and therefore, specific risk has become priced in the market as suggested in Bekaert et al. (2002).

8.6 Implications of the study

The results of this study have several normative implications for those who are interested in stock market dynamics, such as foreign portfolio managers, local investors, and policy makers. We list prominent implications below:

First, since this market is largely dominated by individual investors there is room for foreign portfolio managers and institutional investors to increase their investment. Particularly, as suggested in Lesmond (2005) for other emerging markets, the earnings possibility is more than 100 percent from this market thus this could be a leading profit generating emerging market for investors (see Table 6.4c). This table shows that over the periods from 2007 till 2010, investors of have earned an average returns of around 100 percent from small stocks (i.e. Z category shares). Besides, large cap stocks (i.e. DSE 20) have generated an average return of 93.58% in 2007-08, 11.78% in 2008-09 and 48.73% in 2009-10. Therefore, institutional investors rather focusing on small cap stocks, they have the opportunity to earn a good rate of returns from large cap shares in DSE. In addition, a certain pattern in returns and variance is documented for small firms, thus portfolio managers and institutional investors can invest into less risky large cap and higher dividend yield stocks. Supporting this idea, Kiymaz and Berument (2003) and Charles (2010) claim that uncovering a certain pattern is a stock price is useful for investors in valuation, portfolio optimization and risk management.

Second, this market has no or very little integration with international equity markets, such as the US, UK and Canada; thus it could be a good diversification alternative for foreign investors. Empirically, this is supported by several other studies, such as Bekaert et al. (2007) that emerging markets are less integrated with international markets. Even within the causal structure of conditional variance, the DSE is not found to be associated with other markets and surprisingly during the recent financial crisis (i.e. 2008-09) the liquidity of this market had increased. Altogether, the segmented nature of this market is attracting huge foreign direct investment flow including portfolio investment, e.g. $1.09 billion in 2009 (see Momen, 2010). However, there is regional influence on the DSE which may be due to Bangladesh's relationships in international trade. In addition, our time-varying volatility transmission model shows that in post 2000 period Canada, the UK, Hong Kong and India become determinant of volatility in DSE along with the US, China and Japan. These implies that various market reform and liberalization polices put the DSE more exposed to the global factors than that of early 1990s; but still not like other emerging markets, such as China, India, Brazil which are exposed to global financial crises as well.

Third, negative returns and higher variance on the opening day have significant implications for existing and prospective local investors. They could set their investment strategies based on the finding that individual investors process market information over the weekend. Similarly, major macro and firms' level information are also disclosed over the weekend. Therefore, prospective investors may be betting on the market by processing information earlier. In addition, the weekend effect is documented in smaller stocks and stocks with lower dividend yield, where investors could earn maximum returns. Therefore, based on their own risk preference they can either invest into riskier smaller stocks or less risky large cap and higher yield firms.

Fourth, another important implication of the findings from this market is related to the volatility spillover effect. Over the years, the market has received a spillover effect in volatility from world factors at the beginning and end of each week, however adjusted to regional information during the other week days. We have found that during pre 2000 periods volatility was transmitted to DSE from only a few international markets (e.g. the US, Japan, China) but as time goes by, the market grows more integrated, hence the more evidence on spillover effects recently (during post 2000 all seven markets have found significant, with different degree and on different days). Knowing this characteristic would be helpful for both foreign and local investors to set up their risk management strategies and also portfolio formation. Interestingly, among many, Ng (2000) has documented a similar spillover effect for other Asian equity markets.

Fifth, perhaps the most noteworthy implication of this study is that in between international and local information, the DSE is significantly influenced by local macro and non-macroeconomic news. Particularly, money growth policy, government debt policy and political uncertainty have greater impact on this stock market. That suggests that foreign portfolio managers or institutional and individual investors should give more consideration to local events while constructing their investment policies rather than world or regional factors. Indeed, in emerging markets, if one can forecast changes in political risk one can forecast stock returns (Diamonte et al., 1996). The evidence is also robust when stocks of this market are sorted based on several firm characteristics – size, dividend yield and sector.

Sixth, the managers of financial institutions (FIs) and the manufacturing sector could use the findings of this study in line with their objective to maximize the shareholders wealth. Many of the FIs are involved in business with Islamic regulations, known as Islamic Finance and their returns and volatility are sensitive to any macro and non-macroeconomic information as suggested in Chau et al. (2014). In addition, the liquidity of this categorical stock is largely influenced by changes in monetary policy. Therefore, while deciding their investment decisions and valuing stocks, managers of FIs should consider all those events and the stance of the central bank. On the other hand, returns, variance and the liquidity of the manufacturing sector are sensitive to both monetary and fiscal policy changes. To be specific, expansionary (contractionary) fiscal policy increases (decreases) the liquidity of this sector, however, contractionary monetary policy has a stronger effect than expansionary. Hence, similar to FIs, mangers of manufacturing firms should adjust the uncertainty related to government and central bank policies while doing their valuations or selecting investment alternatives.

Finally, there are several applications of this study to policy makers. (i) Monetary and fiscal policy variables are important determinant for stock market returns, volatility and liquidity. Particularly, the cash reserve ratio (CRR) can control the money supply, bank rate and government borrowing can influence the overall and stock level illiquidity. (ii) Government intervention cannot make a sustainable impact on the market. Sometimes it creates uncertainty among local investors. (iii) Evidence shows that government borrowing enhances the possibility of the 'crowding out' effect in this market. Hence government has to reduce pressure on private firms by declining their loans from the banking sector. In some instances, public enterprises can off-load shares on the stock market to meet their financing requirements. (iv) This market has a faulty mechanism – members of the exchange are simultaneously brokers and dealers which provide ample opportunity for brokers to exploit investors. Therefore, the DSE needs to take appropriate measures for demutualization in the market through enforcement of appropriate regulations. Restrictions should put in place so that owners of brokerage houses cannot become members of the DSE management board. (v) Since the political events significantly control the investment and trading behaviour of investors and the overall economic performance in this market, political leaders need to rethink their political activities. (vi) Bangladesh needs effective cooperation and coordination between regulatory bodies (i.e. the SEC, central bank and government), while setting policy for money and capital markets.

8.7 Limitations of the study

Like many other research studies, this study has some limitations which need to be mentioned. First, this study has limited access to datasets. This study is entirely based on secondary sources, such as Thomson Reuters Datastream, the International Financial Statistics (IFS) of International Monetary Fund (IMF), the Main Board of the Dhaka Stock Exchange and Bangladesh Bank (central bank of Bangladesh), but in many instances data were not available before 2000. Therefore, we have failed to link the dynamic characteristics of DSE with national and international macroeconomic and non-macroeconomic news for the period before 2000. Particularly, we have missed seeing the impact of this macro and non-macro information during the first stock market crash (i.e. crash of 1996) at firm and industry level.

Second, this market lacks microstructure data. For example, we do not have minute by minute trading information or the bid-ask spread (quoted or effective). Therefore, we could not have investigated the market liquidity and illiquidity by applying measures to capture other aspects of trading activity and price impact. However, it is mentioned in earlier studies, such as Amihud (2002), Bekaert et al. (2007) and Goyenko and Ukhov (2009) that this kind of microstructure data are generally not available for most the markets (both developed and emerging equity markets). They thus recommend alternative measures for liquidity. Due to lack of microstructure data, we have failed to examine the information content theory, the information processing hypothesis and volatility spillover in a more rigorous fashion. For example, Rogalski (1984), Harris (1986), and Smirlock and Starks (1986) applied intraday data and decomposed the daily returns into shorter intervals to investigate the characteristics of the weekend effect.

Third, this market has a small scale private bond market and treasury bonds are only traded between financial institutions. Thus we could not extend our analysis to show the joint dynamics of equity and bond market liquidity and their relationship to monetary and fiscal policy variables. Yet, it is suggested in Chordia et al. (2005) and Goyenko and Ukhov (2009) that the liquidity of stock and bond markets covaries via trading activity and order flow which can be influenced by central bank policy.

Fourth, in aligning the structural breaks of the stock market with macro and non-macroeconomic information we could not include the impact of celebrity gossip and media (both newspaper and television) coverage. However, some of the recent studies, such as Engelberg and Parsons (2011) and Birz and Lott (2011) have pointed out the impact of media and newspapers on financial markets.

Fifth, in analysing the firm level evidence of liquidity we have assumed fixed effects and included an interaction of policy variables (i.e. monetary and fiscal policy) and market capitalization of stocks in panel estimations. But this might not be sufficient to account for all potential forms of cross-sectional heterogeneity. Therefore, the issue of cross-sectional homogeneity of the slope parameters in the panel models need to be investigated and tested in future work (see Fernández-Amador et al., 2013).

8.8 Areas of future research

The results of this study have improved our understanding of several key characteristics of emerging equity markets, the role of individual versus institutional investors, volatility spillover dynamics, the association with macro and non-macro information and the influence of monetary and fiscal policy on market liquidity. Still there are several other areas which merit further investigation.

First, our results for our sample period January 2000 to December 2012 also identify the presence of the weekend anomaly on the DSE in both returns and volatility, although due to the exchange's opening days it is a Sunday effect, not a Monday effect. This suggests that investors might get an advantage by designing their investment strategies based on such a regular shift in the market. However, an active trading strategy may not have been profitable all the time due to transaction costs. In a further study we could demonstrate whether it is possible to beat the market using this anomaly, after transaction costs.

Second, we can extend the analysis of the volatility spillover effect in several new studies. By including more domestic countries from various time-zones, we could provide robust results about volatility spillovers from markets with synchronous and non-synchronous trading hours on a daily basis. We could investigate the possible existence of the unidirectional transmission of information from emerging markets to developed markets. We could also examine the spillover effects of monetary and fiscal policy of developed markets on to emerging markets and vice-versa.

Third, it is documented that both macro and non-macroeconomic news are important determinants for stock markets, yet most previous studies have examined them separately. Therefore, we could include more developed and emerging equity markets in our analysis and see their relationship combined with monetary policy, fiscal policy, and other macro and non-macroeconomic events. The study would further extend to include celebrity gossip and media coverage to explore the impact of that news on the stock market.

Fourth, there are a number of interesting ways to expand our results related to liquidity and macroeconomic management policy. Since little empirical work has been done on the liquidity of emerging equity markets, we can apply a similar hypothesis and methodologies to other markets on linking the liquidity with monetary and fiscal policy. These studies could also extend linking movements in liquidity across equity and fixed income markets. In this study we have assumed fixed effects and include an interaction of policy variables (i.e. monetary and fiscal policy) and market capitalization of stocks in panel estimations, which might not sufficient to account for all potential forms of cross-sectional heterogeneity. Therefore, the issue of cross-sectional homogeneity of the slope parameters in the panel models need to be investigated and tested in future work.

Finally, we could also examine whether corporate managers can take advantage of changing macroeconomic management policies (i.e. monetary and fiscal policy) by changing their capital structure decisions. This could be further extended to explore the appropriateness of capital structure adjustments by evaluating firms' performance in response to those changes.

Appendix A:

Synopsis of the History of Bangladesh Capital Market:

Year and Date	Milestone(s)
1952	Kolkata Stock Exchange (formerly Calcutta Stock Exchange) had prohibited the transaction of Pakistani share and securities.
28 April, 1954	Eight promoters were incorporated the formation of "East Pakistan Stock Exchange Association Ltd."
1956	Got the certificate of commencement and started formal trading of shares at Narayanganj (one of the industrial city of Bangladesh close to Dhaka).
1 October, 1957	The stock exchange had purchased a land measuring 8.75 kattah at 9F Motijheel C/A from the Government to construct an office in the city.
1958	Stock Exchange was shifted to Dhaka at the Narayangonj Chamber Building in Motijheel C/A.
1959	The exchange had shifted office to own premises 9F Motijheel C/A, Dhaka.
23 June, 1962	As a public company the name of stock exchange was revised to "East Pakistan Stock Exchange".
14 May, 1964	The name was again changed to "Dhaka Stock Exchange".
1969	Security and Exchange ordinance was introduced in Dhaka Stock Exchange.
1971-1975	Trading was suspended due to Liberation War and after war rehabilitation work.
16 August 1976	Operation of Dhaka Stock Exchange resumed with 9 listed companies.
16 October, 1986	DSE all-share price index was introduced.
8 June, 1993	The Securities and Exchange Commission (SEC) was established under the Securities and Exchange Commission Act, 1993.
3 November, 1993	DSE all-share price index recalculated based on IFC formula.
1994	Security & Exchange Commission Regulation and Security & Exchange (inside trading) regulation were introduce.
1995	The second bourse of the country, "Chittagong Stock Exchange" obtained permission on 12 February, 1995 and began formal trading on 10 October, 1995. However, it was formally opened by the Prime Minister of Bangladesh on 4th November, 1995.
October, 1996	Introduction of "Circuit Breaker" in both the markets.
June - August, 1998	Chittagong Stock Exchange introduced Automated Trading System on 2 June, 1998 and Dhaka Stock Exchange did that on 10 August of the same year. In this year Settlement of Transaction Regulation was also introduced.
20 August, 2000	Central Depository Bangladesh Limited (CDBL) was established to operate and maintain the Central Depository System. However, on 26 January, 2004 CSE formed the CDBL.
1 January, 2001	DSE 20 index was introduced.
1 January, 2005	Launched the government bonds market.
28 March, 2005	DSE all-share price index was re-introduced.
20 February, 2006	Adoption of "Corporate Governance Guidelines".
6 September, 2009	Introduction of Over-the-counter (OTC) market. However, CSE introduced OTC market on 4 July, 2004.
10 October, 2010	Dhaka Stock Exchange has converted into fully Automated Trading System.
23 November, 2011	Securities and Exchange Commission (SEC) took steps to stabilizing the stock market in association with Bangladesh Bank (Central Bank) and Ministry of Finance.
4 December, 2011	Introduction of uniform face value of Tk. 10 for all Shares and Mutual Funds.

Appendix B: Institutional Shareholding in DSE (As of December 2012)

	Total listed companies	Total companies with institutional share holdings	Average percentage of institutional share holdings in the overall industry	Percentage of total market capital of the Industry	Average percentage of market capital of each company
Financial Sector					
Bank	30	26	20.54%	26.72%	0.89%
Insurance	45	31	14.35	5.35	0.12
NBFIs	23	21	18.83	8.4	0.37
Investment	35	27	30.22	2.16	0.06
Manufacturing Sector					
Foods	16	14	10.23	3.54	0.22
Pharma	24	22	19.86	8.16	0.34
Textile	32	27	10.67	3.59	0.11
Engineering	23	21	13.64	4.17	0.18
Ceramics	5	5	19.75	1.19	0.24
Tannery	5	4	9.79	0.62	0.12
Paper and Printing	1	1	8.51	0.02	0.02
Jute	3	1	9.79	0.02	0.01
Cement	6	5	20.01	4.01	0.67
Service Sector					
Fuel and Power	14	12	19.72	11.87	0.85
Service and Real Estate	3	3	14.24	0.49	0.16
IT	5	5	15.04	0.26	0.05
Telecom	2	2	9.45	13.82	6.91
Travel and Leisure	3	2	18.63	2.63	0.88
Miscellaneous	8	7	12.78	2.6	0.33
Total	283	236		100	

Sources: Calculated for the information given on the website of Dhaka Stock Exchange.

Appendix C:

List of selected macro and non-macroeconomic information or events over the sample period from January 1990 to December 2012.

Panel A: Related to Monetary and Fiscal Policy

Date and Year	**Information and Macroeconomic Period(s)**
In 1990	The Cash Reserve Ratio (CRR) was 10% and Statutory Liquidity Reserve (SLR) was 25%.
1 April, 1991	CRR reduced to 9% and SLR to 24%. Again on 25th April, SLR further reduced to 23%. But in December the central bank has set a new rate, CRR at 8% and SLR at 22%.
1 July, 1991	Value Added Tax (VAT) Regulation has introduced.
1 April, 1992	CRR set at 7% and SLR at 21%. In May the central bank again reduced them to 6% and 20% respectively.
July, 1991	Period of high inflation and the rate was more than 8%
June, 1993	Inflation rate was less than 2%.
March, 1994	Bank rate reduced to 5.5%, previously it was in-between 9.75% - 6% from January 1990 – February 1994. Again the rate has gone up from September 1995 until central bank has brought it down to 5% in November, 2003.
In 1994	Total private credit expansion growth rate has reduced to 3.70% from 19.80% of 1990.
December, 1995	The broad money (M2) supply has increased by 12%.
In 1996	The private credit expansion growth rate, however, again increased to 18.10%.
December, 1999	The broad money (M2) supply has increased by 15%.
In 2000	The size of public debt increased to 31.3%, producing a jump in the money supply by 18.6%.
31 May 2003	The floating exchange rate has introduced by the central bank of Bangladesh.
8 November, 2003	CRR set at 4% and SLR at 16%.
September, 2004	Inflation increased to 6.06%.
1 January, 2005	Launched the government bonds market.
1 March, 2005	CRR rose to 4.5%, however, again in the same year on 1st October the central bank has increased them to 5% and 18%, respectively for CRR and SLR.
March 2006	The official exchange rate (US$ to BDT) reached to 1:71.54 from 1:58.95 (in March 2004)
June 2009	Government borrowing increase to BDT 799 billion, a new highest level in history.
July 2009	Government allow black money (undisclosed) whitening opportunity through investment into stocks in 2009-10 fiscal budgets.
December 2010	Inflation increased to more than 11%.
15 December, 2010	Both CRR and SLR have increased by 50 basis points. Therefore, new rates are 6% and 19% respectively for CRR and SLR.
November 2012	Government borrowing breaks all previous record and increase to BDT 1310 billion.
26 December, 2011	Government further passed the provision of investing undisclosed (black) money into stock market.
January 2012	The exchange rate (US$: BDT) further increased to 1:84.86 from 1:69.42 (in October 2010)

Panel B: Political Risk and Election related information

Date and Year	Informations and Macroeconomic Period(s)
6 December, 1990	Military backed autocratic president Ershad offered resignation and Shahabuddin Ahmed took the office as a head of first caretaker government.
27 February, 1991	General Election held and Bangladesh Nationalist Party (BNP) won the election.
February, 1991 – March, 1996	Total 266 days of hartal called by Bangladesh Awami League (AL).
15 February, 1996	An election held without any opposition, only the incumbent party has participated in that election.
24 February – 28 March, 1996	Held a series of hartal, strike and non-cooperation initially from opposition parties, later from business communities, civil society and bureaucrats.
30 March, 1996	Muhammad Habibur Rahman took the office of caretaker government as Chief Advisor.
19 May, 1996	Failed attempt of coup by Lt. Gen. Abu Saleh Mohammad Nasim.
12 June, 1996	General Election held and Bangladesh Awami League gained majority.
June, 1996 – July, 2001	Total 215 days of hartal called by BNP and other parties.
15 July, 2001	Latifur Rahman became the Chief Advisor of caretaker government.
1 October, 2001	BNP secured a decisive victory in general election.
October, 2001 – January, 2007	Total more than 200 days of hartal called by AL and other parties.
21 August, 2004	Grenade attack in an attempt to kill the then-former prime minister as well as the leader of opposition party.
17 August, 2005	Series of bomb blast with the space of 45 minutes at least 450 bombs have exploded in 63 out of the country's 64 districts.
28 October 2006 – 10 January 2011	Series of strike and violence, which includes – attacking trains and buses, blocking main roads, shutting down ferries and forcing the closure of ports, market and schools.
11 January, 2007	President declared state of emergency.
12 January, 2007	Fakhruddin Ahmed has been selected as Chief Advisor of caretaker government.
29 December, 2008	General election held and AL secured a landslide victory.
25-27 February, 2009	Mutiny staged by the paramilitary Bangladesh Rifles.

Panel C: Other Macro, Regulatory and Non-Macroeconomic Information

Date and Year	Information and Macroeconomic Period(s)
April, 1992	The door of foreign investment in the capital market was introduced through the Non-resident Taka Account (NITA)
8 June, 1993	The Securities and Exchange Commission (SEC) was established under the Securities and Exchange Commission Act, 1993.
3 November, 1993	DSE (Dhaka stock exchange) all-share price index recalculated based on IFC formula.
In 1994	Security & Exchange Commission Regulation and Security & Exchange (inside trading) regulation were introduce.

In 1995	The second bourse of the country, "Chittagong Stock Exchange (CSE)" obtained permission on 12 February, 1995 and began formal trading on 10 October, 1995. However, it was formally opened by the Prime Minister of Bangladesh on 4th November, 1995.
October, 1996	Introduction of "Circuit Breaker" in both the markets.
10 August, 1998	Automated Trading System was introduced in Dhaka Stock Exchange.
In 1998	Settlement of Transaction Regulation has introduced by the SEC Bangladesh with a notification on 24th May, 1998.
In 1999	First private sector mutual funds float shares in DSE.
20 August, 2000	Central Depository Bangladesh Limited (CDBL) was established to operate and maintain the Central Depository System.
1 January, 2001	DSE 20 index was introduced.
In 2003	Thirty-one financial institutions getting licence from SEC Bangladesh for providing margin loan. Among them 9 are banks, 8 non-bank financial institutions and 14 are capital market alliance institutions.
28 March, 2005	DSE all-share price index was re-introduced.
December, 2005	Bangladesh includes in Next-11 countries by Goldman Sachs.
20 February, 2006	Adoption of "Corporate Governance Guidelines".
In 2006	Direct listing regulation introduced.
4 April 2007	J. P. Morgan includes Bangladesh in Frontier Five with Vietnam, Nigeria, Kenya and Kazakhstan.
In 2009	SEC of Bangladesh has developed Book Building method with the collaboration of DSE and CSE. Regarding this issue the commission has made a notification on 11th March, 2009 and it is published in the Bangladesh gazette on 19th March, 2009. However, the process has first started in 2010.
6 September, 2009	Introduction of Over-the-counter (OTC) market.
1 July, 2010	The Bangladesh Finance Act (No. 33) 2010 introduced a new capital gain tax for institutions, where they have to pay general 10% tax or a reduced rate of 5% tax on sale or transfer of non-government securities. For individual there is no capital gain tax imposed.
In 2010	A total of twelve commercial banks have been identified by the central bank, which have violated the Bank Company Act 26(2) and invest more than 10% (in some instance more than 80%) of their deposits into stock market. they have been asked to adjust their investment within November 2010. In July-December Monetary Policy Statement of 2010, central bank also anticipated possible diversion of industrial credit to the capital market and instructed commercial banks to adjust those loan portfolios by 31 December, 2010.
10 October, 2010	Dhaka Stock Exchange has converted into fully Automated Trading System.
01 November 2010	Government declares to float shares of eight state owned enterprises that are already listed on the country's capital market within next 15 to 20 days.
24 January, 2011	Probe committee has formed to investigate the stock market crash of 2010.
23 November, 2011	Securities and Exchange Commission (SEC) took steps to stabilizing the stock market in association with Bangladesh Bank (Central Bank) and Ministry of Finance.
23 November, 2011	Withdrawal of capital gain tax for foreign investors and expatriates.
4 December, 2011	Introduction of uniform face value of Tk. 10 for all Shares and Mutual Funds.
10 June 2012	MSA plus introduced, web based trading software.

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