

Impact of Macroeconomic Variables on the Stock Market Returns in Bangladesh: Does a Meaningful Impact Exist?

Mahedi Masuduzzaman
Senior Assistant Secretary,
Ministry of Finance Finance Division,
Macroeconomic Wing

Abstract: This paper strives to investigate the long-run relationship and the short-run dynamics between Bangladesh stock market index (DGEN-Key market-tracking index of Dhaka Stock Exchange) and key macroeconomic variables such as Consumer Price Index (CPI), Exchange rate of BDT against USD (Exrate), Broad money supply (M2), Industrial Production (IP) and Interest rate (Intrate). This study analyse monthly data for the above variables between the periods spanning from July 2006 to October 2012 and employ different econometric tools. The Engle-Granger and bivariate Johansen co-integration tests produces nonexistence of long term relationship. However, Johansen multivariate co-integration tests indicate that the Bangladesh stock market index and chosen five macroeconomic variables are co-integrated, this is indicative of a long-run relationship. Although, there is a long term relationship, it is only IP, CPI and M2 that adjust any disequilibrium once the system is shocked. But, the total adjustment power is very low in the system. This study finds no short-run causal relationship, which further strengthened by the Impulse Response Function(IRF) and Variance Decomposition(VDC) tests. IRF indicates, shock to macroeconomic variables does not generate a significant response to Bangladesh stock market. The VDC established that, a leading proportion of the variability in the stock index was explained by its own innovations while only a marginal was explained by the selected variables. These results recognized, stock prices in Bangladesh cannot be predicted using macroeconomic variables. The findings of no short-run dynamic and very weak long run relationship in this study help astute investors and policy makers in efficient and appropriate decision making regarding Bangladesh stock markets.

Key words: Macroeconomic variables, Investor, Bangladesh, Returns, Stock market, causality, impulse response, variance decomposition.

JEL Classification: C22, E44, G15

I. Introduction

The impact of macroeconomic variables on stock market returns has generated a lot of interest in the financial market literature. The relationship between stock market returns and macroeconomic variables has been widely investigated, especially in developed markets. The early studies on the US stock markets by Lintner (1973), Bodie (1976), Jaffe and Mandelker (1977) and Fama and Schwert (1977) mainly examined whether the financial assets were hedges against inflation. These studies have reported a negative relation between stock returns and changes in the general price level. However, Fama (1981) found a direct positive relationship between stock market returns and real economic activities such as industrial production. Chen *et. al.* (1986), tested whether a set of macro-economic variables explained unexpected changes in stock market returns.

It is recognized that stock markets play a pivotal role in growing industries and commerce of a country that eventually affect the economy. The importance of the stock markets has been well acknowledged in policy makers, portfolio managers, industries and investors perspectives. The stock market avail long-term capital to the listed firms by collecting funds from various potential investors, which allow them to expand in business and also offers investors alternative investment avenues to put their surplus funds in (Naik and Padhi, 2012). It is very interesting to invest in stock market but also a very risky trench of investment. So, potential investors always try to guess the movement of stock market prices to achieve maximum benefits and minimize the future risks. By concerning with the relationship between stock market returns and macroeconomic variables, investors might guess how stock market behaved if macroeconomic indicators such as exchange rate, industrial productions, interest rate, consumer price index and money supply fluctuate (Hussainey and Ngoc, 2009). Macroeconomic indicators such a compositions of data which frequently used by the policy makers and investors to gathering knowledge for current and upcoming investment priority (Masduzzaman, 2012).

The issue whether the stock market performance leads or follows economic activity is now becoming very controversial in Bangladesh as the stock market has gained much attraction in the last few years. Almost all the indicators such as market capitalization, trading volume, turnover and the market index have shown tremendous growth, although it has volatility. In this end, how does and at what extent the stock market returns of Bangladesh respond to the changes in macroeconomic determinants remains an open empirical question. Understanding the main macroeconomic variables, which may impact the Bangladesh stock market index, with the recent data could be helpful for policy makers, investors and all other stakeholders.

The present study therefore, attempts to explore whether there are long-run and short-run dynamic interactions between Bangladesh stock market index (DGEN-Key market-tracking index of Dhaka Stock Exchange -DSE) and key macroeconomic variables namely, Consumer Price Index (CPI), Exchange rate of BDT against USD (Exrate), Broad money supply (M2), Industrial Production (IP) and Interest rate (Intrate) for Bangladesh, by using unit root, Engle-Granger, Johansen co-integration, error correction model (ECM), Granger causality, Variance Decomposition (VDC) and Impulse Response Function (IRF). The author finds no study that particularly investigated the association between stock price of Bangladesh and the leading macroeconomic determinants by employing Impulse Response Function (IRF) and Variance Decomposition (VDC). So this will creates extra importance in the case of Bangladesh stock markets.

The section one of this study is the introductory part. The rest of the study is structured in five sections. The second section of the study will present an overview of related literatures that will give us a sound conception of the facts and section three gives an overview on development of Bangladesh stock markets. The section four provides an avenue regarding the research methodological approach and the relevant information on the time series data sets that are used for this study, while section five discussed the empirical results. Finally, section six will provide the conclusion that will point out the possible recommendations of the study as well.

II. Review of Previous Empirical Studies

The theoretical construct linking the impact of macroeconomic volatility on stock returns is based on the transmission mechanism of leading macroeconomic variables, namely; inflation, exchange rate, interest rate, money supply and industrial production (Smith and Sims, 1993; Flannery and Protopapadakis, 2002). Using US monthly stock returns and inflation time spanning from 1953 to 1974, Nelson (1976) found a negative relationship between stock returns, in both expected and unexpected inflation. Furthermore, empirical tests on the response of stock returns to inflation in the 1980s by Fama (1981), and Solnik (1983), amongst others, also yielded similar results of a negative relationship.

Mukherjee and Naka (1995) investigated the relationship between stock market returns and the main macroeconomic variables (exchange rate, inflation, money supply, industrial production index, the long-term government bond rate and call money rate) in Japan. Their result confirms that, the return of Japanese stock market was closely co-integrated with the leading macroeconomic variables. This indicates a long-run equilibrium relationship between the stock market return and the macroeconomic variables.

Nasseh and Strauss (2000) did their analysis on macroeconomic determinants for Germany, UK and other industrialized countries in Europe. They used quarterly data during the period of 1962.1 to 1995.4 and their findings suggested that consumer price index (CPI) and industrial production exist with large positive coefficients in the said countries' stock markets. They also found negative coefficients on long term interest rates. This study also argue that German industrial production and stock prices also positively influence on the return of other European stock markets like Holland, France, Italy, Switzerland and the UK. Ibrahim and Aziz (2003) estimated vector auto-regression model to explore the dynamic linkages between stock prices and four macroeconomic variables for the case of Malaysia. Empirical results of the analysis suggested the presence of a long-run relationship between these variables and the stock prices and substantial short-run interactions among them. They also stated that, the stock market is playing somewhat predictive role for the macroeconomic variables. Gunasekarage et al. (2004) examined the causal nexus between stock prices and five macroeconomic variables in Sri Lanka, by employing a vector error correction model. The results showed lagged values of consumer price index, M1 and Treasury bill rate have powerful influences on the stock market returns. Both VDC and IRF analyses revealed that shocks to macroeconomic factors explained only a minority of the forecast variance error of the market index.

Abugri (2008) finds that Chile, Argentina, Brazil and Mexico stock markets returns are changed by individual macroeconomic factor such as industrial production, exchange rate, money supply etc as well as the US three month T-bill yield. Kizys and Pierdzioch (2009) trace out that international co movement of monthly equity returns in industrialized economies is not systematically related to macroeconomic shock. Macroeconomic variables influence not only domestic stock market but also international stock market. Mittal and Pal (2011) finds that exchange rate shows significance influence in Bombay Stock Exchange (India). The study conclusively argues that stock market indices are dependent on macroeconomic variables.

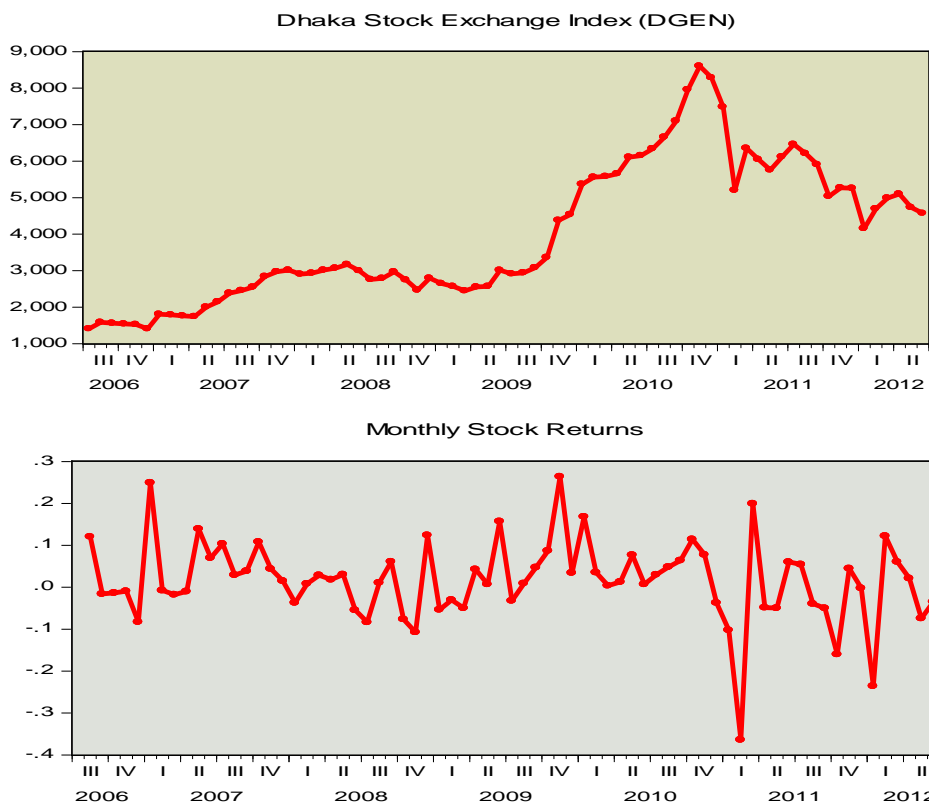
In the Bangladesh context there has been very few study in our area of interest. The author finds no study that particularly examined the relationship between stock price of Bangladesh and the macroeconomic determinants by employing Variance Decomposition (VDC) and Impulse Response Function (IRF). However, Rahman and Uddin (2009) have investigated the interactions between stock prices and exchange rates in three emerging countries of South Asia namely, Bangladesh, India and Pakistan for the period between January 2003 and June 2008. This study claimed that there is no co-integrating relationship between stock prices and exchange rates. Applying Granger causality test, they find out no causal relationship between stock prices and exchange rates. Afzal and Hossain (2011) examined the relationship between stock prices and selective macroeconomic variables using co-integration test and Granger causality test for the time spanning from July 2003 to October 2011. The results of this study state that co-integration exists between stock prices with M1, M2 and inflation rate that implies the long-run relationship. This study also established unidirectional causality running from stock market index to exchange rate and M1 in the short-run. Using data set for the period from January 1987 to December 2010, Ali (2011) have examined the direction of the causal relationship between stock prices and certain macroeconomic variables in Dhaka stock Exchange(DSE) by applying co-integration and Granger causality test. Empirical results of the analysis suggested the stock prices do not granger cause CPI, deposit interest rate, export receipt, GDP, investment, industrial production index, lending interest rate and national

income deflator. But unidirectional causality is found from DSI to broad money supply and total domestic credit. In addition, bi-directional causality is also identified from DSI to exchange rate, import payment and foreign remittances.

III. Brief Overview on Bangladesh Stock Exchange

The recent changing and growing Bangladesh stock markets are consisted of Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE). The DSE formal trade began in 1956 with paid up capital of approximately 04 billion of Bangladesh Taka (BDT). DSE is a public limited company which is officially regulated by Securities and Exchanges Commission (SEC) Act 1993. There is another stock market operating right now namely, Chittagong stock exchange that began formally trade in 1995. Dhaka Stock Exchange is largest and most active stock market in Bangladesh accounting for around 90 per cent of the value of the country's total stock transaction (Turnover US \$48 million) as on October 23,2012 with market capitalization US\$ 23.85 billion (DSE,2012). Actually, DSE is the representation of Bangladesh stock market scenario. After the financial liberalization in Bangladesh since 1990 has open up the market for the international investors and the market expanded rapidly that reflects significant economic growth. DSE General Index (DGEN) is a key market-tracking index that reflects the real scenario of Dhaka Stock Exchange (DSE) performance and Bangladesh stock market performance as well. The figure-1 provides an idea about the share price performance of DGEN during the period considered. The abnormal behaviour observed in share price in between late 2010 and the early 2011, made the returns volatile.

Figure-1: Monthly Share Price Index and Returns of Dhaka Stock Exchange

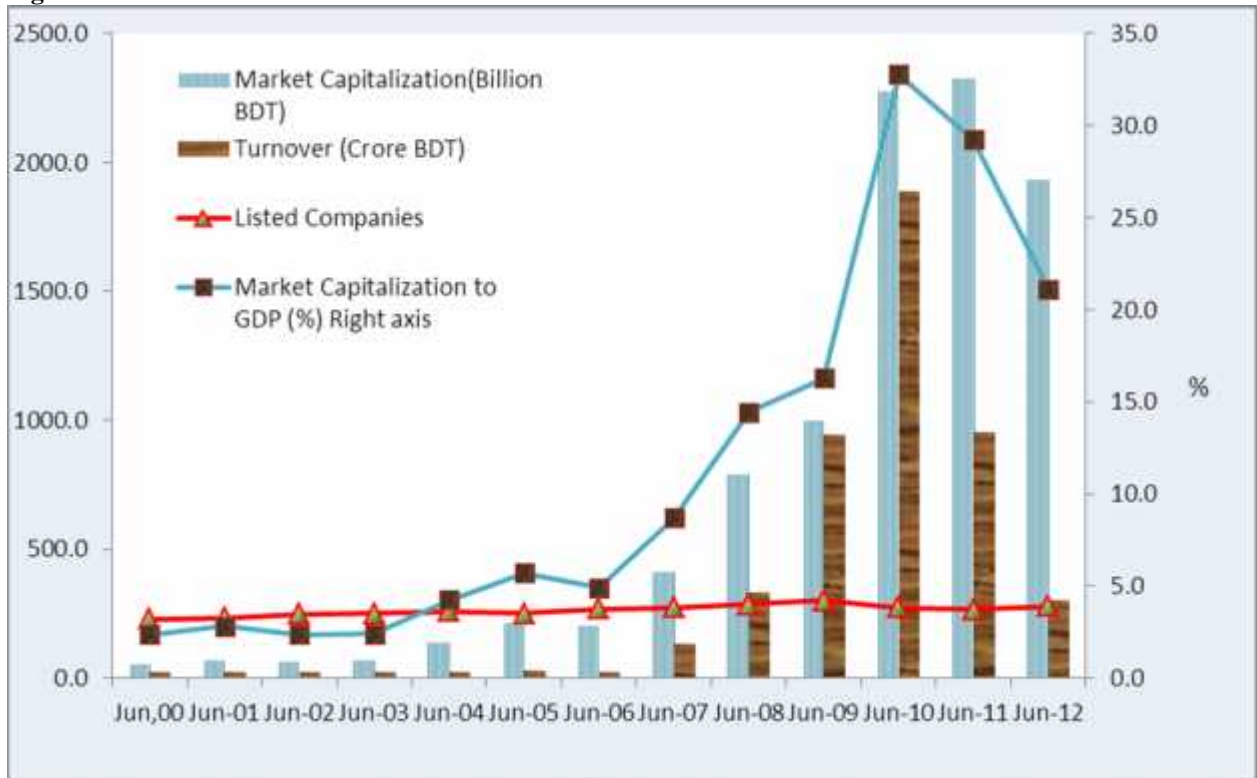


Source: Author's calculation based on DSE data

The Dhaka Stock Exchange (DSE) has experienced rapid growth in terms of market capitalization, turnover and share of market capitalization to Gross Domestic Product (GDP) in the recent past. According to the (Agarwal, 2001), market capitalization is positively correlated with the ability to mobilize capital and diversify risk on an economy wide basis. The figure-2 reveals that the market capitalization of DSE is relatively low compared to

the GDP of the country, although it's increased rapidly since June 2007. Increasing trend of market capitalization indicates that restructuring and efforts of the privatization are well under way (Arayssi et al.-2008). Figure- 2 also depicts the turnover of the stock market of Bangladesh. From June 2000 to June 2012, it increased form 23.8 crore BDT to 299.9 crore BDT. The daily turnover peaked at 1887.37 BDT in June 2010, but showing a declining trend afterwards. Graph-2 also exhibits, market capitalization (% of GDP) has been significantly increased over time but the growth of the listed companies is not increased significantly rather it has remained stagnant during the period between June, 2000 and June, 2012.

Figure-2: Performance of the DSE



Source: Author's calculation based on Bangladesh Bank data.

IV. Data Description and Methodology

a) Data Description

In the empirical analysis we use data from July 2006 to October 2012. We choose monthly frequency to maximize the number of observations for a robust estimation of the model. The data on Bangladesh stock market index (DGEN-Key market-tracking index of DSE), Money supply (M2), Exchange rate of BDT against USD (Exrate) and Interest rate (Intrate) has been obtained from Bangladesh Bank (Central Bank of Bangladesh). The data on Industrial production (IP) index and Consumer Price Index (CPI) has been sourced from Bangladesh Bureau of Statistics (BBS). All the variables, with only exception of Interest rate are expressed in natural logarithm form.

To provide an overall understanding of the chosen stock market index and the macroeconomic variables, we include summary statistics of the data set in table-1. The standard deviation that measures volatility is very high for interest rate and stock market index compared to other four variables. Skewness of the stock market index is negative implies that the distribution has a long right tail. The Kurtosis value of stock index, industrial production, CPI and M2 relatively small implying that the distributions are low relative to normal. The value of skewness and kurtosis indicate the lack of symmetric in the distribution. The significant coefficient of Jarque-Bera statistics of exchange rate, interest rate and M2 also indicates that the frequency distributions of considered series are not normal.

Table-1: Summary Statistics of the chosen variables

	GENINDEX	IP	CPI	EXRATE	INTRATE	M2
Mean	8.19	6.10	5.39	4.27	7.69	12.65
Median	8.05	6.07	5.39	4.24	7.38	12.64
Maximum	9.06	6.47	5.65	4.44	10.56	13.22
Minimum	7.25	5.78	5.13	4.21	5.77	12.11
Std. Dev.	0.48	0.18	0.15	0.06	0.99	0.33
Skewness	-0.15	0.28	0.09	1.48	0.94	0.07
Kurtosis	2.03	1.94	1.92	3.66	4.17	1.71
Jarque-Bera	3.31	4.58	3.77	29.11	15.51	5.30
Probability	0.19	0.10	0.15	0.00	0.00	0.07
bservations	76	76	76	76	76	76

Source: Author's calculation based on BB and BBS data

The following table-2 shows that, Bangladesh stock market have positive average returns. The highest average rate of returns was 1.54 per cent. The highest monthly returns around 27 per cent and the minimum return negative 36 per cent during the sample period. The standard deviation that measures the volatility of the stock market returns is very high during the sample periods.

Table-2: Stock returns of different sample periods

	Mean	Maximum	Minimum	Std. Dev.
Stock Returns	1.54	26.40	-36.35	9.49

Notes: Returns have been calculated as follows, $r_t = \ln(p_t / p_{t-1}) \times 100$

b) Methodology

The Unit Root Test

The time series data are non-stationary that always leads to spurious results. Therefore, it is the prerequisite to perform the unit root test before econometric analysis of any time series. Apart from that, according to Engle and Granger (1987), a long-run relationship could only exist when the variables of interest are integrated to the same order. There are several tests in the literature to examine the unit root in time series variables and each test has its own advantages and disadvantages. The Augmented Dickey-Fuller (ADF) test is widely used for test stationarity of the variables (Dickey, Fuller, 1979, 1981). Phillips and Perron (1988) proposed a modification of the Dickey-Fuller (DF) test and have developed a comprehensive theory of unit roots. In this consideration, we adopt the Phillips Perron methodology to test unit roots in the chosen six variables. The test is conducted at individual variables in level log form and the first differenced log form. If the log forms or first differenced log forms reject the null hypothesis (H_0 : series has a unit root), the time series is stationary.

The PP test is based on the following model

$$\Delta Y_t = \Gamma + bY_{t-1} + v_t \quad \dots\dots\dots (1)$$

Where Δ = first difference operator, Γ = constant, v_t = error term.

Co-integration Test and Error Correction Mechanism (ECM)

After confirming whether the six variables used in this study are integrated of the same order, we have to conduct co-integration test. For robustness of the co-integration test, this study employed both the Engle and Granger (1987) and the Johansen and Juselius (1990) approaches. According to Lutkepohl (1982), it is important to note that, the bivariate co-integration test or regression may be counterfeit due to the omission of the important variables. In this consideration, this study employed both bivariate and multivariate procedure.

The primary step for Engle-Granger test is to run the Ordinary Least Square (OLS) regression and then the second step is to predict it's residual. If the residual is stationary then we can say that the stock market index and the macroeconomic variables are integrated. To move into the first step we consider the following model,

$$y_t = S_0 + S_1 x_t + e_t \quad \dots\dots\dots (2)$$

Where y_t = Stock market index of Bangladesh and x_t represents the chosen macroeconomic variables. We address the residual e_t by using the following Augmented Dickey Fuller (ADF) unit root test.

$$\Delta \hat{e}_t = \Gamma_1 \hat{e}_{t-1} + \sum_{i=2}^n \Gamma_i \Delta \hat{e}_{t-i} + v_t \quad \dots\dots\dots (3)$$

In equation (3) represents the estimated parameters, while v_t is the error terms. To determination of long run relationship, we conducted hypothesis test on the coefficients of Γ_i . If the test statistic of the coefficients exceeds the critical value, then we could reject the null hypothesis and conclude that the residual is stationary. The rejection of null hypothesis implies the linkages of long run relationship among the variables.

Johansen method indicates the maximum likelihood procedure to the identification of existence of co-integrating vectors for chosen non-stationary time series. This model directly investigates the integration in Vector Auto-regression (VAR). The primary step in the Johansen co-integration test is to determine the optimal lag length for each VAR model. This study identified the optimal number of Lags by using Schwarz Criterion (SC) and considered the minimized criterion value. The Johansen's multivariate co-integration test is based on the following vector auto regression equation:

$$z_t = c + A_1 z_{t-1} + \dots\dots\dots + A_p z_{t-p} + \sim_t \quad \dots\dots\dots (4)$$

Where z_t represents $n \times 1$ vector that integrated I (1) and \sim_t is $n \times 1$ -vector innovations. The VAR model (4) can be re-write following way

$$\Delta z_t = c + \Pi z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \sim_t \quad \dots\dots\dots (5)$$

Where $\Pi = \sum_{i=1}^p A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^p A_j$

If the rank $r < n$ in the co-efficient matrix Π of above equation, there is a possibility of existing $n \times r$ matrices namely S and α each with rank r and it can be written in the following way

$$\Pi = S \alpha' \quad \dots\dots\dots (6)$$

Where α = $n \times 1$ column vector that represents the speed of short-run adjustment to disequilibrium. On the other hand, S = $1 \times n$ co-integrating row vector, represents the long run coefficient matrix.

There are two different likelihood ratio test proposed by the Johansen namely,

$$\text{Trace Test} = -T \sum_{j=r+1}^k \ln(1 - \hat{\lambda}_j) \quad \dots\dots\dots (7)$$

$$\text{Maximum Eigen Value Test} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad \dots\dots\dots (8)$$

Where T = Sample size and $\hat{\lambda}_j$ = Estimated values of characteristic roots ranked from largest to smallest.

The equation (7) that is: trace test (λ_{trace}) tests the null hypothesis of co-integrating vector against the alternative hypothesis of n co-integrating vectors and equation (8) that is: maximum Eigen value test (λ_{max}) tests the null of r co-integrating vectors against the alternative hypothesis of r+1 co-integrating vectors.

After confirming whether the six variables used in this study are co-integrated; that is, there is a long term or equilibrium, relationship between stock prices and the macroeconomic variables, we can move in to examine ECM. Of course, in the short-run there may be disequilibrium. Therefore, one can treat the error term of any regression model as the “equilibrium error.” This is a means of reconciling the short-run behaviour of economic variables with its long-run behaviour(Gujrati and Porter-2009). The Engle-Granger representation theorem Engle and Granger (1987) states that if two series are co-integrated, the Error Correction Mechanism (ECM) can interpret the dynamic changes in the short-run and can include variations in the partial adjustment mode. For the purpose of capturing the long-run behaviour an Error Correction Term (ECT) which is lag of residuals generated from the model estimated in level is included in short-run equation (Mittal and Pal -2011). The ECM specification is represented below:

$$\Delta \text{LogDGEN} = s_0 + s_1 \Delta \text{LogCPI} + s_2 \Delta \text{LogIP} + s_3 \Delta \text{LogExrate} + s_4 \Delta \text{LogM} + s_5 \Delta \text{Log int rate} + s_6 \text{ECT}_{t-1} + \epsilon_t \quad (9)$$

We also conducted the causality test based on Granger’s (1969) approach in order to see any influence between stock market index and the macroeconomic variables considered in this study. If we consider x_t (stock market index) and y_t (macroeconomic variables) as two different time series then the model express as following way:

$$\Delta x_t = s_0 + \sum_{i=1}^n s_1 \Delta x_{t-i} + \sum_{i=1}^m s_2 \Delta y_{t-i} + v_{1t} \quad (10)$$

$$\Delta y_t = u_0 + \sum_{i=1}^n u_1 \Delta y_{t-i} + \sum_{i=1}^m u_2 \Delta x_{t-i} + v_{2t} \quad (11)$$

Where Δ is the difference operator, n and m are the lag lengths of the variables. v_{1t} and v_{2t} are the disturbance terms. In the first equation, it is assumed that the values of variable X are a function of its lagged values and the lagged values of variable Y. In the second equation it is assumed that the present values of variable Y are a function of its lagged values and the lagged values of variable X. The null hypothesis is that X does not Granger-cause Y in the second model and that Y does not Granger-cause X in the first model.

Variance Decomposition (VDC) and Impulse Response Function (IRF)

The standard Granger causality analysis interpreted within the sample period only. In this regard, variance decomposition analysis could be an important tool to make proper inference regarding the causal relationships beyond the sample period. Actually, Variance Decomposition indicates the percentage of the forecast error variance in one variable that is due to errors in forecasting itself and each of the other variables (Tarik, 2001).

The impulse response function is designed to infer how each variable responds at different time horizon to an earlier shock in that particular variable and to shocks in other macroeconomic variables. Particularly, we investigate the response of the DGEN(Stock market index of Dhaka Stock Exchange) to one standard deviation shocks to the equation for DGEN and macroeconomic variables and also the the response of macroeconomic variables to one standard deviation to the equation for the DGEN. This study use Cholesky decomposition to make error term orthogonal. A two-standard-deviation confidence interval will be reported for each impulse response function. It is noted that, if a confidence interval containing zero, implies lack of significance and the said confidence interval for IRF will be computed from Monte Carlo simulations. As VAR results are very much sensitive to the choice of appropriate lag length, this study identified the optimal number of Lags by using Akaike Information Criteria (AIC) and considered the minimized criterion value to derive VDC and IRF from the vector error correction model.

V. Empirical Results

The unit-root test is performed on Bangladesh stock market time series and the chosen macroeconomic variables to determine whether the time series is stationary. We employed PP unit root tests. The results of the unit-root test are shown in Table-3. According to the results none of the variable is stationary at their natural log level at standard 05 per cent level of significance. But null hypothesis (H_0 : Non-stationary) are rejected in their log first differences at 01 per cent level of significance. This implies that all the variables are stationary in the log first difference that is I (1). Therefore, it is possible to proceed to the second step of the analysis, testing for co-integration between stock market prices and macroeconomic variables.

Table 3: Phillips-Peron unit root tests with Bangladesh's Stock market indices and other macroeconomic variables

Variables ↓	Intercept				Intercept and Trend			
	Level		First Difference		Level		First difference	
	T-statistics	P-value	T-statistics	P-value	T-statistics	P-value	T-statistics	P-value
DGEN	-1.93	0.31	-8.76	0.00	-1.14	0.92	-8.92*	0.00
CPI	-0.15	0.94	-5.66	0.00	-2.87	0.16	-5.60*	0.00
IP	-1.13	0.70	-14.30	0.00	-2.92	0.20	-14.22*	0.00
Exrate	0.44	0.98	-7.17	0.00	-1.53	0.81	-7.42*	0.00
M2	0.76	0.99	-12.63	0.00	-3.06	0.11	-12.64*	0.00
intrest	-2.24	0.19	-8.25	0.00	-2.42	0.36	-8.21*	0.00

Notes: The critical values and details of the test are presented in Phillips and Perron (1988). *indicates significant at 1%.

Results of Engle-Granger co-integration test are reported in table-4. These results are obtained by employing ADF test for co-integration on the residuals generated from the estimated model (3) in natural log levels. The results indicate that the null hypothesis of no co-integration is not rejected in the estimated models where DSE general index (DGEN) is dependent variable and CPI, IP, Exchange rates, M2 and interest rate are individually explanatory variables. This established the fact that when the market forces are reacting actively, this macroeconomic variable does not affect the Bangladesh stock market in the long run. Furthermore, when DSE general index (DGEN) is dependent variable and other macroeconomic variables acts collectively as dependent variables in the model (3), the null hypothesis of no co-integration is not rejected at standard 05 per cent level of significance that confirmed there is no long-run relationship between stock market indices and the chosen macroeconomic variable.

Table-4: ADF tests results on Engle-Granger co-integration test residuals

Variables	ADF Test (trend and intercept)		ADF Test (without trend)	
	T-statistics	P-value	T-statistics	P-value
DGEN and M2	-0.95	0.95	-1.03	0.74
DGEN and CPI	-0.94	0.95	-1.08	0.72
DGEN and Exrate	-0.95	0.94	-1.76	0.40
DGEN and Intrate	-1.65	0.77	-1.72	0.41
DGEN and IP	-2.10	0.54	-2.33	0.16
DGEN and M2, CPI, Exrate, Intrate, IP	-2.18	0.49	-2.22	0.19

As we mentioned earlier that, for robustness of Engle-Granger test we also used both the bivariate and multivariate Johansen co-integration test and consider both the trace statistic and maximum Eigen value statistic test. The primary step in the Johansen co-integration test is to determine the optimal lag length for each VAR

model. This study identified the optimal number of Lag by using Schwarz Information Criterion (SIC) and considered the minimized criterion value. The empirical result of the Bivariate Johansen co-integration test (Panel A of Table 5) do not support the presence of the co-integrating vector. The null hypothesis ‘Stock market index and the individual macroeconomic variables are not co-integrated ($r=0$) against the alternative of one co-integrating vector ($r \leq 1$)’ is not rejected because the trace statistic (λ_{trace}) value is not exceed the corresponding 05% critical value. The maximum Eigen value statistic (λ_{max}) also produce same result.

We do not find any evidence of co-integration on a bivariate basis between Stock market indices and the macroeconomic variables. However, we want to see whether the stock market index and the macroeconomic variables are co-integrated as group. In this regard, this study also carried out the multivariate Johansen co-integration test. The result of the multivariate test (Panel B of Table 5) implies that long-term relationship exist between stock market indices and chosen macroeconomic variables because trace statistic and maximum Eigen value statistic exceed the corresponding 05% critical value. Since the market index and the chosen macroeconomic variables have at least one co-integrating vector, it is reasonable to assume that they move together in the long run equilibrium path. This result is supported by Afzal and Hossain (2011), who established that long-run relationship existed between stocks prices and the macroeconomic variables in Bangladesh. The finding of this research is also on the line as Mittal and Pal (2011) have established the long-run relationship between stock price and the certain macroeconomic variables in India.

Table 5: Result of the Johansen Co-integration Test (Without Trend)

Panel A: Result of Bivariate Johansen Co-integration Test (Without Trend)					
		Trace Statistic (λ_{trace})	05% Critical Value	Max Eigen Value Statistic(λ_{max})	5% Critical Value
DGEN and M2	$r=0$	4.68	15.49	4.68	14.26
	$r \leq 1$	0.0001	3.84	0.0001	3.84
DGEN and CPI	$r=0$	3.57	15.49	3.08	14.26
	$r \leq 1$	0.48	3.84	0.48	3.84
DGEN and Exrate	$r=0$	5.53	15.49	4.64	14.26
	$r \leq 1$	0.89	3.84	0.89	3.84
DGEN and Intrate	$r=0$	11.80	15.49	8.98	14.26
	$r \leq 1$	2.81	3.84	2.81	3.84
DGEN and IP	$r=0$	11.82	15.49	8.37	14.26
	$r \leq 1$	3.44	3.84	3.44	3.84
Panel B: Result of Multivariate Johansen Test (Without Trend)					
DGEN and M2, CPI, Exrate, Intrate, IP	$r=0$	102.52*	95.75	48.52*	40.07
	$r \leq 1$	53.94	69.81	24.79	33.87
	$r \leq 2$	29.20	47.85	17.34	27.58
	$r \leq 3$	11.85	29.79	5.93	21.13
	$r \leq 4$	5.91	15.49	4.70	14.26
	$r \leq 5$	1.21	3.84	1.21	3.84

Notes: The 5% critical values provided by MacKinnon et al. (1999) indicate no co-integration. Note: * Indicate significant at 05% level.

We have seen that both the trace and maximum eigenvalue of multivariate co-integration test recommend the presence of the long-term relationship exists in the system. Hence, estimating them in a Vector Error Correction Model (VEC) is required. The results obtained from ECM specification represented by model (9) are shown in table-6 with common diagnostic tests. The adjusted R^2 is very low, when stock index acts as a dependent variable, other fairly high compare to stock market index equation. The lagged error correction terms for the equations are statistically not significant at standard 05 per cent level except IP, CPI and M2 but the coefficient is very low that is 0.027, 0.0036 and 0.0031 respectively. This implies that if the system is exposed to a shock, it will be converged to the long run equilibrium at 2.7, 0.36 and 0.31 per cent per month by IP, CPI and M2

respectively, that is total only 3.37 per cent. So the adjustment power is very low in the system. This is the indication of weak long run relationship between Bangladesh stock market indices and the chosen macroeconomic variables. This implies that Bangladesh stock market and the chosen macroeconomic variables do not have strong co-integrating relationship in the long run. The result (Table-6) also shows that none of the variable shows a significant relationship with Bangladesh stock market in the short-run. It is noted that, industrial production have shown an upward trend in the recent past (BBS, 2012), therefore it is expected that industrial production should positively related to stock market. But, the study reveals that these variables have insignificant relationship with stock market returns.

Table: 6 Vector Error Correction Estimations

The normalized co-integrating coefficients for Stock market index are

Genindex	IP	CPI	Exrate	Intrate	M2	Constant
1	17.08 [5.39]	-38.66[-0.17]	5.27[1.16]	0.89[3.36]	3.52[0.86]	11.36
LHS Variables Regressors	D(GENINDEX)	D(IP)	D(CPI)	D(EXRATE)	D(INTRATE)	D(M2)
FCT	0.012580 [-1.24174]	0.027450 [-4.49809]	0.003659 [4.06142]	0.001681 [-1.45951]	0.045438 [-1.24932]	0.003159 [-2.69674]
D(GENINDEX(1))	0.055882 [-0.46233]	0.042067 [0.57778]	0.014711 [1.36879]	0.015138 [-1.10188]	0.439742 [-1.01343]	0.002422 [-0.17335]
D(IP(1))	0.315167 [1.49118]	0.000485 [0.00381]	0.025818 [-1.37790]	0.014065 [-0.58508]	0.480474 [0.63282]	0.055566 [2.77258]
D(CPI(1))	0.163341 [0.14427]	1.615832 [-2.36927]	0.435479 [4.32576]	0.167298 [-1.26113]	0.489796 [0.12050]	0.014509 [-0.11085]
D(EXRATE(1))	1.975874 [1.91367]	1.435009 [2.30732]	0.079858 [0.86986]	0.162122 [1.38141]	7.909809 [2.13397]	0.184583 [1.54636]
D(INTRATE(1))	0.035808 [-1.09467]	0.029644 [1.561448]	0.001587 [0.54548]	0.008601 [2.31339]	0.049349 [0.42024]	0.001536 [0.40608]
D(M2(1))	0.056918 [0.05333]	1.348287 [2.09744]	0.114155 [1.20304]	0.182834 [1.50727]	0.636405 [0.18178]	0.456444 [3.69962]
C	0.018357 [0.93655]	0.031855 [2.69809]	0.002235 [1.28258]	0.000221 [0.09924]	0.023963 [0.34056]	0.021601 [9.53266]
Adj. R squared	0.016117	0.347899	0.315061	0.076515	0.021609	0.179753

Note: All values in the parentheses against each coefficient are t-statistic. "D" stands for first order difference operator. FCT stands for error correction term.

To investigate the possible endogenous relationship between Stock returns and chosen macroeconomic variables, this study perform the Granger causality test to examine whether macroeconomic development is encouraging the stock market performances. The Granger-causality test was applied to first differences of the DSE general index pairwise with each of the five macroeconomic variables and the results are shown in Table-7. Since this test is highly sensitive to the lag orders of the right-hand-side variables, the Schwarz Information Criteria (AIC) was used to determine the optimal lag length. The results suggest that, there is no bidirectional Granger causality existing between stock returns and the chosen macroeconomic determinants. Again, there is no causality in either direction found between the stock price and the macroeconomic variables. The Bangladesh stock market price does not appear to be 'caused' by the macroeconomic variables, nor does it have a significant influence on them.

Table-7: Pairwise Granger Causality Test for Stock Market Returns and Macroeconomic Variables

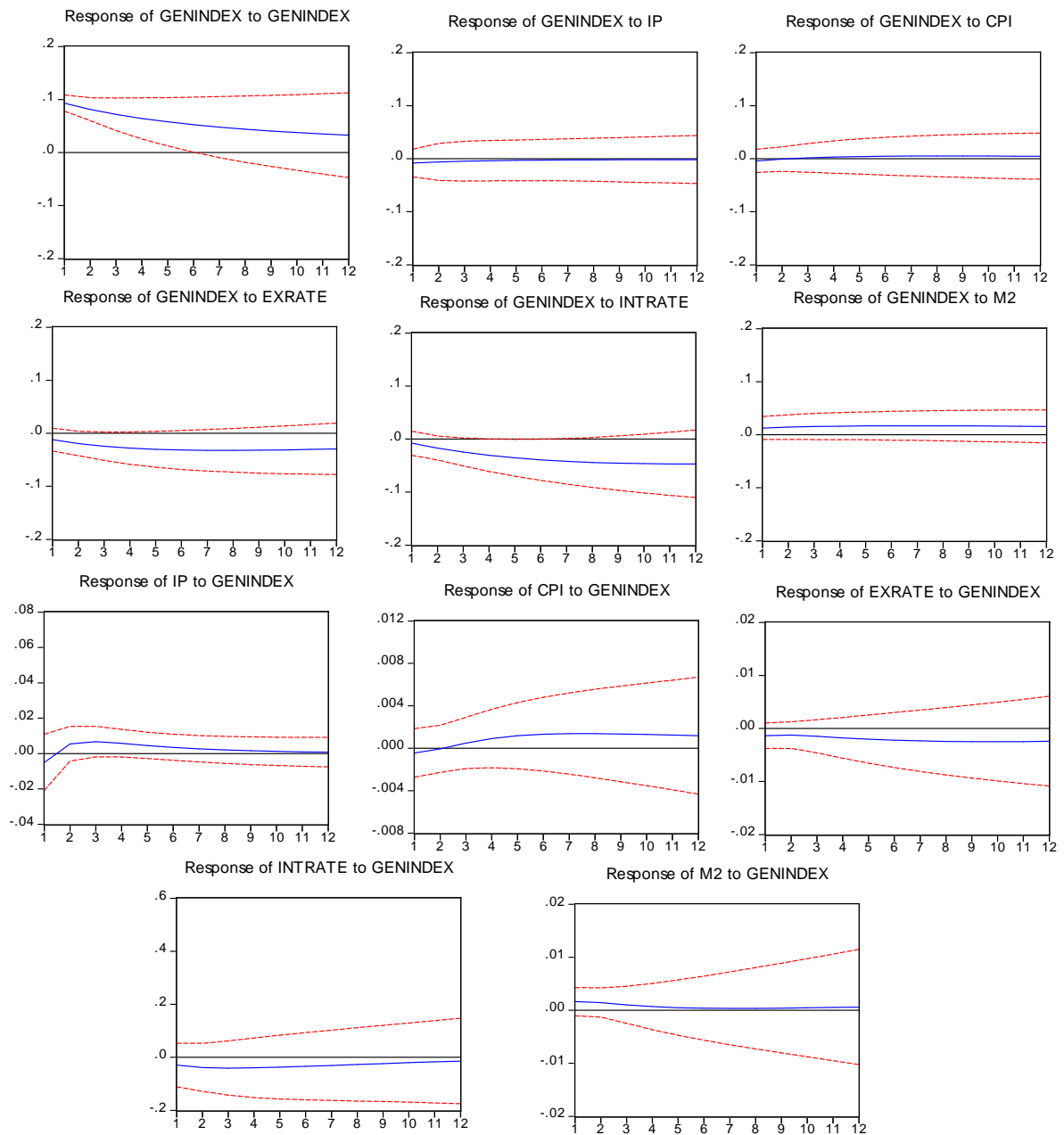
Null Hypothesis:	F-Statistic	Prob.
------------------	-------------	-------

IP does not Granger Cause GENINDEX	0.66970	0.4159
GENINDEX does not Granger Cause IP	0.01780	0.8942
CPI does not Granger Cause GENINDEX	0.01319	0.9089
GENINDEX does not Granger Cause CPI	1.85623	0.1774
EXRATE does not Granger Cause GENINDEX	3.30268	0.0734
GENINDEX does not Granger Cause EXRATE	0.32734	0.5690
INTRATE does not Granger Cause GENINDEX	2.21180	0.1414
GENINDEX does not Granger Cause INTRATE	2.04881	0.1567
M2 does not Granger Cause GENINDEX	0.23967	0.6260
GENINDEX does not Granger Cause M2	0.00079	0.9776

Impulse Response Function (IRF)

The pattern of the impulse response of Bangladesh stock market to a shock in the chosen macroeconomic variables is examined, in order to obtain additional insight into the structure of the stock market linkages. Figure-3 simulated for IRF, lateral axis denotes time horizon and longitudinal axis denotes response degree for innovation shock. Solid line (blue) denotes value of simulation, dashed line (red) denotes confidence interval of two times standard deviation. In figure-3 (First sample) it is possible to observe that the response of DGEN to its own shocks is always positive. The response of stock market index to M2 is positive but insignificant and vice versa. The response of stock market index to exchange rate and interest rate is negative but insignificant. The response of IP and CPI is first two months is negative then it's positive but insignificant. The response exchange rate and interest rate to of stock market index is negative, but again it insignificant. These results again indicate that stock prices and macroeconomic variables in Bangladesh do not have causal link. Only the responses of stock market index to stock index have significant positive impact up to six months.

Figure-3: Impulse Response Function for Bangladesh stock market (Response to one S.D. Innovations)



Variance Decomposition Analysis

After discussing the findings for the impulse response functions in the previous sub-sections, we now turn to the results for the variance decomposition. The variance decomposition analysis was employed to supplement the Granger causality results to reinvestigate the out of sample impact. The result indicates how much of the DGEN own shock is explained by movements in its own variance and the chosen macroeconomic variables over the 12 months forecast horizon. According to the results, shown in figure 4, the amount of variance of the DGEN explained by own goes down when the time horizon increased up to 12 months. At horizon two, 96 per cent of DGEN variance is explained by own. At horizon 12, 87 per cent of DGEN variance is explained by itself. This indicates that at longer horizons, the variance of DGEN may be caused by variance of other macroeconomic factors. At horizon 6, the exchange rates explain 7 per cent of the variances of the DGEN. When the time

horizon goes up, the actual amount of variance of the DGEN explained by the exchange rates also goes up. This discloses that at longer horizons, the variance of DGEN may be caused by variance of other macroeconomic factors as the chosen macroeconomic variables especially do not have significant explanatory power.

Figure: Variance Decomposition



Therefore, it is established that there is no short run relationship exists between Bangladesh stock market and the chosen macroeconomic variables. However, there is very weak long run relationship exists. It is also established that, there is no causal relationship exists between Bangladesh stock market and the chosen macroeconomic variables in the short run. These results indicate that stock prices in Bangladesh cannot be predicted using macroeconomic variables.

VI. Conclusion and Policy Implications

The paper has made an attempt towards examination of the impact of macro-economic variables on Bangladesh stock market applying different time series techniques of Engle-Granger co-integration, Johansen co-integration, Granger- Causality, Error Correction Model(ECM), Impulse Response Function (IRF) and Variance Decomposition (VDC), in a system incorporating the macroeconomic variables such as Consumer Price Index (CPI), Exchange rate of BDT against USD (Exrate), Broad money supply(M2), Industrial Production (IP) and Interest rate (Intrate) have been taken as explanatory variables and to represent stock index (DGEN) of Bangladesh stock market is dependent variable between the period from July 2006 to October 2012.

By applying ADF and PP test, we find all the six variables are non-stationary in the level and the first differences are stationary. By employing Engle-Granger co-integration test we do not find evidence of co-integration that established nonexistence of long-run relationship between Bangladesh stock price and the chosen macroeconomic variables. We also employed the most sophisticated Johansen co-integration test for robustness of Granger co-integration test results. The bivariate Johansen co-integration test produces same result like Engle-Granger tests. While, Johansen multivariate co-integration tests indicate that the Bangladesh stock market index and chosen five macroeconomic variables are co-integrated, this is indicative of a long-run relationship. Although there is a long term relationship among stock prices and the chosen variables, it is only IP, CPI and M2 that adjust any disequilibrium once the system is shocked. But, of course, the total adjustment power is very low in the system. Therefore, error correction term does not support the long run relationship strongly. The results from the ECM also indicate that none of the variable shows a significant relationship with Bangladesh stock market in the short-run. It is noted that, industrial production has shown an upward trend in the recent past in Bangladesh (BBS, 2012). Therefore, it is expected that industrial production supposed to be positively related to stock market. But, the study reveals that these variables have insignificant relationship with stock market returns. This implies that there are many other macroeconomic factors which affect the fluctuation in Bangladesh stock market returns. These results indicate that stock prices in Bangladesh cannot be predicted using only macroeconomic variables. The Granger Causality test implies that Bangladesh stock market price does not appear to be 'caused' by the macroeconomic variables, nor does it have a significant influence on them except uni-directional causality runs from exchange rate to stock returns.

The author finds no study that particularly examined the relationship between stock price of Bangladesh and the macroeconomic determinants by employing Impulse Response Function (IRF) and Variance Decomposition (VDC). The impulse response analysis shows that, shock to macroeconomic variables does not generate a significant response to Bangladesh stock markets. The VDC analyses revealed that a major proportion of the variability in the stock market index was explained by its own innovations while only a minority (insignificant) was explained by macroeconomic variables.

Overall, it is established that there is no short run relationship exists between Bangladesh stock market and the chosen macroeconomic variables. However, there is very weak long run relationship exists. It is also established that, there is no causal relationship exists between Bangladesh stock market and the chosen macroeconomic variables in the short run. These results indicate that stock prices in Bangladesh cannot be predicted using macroeconomic variables. The findings of no short-run dynamic and the mixed long run relationship in this study help astute investors and policy makers in efficient and appropriate decision making regarding Bangladesh stock markets.

The findings of no causality and feedback relationships verify that Bangladesh stock markets do not follow the fundamental and theoretical linkages between stock prices and macroeconomic variables. Actually, Bangladesh market is not properly explained by the economic fundamentals. There are some reasons behind that. In Bangladesh, a big amount of investments are trend-driven and rumour-driven as well (Haque, R. 2011). Weak form of institutional infrastructure, lack of accountability and transparency, questionable transparency of market transactions and weak form of corporate governance are the common phenomena of Bangladesh stock market (Khoda and Uddin, 2009). Apart from the above, Dhaka stock market is familiar with irrational gains and losses. This market lost 25 per cent price just within a couple of months in early 2011, while prices advanced over 82 per cent in late 2010 (Ahmed, 2011). The steep rise and fall in indices cannot follow the macroeconomic determinants. This scenario in Bangladesh stock market happens frequently that increased the vulnerability and led the markets far away from economic fundamentals. So, for the betterment of Bangladesh stock markets, the above mentioned hindrances should be minimised.

REFERENCES

- Ahmed, G.T. (2011). Dhaka Bourse now Asia's Worst. *The Daily Star Newspaper*, Available at <http://www.thedailystar.net/newDesign/news-details.php?nid=202297> , Accessed on October 31, 2012
- Ali, M.B. (2011). T-Y Granger Causality between Stock Prices and Macroeconomic Variables: Evidence from Dhaka Stock Exchange (DSE). *European Journal of Business and Management*, 3(8), 37-52.
- Afzal, N. and Hossain, S.S. (2011). An empirical Analysis of the Relationship between Macroeconomic Variables and Stock Prices in Bangladesh. *Bangladesh Development Studies*, XXXIV(4), 95-105.
- Agarwal, S. (2001). Stock Market Growth and Economic Growth: Preliminary Evidence from African Countries. *Journal of Sustainable Development in Africa*. 3(1), 48-56.
- Arayssi, M.; Elfakhani,S. and Smahta, H.A. (2008). Globalization and Investment Opportunities: A Co-integration Study of Arab, US and Emerging Stock Markets. *The Financial Review*, 43, 591—611.
- BBS (2012), Bangladesh Bureau of statistics, Available at www.bbs.gov.bd/ , Accessed on September 12, 2012.
- BB (2012), Bangladesh Bank (Central Bank of Bangladesh), Available at www.bangladesh-bank.org/, Accessed on September 10, 2012.
- Bodie, Z., (1976). Common stocks as a hedge against inflation. *Journal of Finance*, 31, 459-470.
- Dhaka Stock Exchange (DSE-2012). Bangladesh, Available at <http://www.dsebd.org/>, Accessed on October 31, 2012.
- Dickey, D., Fuller, W.A. (1979). Distribution of the Estimates for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*. 74, 427-431.
- Dickey, D., Fuller, W.A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49, 1057-1072.
- Engle, R.F. and Granger, C.W.J. (1987). Co-integration and Error Correction Representation, Estimation and Testing. *Econometrica*, 55 (1,) 251-76.
- Fama, E.F., (1981). Stock Returns, Real Activity, Inflation and Money. *American Economic Review*, 71, 545-565.
- Flannery, W.J. and Protopapadakis, A.A. (2002). Macroeconomic factors do influence aggregate stock returns. *Review of Financial Studies*, 15, 751-82.
- Fama, E.F. and Schwert, W., (1977). Asset returns and inflation. *Journal of Financial Economics*, 5, 115-46.
- Granger, C.W.J., (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37, 424-38.
- Gujarati, D. and Porter, D. (2009). Basic Econometrics. 5th revised edition, London, McGraw Hill higher education.
- Gunasekarage, G., Pisedtasalasai, A. and Power, D.M. (2004). Macroeconomic influence on the stock market: evidence from an emerging market in South Asia. *Journal of Emerging Market Finance*, 3(3), 285-304.
- Hussainey, K. and Ngoc, L. K. (2009). The Impact of Macroeconomic Indicators on Vietnamese Stock Prices. *The Journal of Risk Finance*, 10(4), 321-332.
- Ibrahim, M. H., and Aziz, H. (2003). Macroeconomic Variables and the Malaysian Equity Market: A View through Rolling Subsamples. *Journal of Economic Studies*, 30, 6-27.
- Iqbal, A., Khalid, N. and Rafiq, S. (2011). Dynamic Interrelationship among the Stock Markets of India, Pakistan and United States. *World Academy of Science, Engineering and Technology*, 73, 98-104.
- Jaffe, J.F. and Mandelker, G., (1977). The 'Fisher Effect' for risky assets: An empirical investigation. *Journal of Finance*, 32, 447-58.
- Khoda, N.A.K.M. and Uddin, M.G.S (2009). Testing Random Walk Hypothesis for Dhaka Stock Exchange: An Empirical Examination. *International Research Journal of Finance and Economics*, 33, 64-76.
- Lintner, J., (1973). Inflation and common stock prices in a cyclical context. National Bureau of Economic Research Annual Report, USA.
- Lutkepohl, H. (1982). Non-causality due to Omitted Variables. *Journal of Econometrics*, 19, 367–378.
- Masduzzaman, M; (2012). Impact of the Macroeconomic Variables on the Stock Market Returns: The case of United Kingdom and Germany. *Global Journal of Business and Management Research*, 12(16), 23-34.
- Mittal, R. and Pal, K. (2011). Impact of Macroeconomic Indicators on Indian Capital Markets. *The Journal of Risk Finance*, 12(2) 84-97
- Mukherjee, T.K. and Naka, A. (1995). Dynamic relations between Macroeconomic Variables and the Japanese Stock Market: An application of a Vector Error Correction Model. *The Journal of Financial Research*, 2, 223-237.

- Naik, P.K., & Padhi, P. (2012). The Impact of Macroeconomic Fundamentals on Stock Prices Revisited: Evidence from Indian Data. *Eurasian Journal of Business and Economics*, 5 (10), 25-44.
- Nasseh, A. and Strauss, J., (2000). Stock Prices and Domestic and International Macroeconomic Activity: A Co-integration Approach. *The Quarterly Review of Economics and Finance*, 40(2), 229-245.
- Nelson, C. R. (1976). Inflation and rates of return on Common Stocks. *Journal of Finance*, 31(2), 471-483.
- Pesaran, M., Shin, Y., (1998). Generalised impulse response analysis in linear multivariate models. *Economics Letters*, 58, 17-29.
- Phillips, P.C., Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika*, 75(2), 335-346.
- Rahman, L. and Uddin, J. (2009). Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Three South Asian Countries. *International Business Research*, 2(2),167-174.
- Smith, K. and Sims, A. (1993). Stock market performance and macroeconomic variables. *Applied Financial Economics*, 3, 55-60.
- Solnik, B. (1983). The relation between stock prices and inflationary expectations: the international evidence. *Journal of Finance*, 39(1), 35-48.