Cointegration and Causality between Stock Market Development and Economic Growth in Bangladesh

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Abstract: In this study, we emply Johansen cointegration, Vector Error Correction Model (VECM) and Granger causality Wald test based on VECM to investigate the linkage between stock market development and real economic growth in Bangladesh for the period from 1981 to 2014. Cointegration test confirms that there is a long run positive relationship exists between real economic growth and stock market development in Bangladesh. The empirical result based on the VECM estimate indicates that long run causality is running from stock market development to economic growth. The result also implies that real GDP growth in Bangladesh takes only eight and half months to converge to its long run equilibrium. The Granger causality Wald tests suggest that there is bidirectional causality running between real GDP growth and stock market development in the short run. Therefore, real economic growth and stock market development in Bangladesh are seemingly dependent as economic growth leads to stock market development (market capitalization ratio and turnover ratio) and turnover ratio leads to economic growth.

Keywords: Stock Market Size, Economic Growth, Cointegration, Vector Error Correction Model

1. Introduction

Financial markets and intermediaries play lots of vigorous functions to the rapid development of an economy. From the time when the pioneering contributors, such as, [1], [2], [3] and [4] reveal the positive relationship between financial development and economic growth, the thought generates an important issue of debate. In their literature, [5] argue that the causal relationships between financial development and economic growth are sketched along three lines: (i) financial deepening promotes economic growth, (ii) economic growth stimulates financial development and (iii) financial development and economic growth influence each other. [3] and [4] contend the link from financial deepening to growth, while [2] supports the opposite direction. More interestingly, [6] find the bi-directional causality between financial development and economic growth. Though, the initiatives of relating economic growth to the financial development have performed long ago, that mainly emphasized the role of the banking sector in economic growth. In the past few decades, the world stock markets obtained more attention in consequence of the growing importance to allocate the necessary capital required for the consistent growth of the economy. The empirical literatures provides the contrasting results on the impact of stock market development on economic growth. Several studies, such as, [7]-[11] claim that stock market development significantly promotes economic growth of a country both directly and indirectly. Unlike [12], reference [13] dispute that stock market of Bangladesh does not have almost any effect on the real economic activity.

Similar to most developing countries, the financial sector of Bangladesh is dominated by 56 scheduled banks who operate under full control and supervision of Bangladesh Bank. Apart from foreign banks, most of the Bangladeshi scheduled banks are disappointing to attain satisfactory

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improvement in spite of a series of reform initiatives over the years. The worst scams in the history of the banking sector of Bangladesh took place during the last few years while, about 100 billion Taka wiped out by the fraud customers with the help of bank directors and officials [14]. Moreover, bad debts increased from 6% to 11% in 2013 [15]. So, bank dominating financial system of Bangladesh is nearly seeming close to the catastrophe bring about by massive nonperforming loans. The studies, such as, [16] and [17] may be a strategic way out for the policymakers of Bangladesh as they uncover that capital markets' development supports a stable evolution in the banking sector. Most of the researches related to emerging stock markets suggest that the markets are informationally inefficient and can provide more return [18-19]. Thus, stock market may perhaps be an appropriate financial system of Bangladesh not only for the new and old industrialists but also for the individuals who want to earn more return.

The researchers and policy makers pay a lot of attention to find out the ways in which economic growth can be enhanced as it is judged as the prime economic objective for any economy. Since stock market is considered as an engine for growth, the researchers and policymakers would pay a special effort to better understand the relationship between stock market development and economic growth. The present study follows this line of thinking and examines the link between stock market development and the economic growth in Bangladesh as rare studies have done in the context of Bangladesh. The specific objectives of this study are as follows.
i. To investigate the existence of short run and long run relationships between stock market development and economic growth.
ii. To examine the direction of causal relationships between stock market development and economic growth.

2. Literature Review

A handsome amount of study resolve on the ambiguous relationship between stock market development and economic growth for the last two decades. Atje and Jovanovic (1993) explore that the stock markets have a positive impact on growth performance for 40 countries over the period 1980-88. They also find a significant correlation between economic growth and the value of stock market trading divided by GDP [9]. Levine and Zervos (1996) show that stock market development is positive and strongly correlated with long run economic growth [8]. Soon after, Levine and Zervos (1998) reveal that stock market liquidity is positively and comprehensively connected with current and future rates of economic growth using cross-country data for 47 countries from 1976 to 1993. They also find that both stock market liquidity and banking development considerably predict future rates of growth and finally conclude that stock markets provide important but different financial services compared with banks [20]. Garcia and Liu (1999) explore the determinants of stock market development, and the relationship between financial intermediary development and stock market development using pooled data from fifteen industrial and developing countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela, Indonesia, Korea, Malaysia, the Philippines, Taiwan, Thailand, Japan and the United States) from 1980 to 1995 [16]. They comment that economic development plays an important role in stock market development. The study settles that the stock market is a complement rather than substitute for the banking sector as many East Asian countries are successful examples where the banking sector promotes stock market development. Duca (2007) investigates the casual examination of stock market prices and GDP in developed market economies (US, UK, Japan, France and Germany) using the Granger causality test [21]. He reveals that the variables are likely to move together over time. He also comments that stock prices are appearing to Granger cause GDP, the occurrence of bubbles and busts in financial markets is likely to deteriorate volatility in economic activity. Deb and Mukherjee (2008) examine the causal relationship between stock market development and economic growth for the Indian economy applying the techniques of unit root tests and the long run Granger non-causality test

proposed by Toda and Yamamoto [11]. The results of the study expose that there is strong causal flow from the stock market development to economic growth. So, the funds raise by the corporate sector from the financial markets during 1996:Q4 to 2007:Q1 thus play an important role in the appreciable growth registered by the Indian economy. The results also show the bidirectional causality between real GDP growth rate and real market capitalization ratio. By employing the error correction approach, Nurudeen (2009) investigates whether stock market development raises economic growth in Nigeria. The econometric results indicate that stock market development (market capitalization) contributes positively to economic growth [22]. Hossain and Kamal (2010) investigate the causal relationship between stock market development and economic growth in Bangladesh using the Engle-Granger causality and ML tests [12]. From the analysis, it is found that the stock market development strongly influences the economic growth in Bangladesh economy, but there is no causation from economic growth to stock market development. The unidirectional causality is prevailed between stock market development and economic growth in the Bangladesh economy. Boubakari and Jin (2010) investigate the causality relationship between stock market and economic growth using Granger causality test of the time series data bring together from 5 Euronext countries named Belgium, France, Portugal, Netherlands and United Kingdom for the period 1995:Q1 to 2008:Q4 [23]. The study considers market capitalization, total trade value, turnover ratio as stock market proxies and in contrast, GDP and FDI for economic growth proxies. The outcomes of the study present that the stock market development does significantly Granger cause economic growth in France and United Kingdom. In addition, stock market development does Granger cause economic growth, but not significant in the Netherlands. But, the causal relationship is rejected for Belgium and Portugal in which the stock marketsare small and less liquid. Haque and Fatima (2011) explore the relationship between stock market development and long run per capita growth rate of Bangladesh using the two dynamic panel models for the sample period of 1980 to 2007 [13]. They comment that stock markets in Bangladesh have no influence on the real economic activity during 1980 to 2007. Olweny and Kimani (2011) investigate the causal relationship between stock market performance and economic growth in Kenya for the period of 2001 to 2010 using the Granger causality test based on the Vector Autoregressive (VAR) model [10]. The findings imply that the causality between economic growth and stock market are run unilaterally or entirely in one direction from the NSE 20-share index to the GDP. From the results, it is inferred that the movement of stock prices in the Nairobi stock exchange reflects the macroeconomic condition of the country and can therefore be used to predict the future path of economic growth. Alajekwu and Achugbu (2012) investigate the role of stock market development on economic growth of Nigeria using 15 years time series data from 1994 to 2008 using Ordinary Least Square (OLS) techniques [24]. The stock market capitalization ratio is used as a proxy for market size, while value traded ratio and turnover ratio are used as a proxy for market liquidity. The results show that market capitalization and value traded ratios have a very weak negative correlation with economic growth, while turnover ratio have a very strong positive correlation with economic growth. Ageli and Zaidan (2013) investigate the link between financial sector development and economic growth in the Saudi economy over the period 1970-2012 by using unit root tests, the co-integration test, the Granger Causality Test and the Vector Error Correction Model (VECM) [25]. The results of the examine show that there is a positive relationship between financial sector development and economic growth in Saudi Arabia. They also comment that the development of the financial system will have a positive impact on the growth of the Saudi economy. Osuala, Okereke and Nwansi (2013) examine the existence of causality relationship between stock market performance and economic growth in Nigeria using the General-to-specific

Autoregressive Distributed Lag (ARDL) /Bound testing approach [26]. In particular, it investigates whether the stock market really promotes economic growth in Nigeria using time series data covering the period 1981 – 2011 of the variables, namely, Gross Domestic Product (a proxy for economic growth) and stock market performance indicators, such as market capitalization ratio, turnover ratio and total number of deals ratio. The study finds the empirical evidence of long run co-integration between economic growth and stock market performance. However, the study reveals that there is no causality from all of the stock market development indicators to GDP in the long run, while the existence of a unidirectional causality from total number of deals ratio to economic growth in the short run. Jahfer and Inoue (2014) examine the long run relationship between the financial development, stock market development and economic growth in Japan, employing Johansen Co-integration and Vector Error Correction Model [27]. The results reveal that there is a long run equilibrium relationship between the financial development, stock market development and economic growth in Japan and that financial development and stock market development causes economic growth, but there is no evidence of causality from economic growth to financial development or stock market development. In addition, the study finds that stock market development plays an important role during the period 1974-2011 in Japan. Finally they conclude that stock market development is matter for the economic growth of Japan after 1974.

2.1 Conceptual Framework

The economic theory suggests that the stock market impacts on aggregate demand through aggregate consumption, savings and investment. A well- performed stock market must increase savings, which leads to allocate capital to the industries for productive investments, and it must generate new employment, more output, and finally an increase in the rate of economic growth. That is why the study aims at determining whether the stock market development in Bangladesh has any influence on the economic growth. Moreover, a substantial body of literature suggests that financial market development plays a significant role in economic growth through fostering savings mobilization, easing risk management, promoting technological transfer and reducing information and transaction costs [5]. Economic growth is a straightforward concept. It is measured by the growth rate of real GDP at constant prices. Stock market development is a multi-dimensional concept. It is generally evaluated by stock market size, market liquidity, market concentration, market integration and the legal rule in the market.

The study uses market size and market liquidity as a measure for stock market development of Bangladesh. Specifically, we use the following indicators of stock market development:

- Market Size: The market capitalization ratio is the main indicator that used as a measure of stock market size and depth. The Market Capitalization Ratio (MCR) is defined as the market capitalization of stocks divided by GDP i.e., $\text{Market Capitalization to GDP} = \frac{Stock\ Market\ Capitalization}{GDP\ in\ Current\ Market\ Price} \times 100.$ In terms of economic significance, market size, i.e., market capitalization ratio is positively related with the ability to mobilize capital and diversify risk on an economy.

- Market Liquidity: Stock market liquidity is the ability of a market to easily buy and sell securities without having to reduce its price very much. The turnover ratio is the main indicator that used as a measure of stock market liquidity.
    i. Turnover Ratio (TR): The turnover ratio measures stock market trading compared with the size of the Economy. $\text{Turnover Ratio} = \frac{Value\ of\ Shares\ Traded}{Stock\ Market\ Capitalization} \times 100.$ A small liquid market generally has a high turnover ratio.

The conceptual framework as brought out from the literature review in this study is illustrated in the figure 1 below.

Figure 1. Conceptual Framework
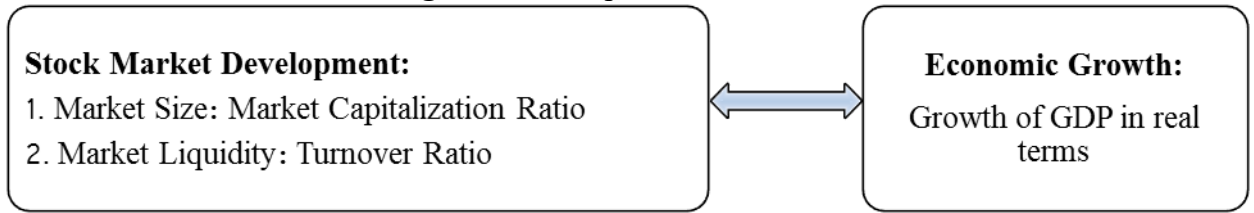
3. Methodology and Findings

A number of statistical and econometric tools have been used to realize the objectives of this study. A comprehensive description of these tests and the results have been described in a lucid style here below.

3.1 Data and Data Sources

Bangladesh has two stock exchanges: Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE). Dhaka Stock Exchange is the oldest and largest stock exchange in Bangladesh. Thus, the study purposefully selects DSE as a sample of the stock market of Bangladesh. On the other hand, the performance of the overall economy is targeted and measured by the growth in GDP in constant prices. The current study concentrates on Bangladesh economy covering a period of thirty four years (1981-2014). Any study of stock market development should preferably be based on monthly data. But given the fact that monthly GDP figures in Bangladesh are not available, the study uses yearly data of GDP growth rate and indicators of stock market development. Stock market development is measured by two proxies: market size (MCR) and market liquidity (TR). In order to calculate the MCR and TR, data of market capitalization and turnover are collected from various issues of the Bangladesh Economic Review published by Bangladesh Bank and [28], while data of GDP in current local prices and real GDP growth rate (GDP) are collected from the World Development Indicators of World Bank (2016).

3.2 Data Statistics

This subsection provides descriptive statistics for the data under study and the purpose is to observe the changes that have taken place over the 34 years. The following Table 1 gives a summary of the statistical features of the variables.

Table 1. Statistical Features of the Variables

Variable	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P-value
GDP	4.94	5.06	7.23	2.13	1.28	-0.25	2.51	0.69	0.71
MCR	7.60	2.31	43.99	0.54	10.54	1.88	5.91	32.04	0.00
TR	28.90	19.87	114.31	0.87	30.52	0.95	3.07	5.12	0.08

The positive skewness values for MCR and TR suggest that these variables have right tails, while negative value for GDP growth uggests that the variable is moderately skewed left. Kurtosis for MCR and TR are more than 3, which indicate that the distributions are leptokurtic. The calculated Jarque-Bera statistic and corresponding p values reject the normality assumption for MCR and TR as skewness and kurtosis are significantly different from zero and three respectively, while distribution of GDP growth is normal.

3.3 Econometric Analysis

The study uses quite a lot of econometric analysis to investigate the relationship and the direction of causality between the stock market development and economic growth in Bangladesh. Unit root tests and cointegration analysis are used to test the stationarity and multiple long run relationship respectively. Vector Error Correction Model (VECM) is employed to test the long run causality, and short run to long run dynamic adjustment of the system of cointegrated variables. Granger causality/Block Exogeneity Wald tests based upon VEC model is performed to test the short run causality among the variables.

3.3.1 Testing For Stationarity

The first step of the econometric analysis requires a test for stationarity considering that the variables selected in this paper are time series which are usually non-stationary. Two extensively used unit root test, namely, Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) test are employed to avoid the problem of spurious regression and to examine the stationarity of the time series. ADF is the augmented form of Dickey Fuller test. The ADF test is performed using the following equation:

$$\Delta Y_t = \alpha + \beta T + \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

where α is an interecpt (constant), β is the coefficient of time trend T, γ and δ are the parameters where, $\gamma = \rho-1$, ΔY is the first difference of Y series, m is the number of lagged first differenced term, and ε is the error term.

Phillips and Perron (1988) have developed a non-parametric unit root conception. The PP test is modified from Dickey-Fuller test so that serial correlation does no longer affect their asymptotic distribution. The PP test test is performed using the following equation:

$$\Delta Y_t = \alpha + \beta T + \gamma \Delta Y_{t-1} + \varepsilon_t \qquad (2)$$

where α is a constant, β is the coefficient of time trend T, γ is the parameter and ε is the error term.

The unit root test results are given in the following Table 2. Both tests are conducted using trend and intercept, intercept, and none term of the models.

Table 2. Unit Root Test Results

Variables	Augmented Dickey Fuller (ADF)			Phillips-Peron (PP)		
	None	Intercept	Intercept and trend	None	Intercept	Intercept and trend
GDPG	1.27	-3.97	-8.04	-0.85	-4.35	-9.56
	(.94)	(.00)	(.00)	(.34)	(.00)	(.00)
MCR	-.54	-1.16	-2.08	-.70	-1.31	-2.27
	(.47)	(.68)	(.54)	(.41)	(.61)	(.44)
TR	-1.22	-2.07	-2.96	-1.13	-2.03	-3.03
	(.20)	(.26)	(.16)	(.23)	(.27)	(.14)
ΔGDPG	-10.87	-4.98	-4.87	-17.94	-20.06	-19.36
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
ΔMCR	-4.73	-4.72	-4.73	-4.65	-4.65	-4.58
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
ΔTR	-6.43	-6.36	-6.26	-6.43	-6.37	-6.26
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)

Note: MacKinnon critical values for the ADF and PP statistic are used. First bracket shows p-values.

The findings of the two tests yield significantly similar results at level and first difference. Nevertheless, both test provides evidence of stationarity of all variables in their first difference. It can be noticed that the null hypothesis of a unit root at the level are accepted in all cases for MCR and TR as test statistics are lower than the critical values. GDP appears to be stationary in the level with intercept, and intercept and trend, however; nonstationary in the level when none term is considered. In order to solve the problem, we have plotted GDP in level using a graph and find that

the series has no trend and intercept. Thus, we accept the results without intercept and trend for the both tests, which indicate that GDP also has a unit root in level.

3.3.2 Testing For Cointegration

Cointegration refers to the situation where the non-stationary time series of the same order exist a long run relationship. Since it has been determined in the unit root test that the variables under examination are integrated of order 1, the cointegration test is performed. The Johansen cointegration test procedures are used to test for the possibility of a long run equilibrium relationship between stock market development and economic growth. Johansen and Juselius (1990) cointegration approach based the on VAR model is applied to examine the long run relationship that may exist among representative variables [29]. The Johansen and Juselius (JJ) approach of maximum likelihood estimation technique do not split variables between dependent and independent as all the variables are treated as endogenous variables of the VAR models. The JJ approach can be expressed mathematically as:

$$Y_t = \alpha + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_\rho Y_{t-\rho} + +\varepsilon_t \tag{3}$$

where Y_t is a vector containing n variables of I(1) at time t, α is an (n× 1) vector of constants, A_ρ is an (n× n) matrix of coefficients, ρ is the maximum lag included in the model and ε_t is an (n× 1) vector of error terms.

As in [30], Equation (4) can be written in the form of the error correction model assuming cointegration of order ρ as:

$$\Delta Y_t = \alpha + (A_1 - I)Y_{t-1} + A_2 Y_{t-2} + \cdots + A_\rho Y_{t-\rho} + +\varepsilon_t \tag{4}$$

or in a final broad form as:

$$\Delta Y_t = \alpha + \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{\rho-1} \Delta Y_{t-\rho+1} + \Pi Y_{t-\rho} + \varepsilon_t \tag{5}$$

Where, $\Gamma_i = (A_1 + A_2 + \cdots + A_{\rho-1} -I)$ represents the dynamics of the model in the short run. In Equation 5, $\Pi = (A_1 + A_2 + \cdots + A_\rho -I)$ represents the long run relationship among the variables included in the vector Y_t, and I is the identity vector. The key idea of the JJ approach is to determine the rank of the matrix Π, which represents the number of independent cointegration vectors.

Reference [31] suggests two test statistics named trace and eigenvalue test statistic for estimating the number of cointegrating vectors or equations. The trace and maximum eigenvalue test are as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln\left(1 - \hat{\lambda}_i\right) \tag{6}$$

and

$$\lambda_{max}(r, r+1) = -T \ln\left(1 - \widehat{\lambda_{r+1}}\right) \tag{7}$$

where T is the sample size and $\hat{\lambda}_i$ is the eigenvalues.

The trace test statistic hypothesizes that:
$H_0 : r \leq n$ (there are at most n number of cointegrating vectors)
$H_1 : r > n$ (there are at least n number of cointegrating vectors);
and the eigenvalue test statistic hypothesizes that:
$H_0 : r = n$ (there are exactly n number of cointegrating vectors)
$H_1 : r = n+1$ (there are exactly n+1 number of cointegrating vectors).

In order to estimate the equation (5), an appropriate lag length must be determined as [32] argue that the number of cointegrating vectors generated by Johansen approach may be sensitive to the number of lags in the VAR model. Thus, five different criteria, namely Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwarz Information Criteria

(SIC) and Hannan-Quinn Information Criteria (HQ) are used to determine the lag lengths used in the VAR. Table 3 presents the results for each criterion with a maximum of 4 lags. It is clear that LR, FPE, AIC and HQ criteria stand in favor of 4 lags, while SIC criteria suggests for only 1 lag.

Table 3. Optimal Lag Lengths of the VAR Model

Lags	LogL	LR	FPE	AIC	SIC	HQ
0	-293.4954	NA	77095.82	19.76636	19.90648	19.81119
1	-253.6893	68.99732	9934.603	17.71262	18.27310*	17.89192
2	-245.8407	12.03446	10960.14	17.78938	18.77022	18.10316
3	-237.4956	11.12680	12074.50	17.83304	19.23424	18.28130
4	-220.3042	19.48357*	7764.191*	17.28695*	19.10850	17.86968*

Note: * indicates lag order selected by the criterion.

The presence of residual serial correlation makes the result less efficient. Thus, we proceed to conduct Lagrange Multiplier (LM) tests for each suggested lags up to maximum 4 lags (Table 4). The p-values associated with the LM tests strongly reveal the presence of serial correlation in the estimated residuals generated from VAR (1) model. In contrast, 4 lags produce no autocorrelation in the VAR model for up to 4 years. So, we accept VAR (4) model for cointegrating analysis.

Table 4. Residual Serial Correlation LM Tests for the VAR Model

Lags	4 Lags		1 Lag	
	LM-Stat	P-Values	LM-Stat	P-Values
1	7.353439	0.6004	16.49633	0.0572
2	5.864296	0.7534	4.713057	0.8586
3	8.537068	0.4811	20.88533	0.0132
4	9.322212	0.4081	9.189561	0.4200

Note: P-values from Chi-square with 49 df.

Table 5. Johansen Multivariate Cointegration Test Results

Panel (a): Unrestricted Cointegration Rank Test (Trace)					
HypothesizedNo. of CE(s)			Trace	0.05	
H_0	H_1	Eigenvalue	Statistic	Critical Value	P-value[***]
r = 0	r≥ 1	0.596049	31.72904[**]	29.79707	0.0296
r ≤ 1	r≥ 2	0.146107	5.441667	15.49471	0.7603
r ≤ 2	r≥ 3	0.029258	0.861133	3.841466	0.3534
Panel (b): Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
HypothesizedNo. of CE(s)		Eigenvalue	Max-Eigen	0.05	
H_0	H_1		Statistic	Critical Value	P-value[***]
r = 0	r = 1	0.596049	26.28738[*]	21.13162	0.0086
r = 1	r = 2	0.146107	4.580534	14.26460	0.7936
r = 2	r = 3	0.029258	0.861133	3.841466	0.3534

Notes: [*] and [**] denotes rejection of the null hypothesis at the 1% and 5% levels respectively. [***] indicates MacKinnon-Haug-Michelis (1999) p-values.

Table 5 presents particularized results of cointegration test, including the trace test (Panel-a) and the maximum eigenvalue test (Panel-b). A visual inspection of Panel-a in Table 3 reveals that the null hypothesis of there are at most 1 number of cointegrating vector can be rejected since the λ_{trace} statistics of 31.72904 is greater than its critical value of 29.79707 at the 5% level of significance. Similarity, Panel-b in Table 5 shows that the null hypothesis of there is exactly one cointegrating vector can be rejected at the 1% level of significance. Thus, both the trace and maximum eigenvalue test suggest for 1 cointegrating vector in the system. Consequently, it can be assumed from the

Johansen cointegration test that there is at least one cointegrating vector in the system indicating that there is at least one long run relationship among the variables preferred for the study.

Table 6. Normalized Cointegrating Coefficient

Cointegrating Equation(s): Log likelihood: -208.3761			
GDP	C	MCR	TR
1.000000	-3.980490	-0.027965	-0.023297*
		(0.03245)	(0.00433)
		[-0.86192]	[-5.38018]

Note: Standard errors in () and t-statistics in []. * denotes significance of variable at 1 % level

The normalized cointegrating coefficient gives the long run relationship and this is reported in Table 4. Based on the estimated cointegration vector, the actual long run relationship can be represented by:

$$GDP = 3.980490 + 0.027965 \, MCR + 0.023297 \, TR \quad (8)$$

Table 6 and Equation (8) indicate that long run relationship exist between stock market development based and real economic growth in Bangladesh. In the long run, TR has a significant and MCR has an insignificant long run positive relationship with real economic growth. The result implies that a 1% increase in market capitalization ratio and turnover ratio contribute 0.03% and 0.02% increase in real economic growth in Bangladesh respectively.

3.3.3 Vector Error Correction Model (VECM)

Vector Error Correction Model (VECM) is employed to investigate the long run causality and short run to long run dynamic adjustment of the system of cointegrated variables. In an effort to determine the short run causality among the variables, Granger causality/Block Exogeneity Wald tests based upon VEC model is also performed. A VECM is a restricted vector autoregressive (VAR) model designed to deal with nonstationary series that are known to be cointegrated. The presence of cointegration indicates that at least one of the variables would react to deviate from the long run relationship. The VEC mechanism explains how the examined model adjusts in each time period towards its long run equilibrium state. Equation (4) can be written as a VECM as:

$$\Delta Y_t = \alpha + \sum_{i=1}^{\rho} \Gamma_i \Delta Y_{t-1} + \Pi Y_{t-\rho} + \varepsilon_t \quad (9)$$

where $\Gamma_i = A_1 + A_2 + A_3 + \ldots + A_{\rho-1} - I$ represents the dynamics of the model in the short-run and $\Pi = A_1 + A_2 + A_3 + \ldots + A_\rho - I$ is the long-run relationship among the variables included in the vector Y_t and I is the identity vector. ΔY_t is an n x 1 vector of variables and α is an (nx1) vector of constants. Π is the error correction mechanism, which has two components: $\Pi = \mu\beta'$ where μ is an (n x 1) column vector representing the speed of the short run adjustment to the long-run equilibrium, and β' is a (1 x n) cointegrating vector with the matrix of long run coefficients. Γ is an (n x n) matrix representing the coefficients of the short run dynamics. Finally, ε_t is an (n x 1) vector of white noise error terms, and ρ is the order of the autoregression.

The estimates of the VEC model with GDP, MCR and TR are presented in Table 7. The long run causal relationship is implied through the significance of the lagged error correction terms. Error correction term contains the long run information since it is derived from the long run cointegrating relationship. The results of the estimated multivariate VECM clearly indicate that the error correction terms of the first difference Real GDP growth equation is correctly signed (negative) and statistically significant at the 1 % level of significance. On the other hand, market capitalization ratioa and turnover ratio equations are not correctly signed, however; statistically significant. The

results confirm that a unidirectional long run causality is running from stock market development to real GDP growth in Bangladesh.

Table 7. Vector Error Correction Estimates

Error Correction	D(GDP)	D(MCR)	D(TR)
Coint. Eq.	-1.391509*	5.758935**	28.76262*
Standard errors	0.49912	2.45399	8.71444
t-statistics	-2.78794	2.34677	3.30057
P-value	0.0077	0.0234	0.0019

Note: * and ** denote singnificance of variables at 1% and 5% levels respectively.

A negative error correction term also signifies the speed of dynamic adjustment of a system of the cointegrated variables from the short run to the long run equilibrium level. So, about 139% of disequilibrium is corrected each year by changes in real GDP growth. The calculation also indicates that real GDP growth in Bangladesh takes only 8 and half months to converge to its long run equilibrium.

Table 8. VECM Granger Causality/Block Exogeneity Wald Tests

Dependent Variable	Excluded	Chi-Square Statistics	Degrees of Freedom	P-value
D(GDP)	D(MCR)	2.739249	4	0.6024
	D(TR)	10.80825	4	0.0288**
D(MCR)	D(GDP)	10.68767	4	0.0303**
D(TR)	D(GDP)	14.12965	4	0.0069*

Note: * and ** denote singnificance at 1% and 5% levels respectively.

In a VEC model, lagged explanatory variables produce another possible sources of causality named short run causality. In an effort to determine the short run causality among the variables, Granger causality/Block Exogeneity Wald tests based upon VEC model is performed. This test detects whether the lags of one excluded variable can Granger cause the dependent variable in the VAR system using the chi-square (Wald) statistics. According to the test results in Table 8, the individual short run causal effect from stock market development based on TR to real GDP growth is significant based on the chi-squared statistics and p-values. Moreover, the short run causal effects of real GDP growth to MCR and TR are significant at 1% and 5% levels respectively. So, there is a unidirectional causality running from GDP to MCR, while there is a bidirectional causality running between GDP to TR.

4. Conclusion

This study examines the existence of short run and long run relationship between stock market development and economic growth in Bangladesh. Moreover, this study also investigates the direction of causal relationships between stock market performance and economic growth in Bangladesh. Johansen multivariate cointegration test, VECM and Granger causality/Block exogeneity Wald test based on VECM approach are employed to investigate the linkages between stock market performance and economic growth. Cointegration test confirms that the market capitalization ratio and turnover ratio have a positive long run effect on real GDP growth. So, we conclude that stock market development based on MCR (market size) and TR (market liquidity) contributes to real economic growth in the long run. VECM result reveals that about 139% of disequilibrium is corrected each year by changes in real GDP growth. VECM also indicates that long run causality is running from stock market development to real GDP growth. Granger causality/Block exogeneity Wald tests based on VECM approach reveal that there is a there is a

bidirectional short run Granger causality running between GDP to stock market development in Bangladesh.

The results of cointegration test lead some sorts of support to empirical studies of [8], [9], as well as some other studies and theory that the stock market has direct association with GDP growth rate. The results of the present study also consistent with [11] and [21] as well as some other studies that stock market and GDP growth rate have a causal association with each other. Our findings are not consistent with the results of [23] as they reject any direction of causality between stock market and economic growth in the countries where the stock markets are small and less liquid. Contrary to [13], this study finds an evident similar to [12] that stock market development causes economic growth in Bangladesh. Though the contribution of the stock market in Bangladesh related to money market is still in a transition period, an impressive track record in real economic growth and stock market performance over the last two decades prompt each other indeed. Thus, policymakers of Bangladesh should give a boost to the stock market such that it functions smoothly since a well functioning stock market is expected to contribute on economic growth better than the results of this study demonstrate.

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