Dynamic Linkages between Macroeconomic Variables and Stock Prices in Bangladesh: An Empirical Analysis

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Abstract

This paper examines the dynamic causal relationship between capital stock prices and macroeconomic activities in Bangladesh. Though the empirical literature on this issue is voluminous, however for Bangladesh it is quite nascent. Only a handful of studies for Bangladesh [Chowdhury (1995), Mohiuddin et.al. (2006), Rahman and Uddin (2009), Ali (2011), Afzal and Hossain (2011)] has been conducted of which most of them suffer either from omitted variable bias or from the methodological deficiencies. This study is an improvement of the early studies in terms of data used and from methodological point of view. The major objective of this paper is to examine the short run dynamics of the long run relationship between the macrovariables such as the gross domestic product (GDP), money supply (M2), consumer price index (CPI), exchange rate (EXR), interest rate (IR), private sector credit (PSC) on the variability of the stock price (SPI) in Bangladesh. That is to see whether they are cointegrated or not. It also sheds lights on the causal relationship among the considered variables using annual time series data for the period 1985 to 2010. The empirical results show that all the time series data are nonstationary and cointegrated with a single vector. All the explanatory variables have been found to contribute to the long-run equilibrium relationship. The estimation of the error-correction model further confirms the existence of long run stable equilibrium among the variables in the model. It is confirmed that any disequilibrium is corrected by fast adjustment. The Granger causality test also indicates that the lagged change in GDP, M2 and PSC has significant predictive ability for the movements in the stock prices. However, the bidirectional causality has not been established. The implication of the result is that monetary policy has strong stimulus in stabilizing and smooth functioning of the stock market in Bangladesh.

Keywords: Stock Market, Macroeconomic Activities, Cointegration, Granger Causality, Error Correction Models.

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1.0 Introduction

The central objective of macroeconomics is to achieve higher level of output. The role of savings and so the accumulation of capital to this end has gained attention in the literature over a long period of time, dating back to the Adam Smith's the Wealth of Nations. Over the course of time different school of thought and economists like Frank Ramsey (1928), Allyn Young (1928), Frank Knight (1944), Joseph Schumpeter (1934) and Harrod (1939) & Domar (1946) analyzed growth process of the capitalist economies in various lines, identifying different determinants of economic growth. The general consensus is that accumulation of capital plays critical role in the economic growth process. The role of private sector in such accumulation is very important in developing countries like Bangladesh. The stock market plays a sine qua non in mopping up the necessary idle money of the savers to bring it to the directly productive activities. Stock exchanges enable firms to acquire capital quickly, due to the ease with which securities are traded. Stock exchange activity, thus, plays an important role in helping to determine the effects of macroeconomic activities. Therefore, the establishment of the lead to lag relationship between macro variables and stock prices is highly important. The significant lagged effects of macroeconomic variables on stock prices indicate informational inefficiency of the stock market, which led to earn supernormal capital gain by an individual through the exploitation of previous information on various macroeconomic fundamentals. Such situations disfigure the market capacity to efficiently allocate scarce resources. However, studies show a reverse effect from stock market movement to anticipate future economic conditions. Therefore examining the dynamic linkages between the stock prices and macroeconomic variables is crucial in formulating stabilization policies (Ibrahim, 1999).

Bangladesh is a small economy, where there is an acute shortage of capital to the government as well as the private sector needed for the industrial development. However, there is a huge amount of unorganized capital / savings in the hands of private individuals which needs channeling to the directly productive activities. Though in the emerging stage, the stock market in Bangladesh can play decisive role in bringing the idle money to make a strong industrial base of the economy. The examination of the causal relationship between the stock prices and the macroeconomic variables is thus imperative. The major objective of the paper is to shed light on the nature of causal relationship that exists between the stock market and macroeconomic variables, i.e. is it unilateral or bilateral.

The paper will be articulated as follows. After introducing the issues in section 1, section 2 briefly survey the existing literature on this issue. Section 3 presents the methodology of the study. Section 4 points out the data and the analytical framework for testing stationarity, cointegration, error correction models and causality among the variables of the study. Section 5 analyzes the results found following the analytical framework. Finally, section 6 summarizes the paper with concluding remarks.

2.0 Survey of the Literature

The causal nexus between macroeconomic variables and stock prices becomes an active area of research in the developed countries. Very early studies by Palmer (1970) and Sprinkel (1971) have indicated that money supply leads to stock prices, which was further supported by the latter studies by Malliaris and Urrutia (1991) for the United Sates. Thorton (1993) found that stock returns lead to real income. Chang and Pinegar (1989) and Chen et.al. (1986) concluded that there is a close relationship between stock market and the domestic economic activity. Using Indian data Panda and Kamaiah (2001) found that expected inflation and real activity do affect stock returns.

A handful of important studies for developing economies include Mookerjee and Yu (1997) and Maysami and Koh (2000) for Singapore, Kwon et al. (1997) and Kwon and Shin (1999) for South Korea, and Habibullah and Baharumshah (1996) and Ibrahim (1999) for Malaysia. Using bi-variate co-integration and causality tests, Mookerjee and Yu (1997) note significant interactions between M2 money supply and foreign exchange reserves and stock prices for the case of Singapore. However, Maysami and Koh (2000) document significant contribution of interest rate and exchange rate in the long-run relationship between Singapore's stock prices and various macroeconomic variables. Evaluating the Korean equity market, Kwon et al. (1997) provide evidence for the exchange rate, dividend yield, oil price and money supply as being significant macroeconomic factors.

Stabilizing the price level that is containing moderate inflation is also one of the key macroeconomic goals. A few earlier studies address the linkage among the stock market and inflation. Famma (1990) suggests that macroeconomic variables have predictive power for the stock exchange performance, although they do not consent to the anticipating authority of stock performance for the economy.

Aggarwal (1981), Soenen and Hennigar (1988) examined the relationship between exchange rates and stock prices. Literature showed that any change in the exchange rates would affect corporate foreign business and profitability. This will, as a result, affect firm's equity prices. The type of change in equity prices would base on the global distinctiveness of the firm. Aggarwal (1981) noted strong positive relationship between the US dollar and US equity prices, while Soenen and Hennigan (1988) found a considerable negative relationship. Index of industrial production indicates a measure of total economic activity in the economy and influences equity prices by effecting on future earnings (Famma, 1990).

Mukherjee and Naka (1995) explored the relationship between industrial production and stock prices in Japan and found positive relationship between industrial production and stock exchange prices. Bhattacharya and Mukherjee (2002) examined the causal relationship between stock prices and macro-economic factors in India. This study applied methodology of Toda and Yamamoto for the period of 1992-1993 to 2000-2001, and found that change in industrial production affects the stock prices. Nishat and Shaheen (2004) found industrial production having largest positive relationship with stock prices in Pakistan.

Chakravarty (2005) has also examined positive relationship between industrial production and stock prices using Granger causality test and observed unidirectionality from industrial production to stock prices in India. Balance of trade has also been taken by many researchers to analyze its effects on stock exchange prices; however it is observed that it has no significant

effects on stock exchange prices, for instance Bhattacharya (2002) found negative relationship between trade balance and stock exchange prices in India.

Most of the empirical literature on stock prices and macroeconomic variables has used the modern time series techniques of cointegration and error correction modeling. For instance, Maysami and Sims (2002, 2001a, 2001b) employed the Error-Correction Modelling technique to examine the relationship between macroeconomic variables and stock returns in Hong Kong and Singapore (Maysami and Sim, 2002b), Malaysia and Thailand (Maysami and Sim 2001a), and Japan and Korea (Maysami and Sim 2001b). Using Hendry's (1986) approach which allows making inferences to the short-run relationship between macroeconomic variables as well as the long-run adjustment to equilibrium, they analyzed the influence of interest rate, inflation, money supply, exchange rate and real economic activity, along with a dummy variable to capture the impact of the 1997 Asian ?nancial crisis. The result confirmed the influence of macroeconomic variables on the stock market indices in each of the six countries under study, though the type and magnitude of the associations differed depending on the country's ?nancial structure. Islam (2003) replicated the above studies to examine the short-run dynamic adjustment and the long-run equilibrium relationships between four macroeconomic variables (interest rate, in?ation rate, exchange rate, and the industrial productivity) and the Kualalumpur Stock Exchange (KLSE) Composite Index and reached the same conclusion.

Ibrahim (1999) also investigated the dynamic interactions between the KLSE Composite Index, and seven macroeconomic variables (industrial production index, money supply M1 and M2, consumer price index, foreign Relationship between macroeconomic Variables and Stock Market Indices reserves, credit aggregates and exchange rate). Observing that macroeconomic variables led the Malaysian stock indices, he concluded that Malaysian stock market was informationally inefficient.

Chong and Goh (2003) examine the dynamic linkages among stock prices, economic activities, real interest rates and real money balances in Malaysia and found that the considered variables are linked in the long run both in the pre- and post capital control sub periods. Mukherjee and Naka (1995) applied Johansen's (1998) VECM to analyze the relationship between the Japanese Stock Market and exchange rate, in?ation, money supply, real economic activity, long-term government bond rate, and call money rate. They concluded that a cointegrating relation indeed existed and that stock prices contributed to this relation. Maysami and Koh (2000) examined such relationships in Singapore. They found that in?ation, money supply growth, changes in short- and long-term interest rate and variations in exchange rate formed a cointegrating relation with changes in Singapore's stock market levels.

Islam and Watanapalachaikul (2003) showed a strong, significant long-run relationship between stock prices and macroeconomic factors (interest rate, bonds price, foreign exchange rate, price-earnings ratio, market capitalization, and consumer price index) during 1992-2001 in Thailand. Hassan (2003) employed Johansen's (1988, 1991, 1992b) and Johansen and Juselius' (1990) multivariate cointegration techniques to test for the existence of long-term relationships between share prices in the Persian Gulf region. Using a vector-error-correction model, he also investigated the short-term dynamics of prices by testing for the existence and direction of intertemporal Granger-causality.

Vuyyuri (2005) investigated the cointegrating relationship and the causality between the financial and the real sectors of the Indian economy using monthly observations from 1992 through December 2002. The financial variables used were interest rates, inflation rate, exchange rate, stock return, and real sector was proxied by industrial productivity. Johansen (1988) multivariate cointegration test supported the long-run equilibrium relationship between the financial sector and the real sector, and the Granger test showed unidirectional Granger causality between the financial sector and real sector of the economy. Maghyereh (2002) investigated the long-run relationship between the Jordanian stock prices and selected macroeconomic variables, again by using Johansen's (1988) cointegration analysis and monthly time series data for the period from January 1987 to December 2000. The study showed that macroeconomic variables were related in stock prices in the Jordanian capital market.

Gunasekarage, Pisedtasalasai and Power (2004) examined the influence of macroeconomic variables on stock market equity values in Sri Lanka, using the Colombo All Share price index to represent the stock market and (1) the money supply, (2) the treasury bill rate (as a measure of interest rates), (3) the consumer price index (as a measure of in?ation), and (4) the exchange rate as macroeconomic variables. With monthly data for the 17-year period from January 1985 to December 2001 and employing the usual battery of tests, which included unit roots, cointegration, and VECM, they examined both long-run and short-run relationships between the stock market index and the economic variables. The VECM analysis provided support for the argument that the lagged values of macroeconomic variables such as the consumer price index, the money supply and the Treasury bill rate have a signi?cant in?uence on the stock market.

Though the relationship between stock prices and macroeconomic variables are well documented in the developing and developed countries, for emerging markets such as Bangladesh it is quite nascent. A study by Mohiuddin et. al. (2006) suffers from methodological deficiency. It examines the linkages between macrovariables and stock prices in the multivariate framework without addressing the time series issues. Rahman and Uddin (2009) examined the dynamic relationship between exchange rates and stock price index in three South Asian markets namely, Dhaka Stock Exchange index, Bombay stock exchange index and Karachi stock exchange index. The study found that there is no cointegrating relationship between stock prices and exchange rates. Ali (2011a) long-run equilibrium relationship as well as causal relationships between the DSE all share price index (DSI) and the four microeconomic variables (i.e. market dividend yield, market price-earnings multiples, monthly average market capitalization and monthly average trading volume) using monthly data from the period January 2000 to December 2010. Significant findings include long-run equilibrium relationship among the variables under study. However, the study did not consider the short run dynamics among the variables and so did not apply error correction model. A very recent study by Afzal and Hossain (2011) examined the relationship between macroeconomic variables and stock prices in Bangladesh under bivariate and multivariate causality framework. The study found a long run causal relationship among the considered variables. However, the study suffers from omitted variable bias. It omitted two key macroeconomic variables of gross domestic product (GDP) and private sector credit, which

are strongly correlated to the stock prices. The present study tried to overcome all the shortcomings of the earlier studies on Bangladesh and is an improvement in terms of data used and the methodology applied.

3.0 Methodology

With a view to accomplish the stipulated objectives of the study various tools of the time series econometrics have been applied. To examine the dynamic linkages among the variables in the model the paper has taken into account of various modeling issues that arise in causality framework. The usual first step in any standard time series analysis is to conduct the unit root test to examine the stochastic properties of the data. The study examines the stationary properties of the data on the variables by applying the Augmented Dicky Fuller (ADF) test. Though some of the studies also used the Phillips-Parron test, the present study relied on the ADF test only since our data point is small and over the considered time frame the Bangladesh has not experienced any significant structural changes. Once it is found that the considered time series are integrated of order one i.e. I(1) then it is necessary to check whether there exist any long run relationship among them. Johansen and Juselius test has been applied to examine the cointegration i.e. the long run relationships among the variables. Some of the earlier studies (Afzal and Hossain, 2011) for Bangladesh used the Engel and Granger two step procedure to examine the cointegration among the variables. However, due to the robustness of such study in case of small data points the present study relied on the Johansen and Juselius cointegration test. Then the Error Correction models and Granger causality test has been applied to test the short run dynamics of long run relationships between macro variables and stock prices. The findings of the above tests help to examine the nature and direction of long run equilibrium relation and the extent of causality among the stock prices and the macroeconomic variables in Bangladesh.

4.0 The Analytical Framework

4.1 Data

This study is based on the annual data[2] for the period 1985 to 2010 taken from the Economic Trends published by the Bangladesh Bank, and various reports published by Security and Exchange Commission. To measure the stock price; the study uses the annual average values of the stock price index (SPI) of Dhaka Stock Exchange. Broad money (M2) is considered as monetary stock. Though some early studies (Afzal and Hossain, 2011) uses both narrow money (M1) and broad money (M2) we relied on the study of Ibrahim (1999), which shows that M2 is a preferable intermediate target to stabilize the economy and M2 is found to be cointegrated with other macrovariables and is thus superior as a long run policy variable. Friedman and Schwartz (1963) explained the relationship between money supply and stock returns by simply hypothesizing that the growth rate of money supply would affect the aggregate economy and hence the expected stock returns. Nominal GDP is used as a measure of aggregate economic activity. The results of studies by Fama and Schwert (1977), Chen, Roll and Ross (1986), Nelson (1976) and Jaffe and Mandelker (1976) pointed to a negative relation between consumer price index and stock prices. Therefore, the study

[2] Some of the early studies for Bangladesh for instance Afzal and Hossain (2011) used quarterly data. However, for Bangaldesh quarterly data is not available for all the variables. The early studies did not provide explanation how the quarterly data has been generated. Therefore, the preset study relied on annual data.

uses the consumer price index (CPI) as a measure of the aggregate price level, (Base: 1995-96 =100). Data on CPI have been obtained from various issues of Statistical Yearbook of Bangladesh. The domestic credit aggregates are claims on the private sector (PSC). The weighted average of annual interest rate on lending by banks has been considered as the interest rate (IR). Lastly, the study employs the annual average of Tk/$US exchange rate as a measure of the foreign exchange rate (EXC). Econometric estimations have been done by using econometric software package Eviews 7.0.

4.2 Granger Causality Test

To test the causal relationship between stock prices and macroeconomic variables the study relied on the Granger Causality test, due to its wide applicability to examine the direction of causality among variables. Although regression analysis deals with the dependence of one variable on other variables, it does not necessarily imply causation. Alternatively, the existence of a relationship between variables does not prove causality or the direction of influence. But in regression involving time series data we need to examine the direction of causality. Otherwise the simple regression results become spurious. The direction of causality can be explained by the Granger Causality test. The basic idea of the Granger Causality is that a variable X causes another variable if Y can be explained better by the present and lagged values of X than by the past values of Y alone assuming that both X and Y are stationary variables. This test assumes that the information relevant to the prediction of the respective variables is contained solely in the time series data on these variables (Gujrati, 2003). For illustrative purpose using a two variable system, the test is based on the following regression:

$$Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i Y_{t-i} + \sum_{j=1}^{n} \alpha_j X_{t-j} + u_t \qquad (1)$$

$$X_t = \gamma_0 + \sum_{i=1}^{m} \gamma_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + v_t \qquad (2)$$

where u and v are mutually uncorrelated white noise series and t denotes time period. Causality may be determined by estimating equations (1) and (2) and testing the null hypothesis that $\alpha_j = \delta_j = 0$ for all j's against the alternative hypothesis that $\alpha_j \neq 0$ and $\delta_j \neq 0$ for at least some j's. If the coefficients α_j's are statistically significant but δ_j's are not, then Y is said to have been caused by X. The reverse causality holds if δ_j's are statistically significant while α_j's are not. If both α_j and β_j are significant, then causality runs both way. In addition, the framework can be generalized to include more variables in the system. In this study we have extended the Granger Causality test for the six considered variables.

The implementation of Granger causality test needs to estimate the unrestricted and restricted version of equations. To test whether X causes Y the unrestricted regression involves the estimation of equation (1) using OLS. From this regression we obtain the unrestricted residual sum of squares (RSS_{ur}). Then, another version of (1) that restricts the coefficient of all lagged X's to zero is to be performed and obtained the restricted residual sum of squares (RSS_r). The causality test can be performed by the usual F test[3] .

The F test is based on the following statistic:

$F = [(RSS_r - RSS_{ur})/m] / [RSS_{ur} / (n - k)]$

Which follows F distribution with m and (n – k) df. Here m is equal to the number of lagged X terms included in the equation (1) and k is the number of parameters estimated in the unrestricted equation. X is said to Granger cause Y if the computed F statistics is significant at the conventional level. The same procedure can be applied to test causality from Y to X.

The Granger causality test assumes that the disturbance term of the regression is serially uncorrelated. However, the non-stationarity of the variables may destroy this assumption (Serietis, 1988), which makes the OLS estimation biased and inconsistent and thus decrease the credibility of the regression result. Intuitively, a time series is said to be stationary if its mean and variance do not systematically vary over time. In contrast, time series is non-stationary if its mean and variance is variable with time. Granger causality test may not be valid if non-stationarity in the data is not handled properly. The study thus examined whether the considered time series is stationary or not.

The number of lagged terms to be included in the causality test is an important practical question since the direction of causality may depend critically on the number of lagged term included. If we use too few lags we will omit potentially valuable information contained in the more distant lagged values, the causality result is thus distorted. On the other hand, if we use too may lags we will be estimating more coefficient than necessary, which in turn introduces additional estimation error into forecasts and may cause an absence of causality between them. The study used Schwartz information criteria to make such choice.

The stationarity properties of the series are not taken into consideration in the standard Granger causality test which may report one-way or two-way causality or no causality. However, if the variables are cointegrated, the modified Granger causality test rules out the possibility of no causality when the variables share a common trend. The estimation of the Granger causality test involves three steps. Step I includes the identification of the order of integration of the variables under consideration. If the variables under consideration are integrated of the same order they are considered to be cointegrated. However, statistically we have to test whether the variables are cointegrated or not. If the variables are cointegrated, the residuals obtained from the cointegrating regressions are used as error-correction terms in estimating the modified Granger causality equations. The process of cointegration and error correction has explained below.

4.3 Cointegration Test and Error Correction Models[4]

Most of the economic time series have the tendency to move together, which has statistical implication of the existence of a long-run relationship between economic variables (Thomas, 1993). Thus we need to test for the possible cointegration of the variables as a guide for model specification. Presence of cointegration between two variables led to the causality in the Granger sense as least in one direction (Miller, 1999). There are two channels of causality between cointegrated variables –the standard Granger test and the error correction specification[5].

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[4] This section draws partially on Hossain, M.A. (2009).

[5] If Yt and Xt are cointegrated, then Granger representation theorem (Engle and Granger, 1987) says that the relationship between the two variables can be expressed as the error correction mechanism as follows:

$$\Delta Y_t = \lambda_1 Z_{t-1} + \sum_{i=1}^{k} \delta_i \Delta X_{t-i} + \sum_{j=1}^{k} \pi_j \Delta Y_{t-j} + u_{1t} \quad \ldots\ldots(3)$$

$$\Delta X_t = \lambda_2 Z_{t-1} + \sum_{i=1}^{k} \tau_i \Delta X_{t-i} + \sum_{j=1}^{k} \zeta_j \Delta Y_{t-j} + u_{2t} \quad \ldots\ldots(4)$$

where, Zt = γt – YXt , and u1t and u2t are white noise error terms. In these two equations, the series Yt and Xt are cointegrated when at least one of the coefficients λ1 or λ2 is not zero. This error correction model allows us to study the short run dynamics of the long run relationship between Yt and Xt. If λ1≠ 0 and λ2 = 0, then Xt will lead Yt in the long run. The opposite will occur if λ2≠ 0 and λ1≠ 0. If both λ1≠ 0 and λ2≠ 0, then feedback relationship exists between Yt and Xt , which will adjust in the long run. In addition short run dynamics between Yt and Xt are characterized by the coefficients δi's ζ_j's. If δi's are not all zero, movements in the Xt will lead to Y_t in the short run. If ζ j's are not all zero, movement in the Yt will cause Xt in the short run. If γ can be obtained so that Zt can be constructed, the remaining paraments in equations (3) and (4) can easily be estimated.

5.0 Analysis of the Results

Testing for causality and cointegration and to estimate the error correction models among the considered variables, we need to proceed with the following three steps.

5.1 Testing for the Order of Integration

The first step consists of determining the order of integration of the variables under consideration. This is done by using the Augmented Dickey- Fuller (ADF) test (Dickey and Fuller, 1981). This test is based on the following regression equation with a constant and a trend of the form:

$$\Delta Y_t = a_1 + a_2 t + bY_{t-1} + \sum_{i=1}^{m} \rho_i \Delta Y_{t-i} + \upsilon_t \quad \text{.....(5)}$$

where, $\Delta Y_t = Y_t - Y_t\text{-}1$ and Y is the variable under consideration, m is the number of lags in the dependent variable, is chosen by Schwarz criterion and õt is the stochastic error term. The null hypothesis of a unit root implies that the coefficient of $Y_t\text{-}1$ is zero. If the null hypothesis is rejected, then the series is stationary and no differencing in the series is necessary to induce stationary. The ADF is widely used due to the stability of its critical values as well as its power over different sampling experiment. In this study the test is applied to both the original series (in logarithmic form) and to the first differences. Further, both the models with and without trend are tried. The lag parameters are determined by Schewarz's criterion. The results are reported in table -2.

Table 2: ADF Unit Root Tests

	Log Levels		First Difference	
Variables	No Trend	With Trend	No Trend	With Trend
SPI	-1.24	-2.75	-5.52*	-5.42*
GDP	-0.28	-2.04	-4.76*	-4.73*
M2	-2.03	-0.93	-2.64***	-3.25***
CPI	-1.14	-3.23	-4.58*	-4.32*
IR	-2.02	-3.24	-3.49**	-3.41***
EXR	-2.42	-3.22	-8.11*	-7.92*
PSC	-1.7	-1.74	-2.93***	-4.59***

Notes: i) * , ** and *** indicates significance at 1% , 5% and 10% respectively.
ii) Author's own formulation by using econometric software Eviews 7.0.

The results indicate that at the levels all the considered variables are nonstationary. Therefore to achieve stationarity the variables must be first-differenced. The ADF statistics are significant only for the first-differenced series. This shows that, all the series are integrated of the same order i.e., I(1). Since all of the series are integrated of the same order, the series may be tested for the existence of a long-run relationship between them. Thus, cointegration analysis can be applied to the selected variables in the present analysis as all the series are found to be stationary in first differences.

5.2 Testing for Cointegration (Multivariate Cointegration Test)

If the considered time series variables found to be integrated of order one i.e. I(1), it is possible that they have a tendency to move together in the long run. That is they are cointegrated and have a stable long run relationship. The usual second step thus involves searching for

cointegration between variables. This can be understood from the graphical representation of the two series and to see whether they have any common stochastic trend and can be tested either by Engle-Granger two step cointegration procedures or by Johansen-Juselius cointegration technique. We relied on Johansen-Juselius[6] cointegration technique because of limited data points.

The result is presented in table-3 and 4.

Table 3: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.979582	281.5163	125.6154	0.0000
At most 1 *	0.968797	188.1236	95.75366	0.0000
At most 2 *	0.878102	104.9096	69.81889	0.0000
At most 3 *	0.753221	54.39996	47.85613	0.0107
At most 4	0.443693	20.81765	29.79707	0.3691
At most 5	0.239075	6.743210	15.49471	0.6077
At most 6	0.007717	0.185919	3.841466	0.6663

Notes:
Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Author's own formulation using econometric software Eviews 7.0.

[6] In this technique two test statistics are used to identify the number of cointegrating vectors, namely the trace statistic and the maximum eigenvalue test statistic. The Trace test statistic for the null hypothesis that there are atmost r distinct cointegrating vectors is

$$\lambda_{trace} = T\sum_{i=r+1}^{n}\ln(1-\lambda_i) \quad \ldots\ldots\ldots\ldots\ldots(6)$$

where, ēi's are the N-r smallest squared canonical correlations between Xt-k and ĀXt (where Xt = (considered variables)/ and where all variables in Xt are assumed I(1)), corrected for the effects of the lagged differences of the Xt process. The maximum eigenvalue statistic for testing the null hypothesis of at most r cointegrating vectors against the alternative hypothesis of r + 1 cointegrating vectors is given by

$$\lambda_{max} = -T\ln(1-\lambda_{r+1})$$

Johansen (1988) shows that equations (6) and (7) have non-standard distributions under the null hypothesis and provide approximate critical values for the statistic, generated by Monte Carlo methods.

* denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values
Source: Author's own formulation using econometric software Eviews 7.0.

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.979582	93.39266	46.23142	0.0000
At most 1 *	0.968797	83.21402	40.07757	0.0000
At most 2 *	0.878102	50.50961	33.87687	0.0002
At most 3 *	0.753221	33.58231	27.58434	0.0075
At most 4	0.443693	14.07444	21.13162	0.3590
At most 5	0.239075	6.557291	14.26460	0.5428
At most 6	0.007717	0.185919	3.841466	0.6663

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level

Table-3 and 4, reports the maximum eigen-value and trace tests of Johansen and Juselius (1991). These are complementary versions of the same test to determine the cointegration rank, r. Both the test suggests that the considered variables are cointegrated. This result indicates the existence of a stable long run relationship among stock price index and the considered macroeconomic variables in Bangladesh. That is changes macroeconomic variables in Bangladesh economy will have some important long run implications on the changes in the stock price index.

5.3 Estimation of the Error Correction Models

The cointegration among the considered variables implies the presence of long run equilibrium relationship. However, in the short run there may be disequilibrium. Therefore, we can treat the error term in the cointegrating relation as the equilibrium error which is used to tie the short run behavior of the variables. The error-correction mechanism first used by Sargan and later popularized by Engle and Granger corrects for disequilibrium. Therefore, the error-correction models (ECM) are applied to explore the direction of causality. Any ECM has an interesting temporal causal interpretation in the Granger sense. That is when two series are seen to be cointegrated the absence of causal relationship between them is ruled out in the error correction framework, while such a possibility exists in the Granger test. Thus, the study also employs Granger causality to examine the direction of causality. The results are reported in table- 5.

Table 5: Causality based on Granger Causality (F statistic) and Vector Error Correction Model (t statistic)

Dependent	Significance level of F statistics							t statistics
Variable	ΔLSPI	ΔLGDP	ΔLM2	ΔLCPI	ΔLIR	ΔLEXR	ΔLPSC	ECMt-1
ΔLSPI		0.223	0.29	2.093**	1.13	2.48**	0.316	-2.83*
ΔLGDP	2.789**		0.87	2.689**	4.92*	3.11*	0.19	-.0240
ΔLM2	6.12*	0.82		5.412*	3.41*	4.08*	0.36	-1.04
ΔLCPI	1.7	0.8	0.676		3.272*	2.192	3.55	-0.64
ΔLIR	1.06	0.076	0.36	0.118		0.92	2.27	-0.68
ΔLEXR	1.46	3.22*	1.19	0.15	1.1		0.003	-0.170
ΔLPSC	2.824**	5.35	0.459	6.308*	5.63*	2.586		-2.94*

Notes: i) * , ** and *** indicates significance at 1% , 5% and 10% respectively.

Source: Author's own formulation using econometric software Eviews 7.0.

The table reflects the direction of causality among the considered variables in the empirical framework. It is revealed from the table that there is a unidirectional causality from the consumer price index (CPI) and exchange rate (EXR) to the stock price index (SPI) and also from the stock price index to the gross domestic product (GDP), money supply (M2) and private sector credit (PSC). The respective coefficients are statistically significant at different levels indicated in the table. The implication of the result is that the lagged change in GDP, M2 and PSC has significant predictive ability for the movements in the stock prices. This result is justified both from the F statistic based on Granger causality and from the error correction models. The predictive ability of stock prices for GDP and PSC is consistent with the hypothesis that stock prices contain the market participants' expectations for future economic activities. This result is in line with Ibrahim (1999) Secondly, from column 1 of the table it is also revealed we see that the stock price movements anticipate variations in CPI and EXR, (the statistically significant respective coefficients are 2.789 and 2.824) but have no predictive ability to the changes of the other macroeconomic variables. Therefore the monetary policy has significant stimulus in the effective functioning of the stock market.

6.0 Summary and Conclusions

This study examines the causal linkages between the Bangladesh stock price index and the fundamental economic forces, which include nominal GDP, nominal broad money supply, nominal interest rate, exchange rate, consumer price index and private sector credit. In doing so, we first examine the time series properties of the data using both the widely used ADF unit root tests. The unit root test results show that all the data series are of I(1) processes. Hence, we utilize the Johansen-Juselius multivariate cointegration test to examine the long run equilibrium relationship among the variables in the model. Existence of a single cointegrating vector was detected and all the identified variables belong to the cointegrating space. The normalized cointegrating vector shows that the Bangladesh stock prices index is elastic with respect to lagged change in GDP, M2 and PSC. However, it is inelastic with respect to the other considered variables and they are not highly significant. The estimation of

error-correction model further confirms the existence of long run stable equilibrium among the variables in the model. It is confirmed that any disequilibrium is corrected by fast adjustment. The Granger causality test also indicates that the lagged change in GDP, M2 and PSC has significant predictive ability for the movements in the stock prices. However, the bidirectional causality has not been established as is evident from column 1 in table 5.

To sum up, it is of interest to note that potential macroeconomic variables could provide impetus to the emerging stock market in Bangladesh. By knowing the linkages between stock prices and macroeconomic variables, investors can obtain more information on changes in these variables to predict the movement in stock returns. Since the unidirectional causality runs GDP, M2 and PSC to stock price index the monetary policy should be designed in such a way that can contribute to stabilize and smooth functioning of the stock market.

References

Afzal, N. and S.S.Hossain, 2011. An Empirical Analysis of the Relationship between Macroeconomic Variables and Stock Prices in Bangladesh, Bangladesh Development Studies, Vol XXXIV, December 2011, No. 4. 95-105.

Aggarwal, R. 1981. Exchange Rates and Stock Prices:A Study of the US Capital Markets under Floating Exchange Rates. Akron Business and Economic Review 12: 7-12.

Ali, M.B. 2011a. Stock Prices and Macroeconomic Variables: T-Y Granger Causal Evidence from Dhaka Stock Exchange (DSE). Research Journal of Finance and Accounting, 2(6).

Atindehou, R. B. and J. Gueyie, 2001. Canadian chartered bank's stock returns and Exchange rate risk, Management Decision, 51(4): 285-295.

Bangladesh Economic Survey (Various Issues), Ministry of Finance, Government of Bangladesh.

Bhattacharya, D. 2002. Stock Price and Economic Growth in India. (mimeo)

Bhattacharya, B. and Mukherjee, J. (2008). The nature of the causal relationship between stock market and macroeconomic aggregates in India: An Empirical Analysis (mimeo).

Chang, E.C. and J.M. Pinegar. 1989. Seasonal Fluctuations in Industrial Production and Stock Market Seasonals, Journal of Financial and Quantitative Analysis, 18 (2): 59-74.

Chen, N., Roll, R., and Ross, S. A. 1986. Economic forces and the stock market, Journal of Business, 59(3): 383-403.

Chowdhury A.R., 1995, "Is the Dhaka Stock Exchange Informationally Efficient?", The Bangladesh Development Studies, vol. XXIII, pp. 89-104

Chong, C. S. & Goh, K. L. 2003. Linkages of economic activity, stock prices and monetary

policy: the case of Malaysia.

Dickey, D. A. and W. A. Fuller (1981). "Likelihood Ratio Statistics for Autoregressive Time

Series with a Unit Root", Econometrica, Vol. 49, pp.1057-1072.

Dickey, D. A., D. W. Jansen, and D. L. Thornton. 1991. A Primer on Cointegration with an Application to Money and Income. Federal Reserve Bank of St. Louis Review: 58-78.

Darrat, A. F. 1990. Stock Returns, Money, and Fiscal Deficits, The Journal of Financial and Quantitative Analysis, 25(3): 387-398.

Domar, E.D. (1946). "Capital Expansion, Rate of Growth and Employment" Econometrica, 14, April, pp. 137-147.

Engle, R.F. and C.W. Granger, (1987). "Co-integration and Error Correction: Representation, Estimation and Testing". Econometrica, Vol.55, P. 251-276.

Flannery, M. J., and Protopapadakis, A. A. 2002. Macroeconomic factors do influence aggregate stock returns, The Review of Financial Studies, 15(3): 751-782.

Fama, E. F. and Schwert, G. W. 1977. Asset returns and inflation, Journal of Financial Economics, 5: 115-46.

Fama, E.F.,(1981), "stock Returns, Real Activity, Inflation and Money", American Economic Review 71, 545-565.

Fama, E.F. (1990), "Stock Returns, Expected Returns, and Real Activity", Journal of Finance 45, 1089-1108.

Friedman, M. & Schwart., A. J. 1963. Money and Business Cycles. Review of Economics and Statistics 45 (1): 485.

Gujarati, D.N., 2003. Basic Econometrics. Mcgraw Hill, New York.

Gunasekarage, A., and Pisedtatalasai, A., 2004, Macroeconomic Influence on the Stock Market: Evidence from an Emerging Market in South Asia, Journal of Emerging Market Finance, vol. 3, no. 3, pp. 285-304

Hassan, A. H. 2003. Financial integration of stock markets in the Gulf: A multivariate cointegration analysis. International Journal of Business 8(3).

Harrod, Roy F. (1939). "An Essay in Dynamic Theory" Economic Journal, 49, June, pp. 14-33.

Hendry, D. F. 1986. Econometric modeling with cointegrated variables: An overview.

Oxford Bulletin of Economics and Statistics 48(3) 201-212.

Hossain, M.A. (2009). Money and MacroVariables in Bangladesh (mimeo).

Hossain, Z. 2011. Forecasting Volatility in the Dhaka Stock Exchange, Bank Parikrama, Vol. XXXVI, June-December 2011, pp. 73-88.

Habibullah, M.S. and A.Z. Baharumshah, 1996a. Money, Output and Stock Prices in Malaysia: An Application of the Cointegration Test. International Economic Journal, 10(2): 121-130.

Ibrahim, H. Mansor, 1999. Macroeconomic Variables and Stock Prices in Malaysia: An Empirical Analysis, Asian Economic Journal 1999, Vol. 13, No. 2.

Islam, M. 2003. The Kuala Lumpur stock market and economic factors: a general-to-speci?c error correction modeling test. Journal of the Academy of Business and Economics, 13 (2).

Islam, S. M. N. & Watanapalachaikul, S. 2003. Time series ?nancial econometrics of the Thai stock market: a multivariate error correction and valuation model. Available at http://blake.montclair.edu/~cibconf/conference/DATA/Theme2/Australia2.pdf

Jaffe, J. and Mandelker, G. 1976. The Fisher Effect for Risky Assets: An Empirical Investigation, Journal of Finance, 31(2): 447-458.

Johansen, S., 1988. "Statistical Analysis of Cointegrating Vectors". Journal of Economic Dynamics and Control, Vol. 12, P. 231-254.

Johansen, S. and K. Juselius. (1990) Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money. Oxford Bulletin of Economics and Statistics 52: 169-211.

Khan, H.R. 1992. The Performance of Stock Markets in Bangladesh: An Appraisal, The journal of the Department of Finance and Banking, University of Dhaka, Vol.2 No.1

Kwon, C. S., and T. S. Shin, 1999. "Cointegration and Causality Between Macroeconomic Variables and Stock Market Returns." Global Finance Journal 10, no. 1: 71-81.

Knight, F. H. (1944). "Diminishing Returns from Investment" Journal of Political Economy, 52, March, pp. 26-47.

Maghyereh, A. I. 2002. Causal relations among stock prices and macroeconomic variables in the small, open economy of Jordan. available at http://ssrn.com/abstract=317539.

Maysami, R. C., and T. S. Koh. 2000. A Vector Error Correction Model of the Singapore Stock Market. International Review of Economics and Finance 9: 79-96.

Malliaris, A.G. and J.L. Urrutia, 1991, An Empirical Investigation among Real, Monetary and Financial Variables, Economic Letters, 37, 151-157.

Maysami, R. C. & Sim H. H. 2001a. An empirical investigation of the dynamic relations between macroeconomics variable and the stock markets of Malaysia and Thailand. Jurnal Pengurusan 20: 1-20.

Maysami, R. C. & Sim, H. H. 2002. Macroeconomics variables and their relationship with stock returns: error correction evidence from Hong Kong and Singapore. The Asian Economic Review 44(1): 69-85.

Maysami, R. C. & Sim H. H. 2001b. Macroeconomic forces and stock returns: a general-to-speci?c ECM analysis of the Japanese and South Korean markets. International Quarterly Journal of Finance 1(1): 83-99.

Miller, S. M.(1999). Monetary Dynamic: An Application of Cointegration and Error Correction Modeling. Journal of Money, Credit and Banking 23 (2).

Mohiuddin, et. Al (2006). An Empirical Study of the Relationship between Macroeconomic variables and Stock Price: A Study of Dhaka Stock Exchange (DSE) (mimeo).

Mokerjee, Rajen and Qiao Yu (1997). Macroeconomic Variables and Stock Prices in a Small Open Economy: The Case of Singapore. Pacific-Basin Finance Journal, 5, 377-388

Mukherjee, T. K., and A. Naka, 1995. "Dynamic Relations Between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error-Correction Model." The Journal of Financial Research 18, no. 2: 223-37.

Nelson, C.R. 1976. Inflation and Rates of Return on Common Stocks, Journal of Finance, 31(2):471-483.

Nishat M., Shaheen R. (2004). Macroeconomic factors and Pakistani equity market. The Pakistan Development Review, 43(4), 619-637.

Palmer, M. 1970, Money Supply, Portfolio Adjustments and Stock Prices, Financial Analyst Journal, 26, 19-22.

Panda, C. and B. Kamaiah, 2001. Monetary Policy, Expected Inflation, Real Activity and Stock Returns in India: An Empirical Analysis, Asian-African Journal of Economics and Econometrics, 1: 191-200.

Pearce, D. K., and Roley, V. V. 1985. Stock Prices and Economic News, Journal of Business, 58(1): 49-67.

Rahman, L. and J. Uddin, 2009. Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Three South Asian Countries, International Business Research, 2(2).

Rahman, L. 2010. An Empirical Relationship between Money Supply and Stock Prices in Bangladesh. (mimeo).

Ripley, D. M. 1973. Systematic elements in the linkage of National Stock Market Indices, The Review of Economics and Statistics, 55(3): 356-361.

Ramsey, F. (1928). "A Mathematical Theory of Saving" Economic Journal, 38, December, pp. 543-559.

Schumpeter, J.A. (1934). The Theory of Economic Development. Cambridge, M.A: Harvard University Press.

Serletis, A.(1988). The Empirical Relationship between Money, Prices and Income Revisited. Journal of Business and Economic Statistics, 6 (3).

Securities and Exchange Commission of Bangladesh, Annual Reports.

Statistical Year Book, Bangladesh Bureau of Statistics, Various reports.

Sprinkel, B.W. 1971. Money and Markets: A Monetarists View, Richard D. Irwin Homewood, IL.

Thomas, R. L. (1993). Introductory Econometrics: Theory and Applications. 2nd edn. Longman.

Thorton, J. 1993. Money, Output and Stock Prices in the UK: Evidence on some

(non)relationships, Applied Financial Economics, 3, 335-338.

Vuyyuri, S. 2005. Relationship between real and ?nancial variables in India: A cointegration analysis. Available at http://ssrn.com/abstract=711541.

Young, A. (1928). "Increasing Returns and Economic Progress" Economic Journal, 38, December, pp. 527-542.