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# Financial Development and Economic Growth in Bangladesh and India: Evidence from Cointegration and Causality Tests

MD. ZAHIRUL ISLAM SIKDER*
MD. ABDUL WADUD**
MD. ABU HASAN***

**Abstract:** *The relationship between financial development and economic growth has been the subject of increasing attention over the 21th century. This study is basically an econometric analysis of financial development and economic growth in Bangladesh and India involving time series data of GDP, domestic credit provided by financial sector, domestic credit to private sector, and broad money from 1974 to 2015.This study employs Johansen's multivariate cointegration procedure to test the long run relationship. In addition, vector error correction model is used to test the causal relationship between financial development and economic growth. To test the statioanrity properties of the variables we use ADF and PP unit root tests and find that the variables are stationary in their difference form. Johansen's cointegration test reveals the presence of long term relationship between financial development and economic growth in Bangladesh and India. Results of ECM provide the evidence of bidirectional causal relationship between financial development and economic growth in both countries. Thus, right and effective monetary policy is very important to accelerate economic growth as both supply-leading and demand-following hypothesesare effective in Bangladesh and India.*

***Key Words:*** *Financial development; Economic Growth; Cointegration; VECM*

* Founder Principal, Dhaka City International College, Dhaka, Bangladesh
** Professor, Department of Economics, University of Rajshahi, Bangladesh
*** Assistant Professor of Economics, BCS (General Education), Bangladesh

## 1. Introduction

Financial development and economic growth are two most important components for economic development. These two components play vice versa causal role to buildup economic development. There are still old argument concerning the direction of causality between financial development and economic growth to the power of influence and the way of financial factors impact. In recent years, the relationship between financial development and economic growth has become an issue of extensive analysis. The theoretical relationship between financial development and economic growth goes back to the study of Schumpeter (1911) who identified on the services provided by financial intermediaries and argues that these are essential for innovation and development. Patrick (1966) identifies two possible directions of causality between financial development and economic growth. These relationships are labeled as the supply-leading and demand-following hypothesis. The demand-following view postulates a causal relationship from economic growth to financial development. In contrast, the supply-leading view postulates a positive impact of financial development on economic growth, which means that creation of financial institutions and markets increases the supply of financial services and thus leads to economic growth.

The relationshipbetween the financial development and economic growth is important for economic development in Bangladesh andIndia. Bangladesh andIndia experience an average rate of 4.76% and 5.86% GDP growth rate respectively over the period from 1974 to 2015 (World Bank, 2016). The trend of financial development indicatorsalso conclusively implies that Bangladesh and India and are performed well over the 42 years from 1974 to 2015 relative to other countries in this region. Though India has experienced higher average rate of growth in GDP and financial development from 1974 to 2015, Bangladesh is performing better than any other South Asian countries from 1990s.The above growth scenario motivates us to find the cointegrating and casual relationship between financial development and economic growth of Bangladesh and India. The specific objectives of this research are as follows:

i. To investigate the short-run and long-run relationship between various indicators of financial development and economic growth;

ii. To assess the causality and direction of causality between indicators of financial development and economic growth.

This research is organized as follows: section 2 reviews the literatures; data andmethodology are provided in section 3; section4 presents the empirical findings, and finally, section 5 concludes the study.

## 2.1 **Literature Review**

The relationship between financial development and economic growth has been the subject of growing attention over the past few decades. **Goldsmith (1969)** empirically shows the existence of a positive relationship between financial development and GDP per capita. **Levine et al. (2000)** find that the development of financial intermediation affects growth positively, and that cross-countries differences in legal and accounting system largely account for different degrees of financial development. **Rahman (2004)** investigates the association between financial development and economic growth in case of Bangladesh over the period of 1976-2005. Applying the structural VAR approach, he reports that financial development supports investment which increases economic growth. This confirms the validity of supply side hypothesis in Bangladesh. **Ang and McKibbin (2005)** examine the causal relationship between financial development and economic growth in Malaysia using time series data from 1960*to*2001. The ratio of liquid liabilities (or M3) to nominal GDP, commercial bank assets to commercial bank plus central bank assets , and ratio of domestic credit to private sector to nominal GDP are used to construct an index as a proxy for financial depth using principal components analysis. The findings suggest that growth exerts a positive and unidirectional causal effect on finance in the long-run.**Khan *et al.*(2005)** investigates the link between financial development and economic growth in Pakistan over the period 1971-2004. The study shows a positive impact of real deposit rate on economic growth. The authors recommend that policy makers should focus attention on long run policies to promote economic growth. **Guryay et al. (2007)** examine the link and causal relationship between financial development and economic growth on Northern Cyprus. Applying the tool of Ordinary Least Squares (OLS), the authors utilize time series data for 18 years, covering the periods of 1986-2004. Their findings reveal an insignificant positive relationship between financial development and economic growth. Another important finding worthy of reporting has to do with the direction of the causality between the two variables. Results from this test reveal that the causality runs from economic growth to financial development. **Sanusi and Salleh (2007)** examine the relationship between financial development and economic growth in Malaysia covering the period 1960-2002. Three measures of financial development are used, namely, Broad Money to GDP, Domestic Credit Provided by the Banking System, and Domestic Credit to Private Sector to GDP. By employing the autoregressive distributed lag approach, the study finds that ratio of broad money to GDP, and credit provided by the banking system have positive and statistically significant impact on economic growth in the long run. The results further indicate that a rise in investment enhances economic growth in the long run. **Pradhan (2009)** examines the long run and short run dynamics between financial development and economic growth using time series data over the period 1993-2008 in India. Applying the Johansen cointegration test, which confirms the existence of cointegration, the author declares a positive long run relationship between financial development and economic growth. The Granger causality test confirms the interdependence between financial development and economic growth in India. Considering this bidirectional relationship, the researcher documents that the effect of financial development must be considered as a policy variable necessary to stimulate economic growth and vice versa. One notable weakness of this study is the use of industrial production which is not really a sufficient proxy for economic growth. **Chakranorty (2010)** investigates the finance-growth nexus in India using different indicators of financial development and reports that stock market capitalization (financial development indicator) adds in economic growth. Using rolling regression, **Hye (2011)** investigates the relationship between financial development and economic growth in case of India over the period of 1973-2008. He notes that financial development impedes economic growth. **Hye and Islam (2013)**investigate the relationship between financial development and economic growth in Bangladesh using time series data over the period of 1975-2009. The ARDL bounds testing approach to cointegration is applied to test whether cointegration between variables exists. They find that the variables are cointegrated in the long run and financial development impedes economic growth.

We find that researchers' use different indicators of financial development and different studies use different econometric techniques. Empirical results are found mixed, so this is basically an issue of empirical investigation. So far our knowledge goes there are no studies explore this issue combindly for Bangladesh and India using cointegration and error correction modeling approach.

## 3. Data and Methodology

### 3.1 Data and Data Description

The study uses time series data ofreal GDP grwoth rate, Domestic Credit provided by the Financial Sector (as % of GDP) – DCBS, Domestic Credit provided by the Private Sector (as % of GDP) – DCPS, and M2 as Broad Money covering the period from 1974 to 2015. The data of real GDP grwothis used as dependent variable and as proxy for economic growth. Data of DCBS (as % of GDP), DCPS (% of GDP), and M2 (as % of GDP) are used as independent variable and as indexes of financial development. These data are collected from World Development Indicators (WDI)-2016 of the World Bank.

Figure 1 shows the trends of GDP growth rate of Bangladesh and India. GDP growth rate of Bangladesh falls from 9.56 per cent in 1974 to -4.09 in 1975. This is perhaps because of the effect of famine, heavy rainfall, massive flooding in 1974. The GDP growth has started increasing sharply and reached 5.66 percent in 1976. Till 1990 from 1984 there was a remarkable ups and downs in GDP growth rate. After that till 2004 the growth rate was fluctuating slowly with an average rate of growth rate of around 5.00 per cent. In 2007 the GDP growth rate reaches a peak at 6.4 per cent. After 2011 the GDP growth rate was almost stable. GDP growth rate of Bangladesh is an upward positive trends till 2015.**India has** performed **with an average 5.85 percent annual growth over the 42 years.** GDP growth rate of India was -5.24 percent in 1979 as agricultural production in 1976-77 is declined at 6%, production of commercial crops, foods, industrial

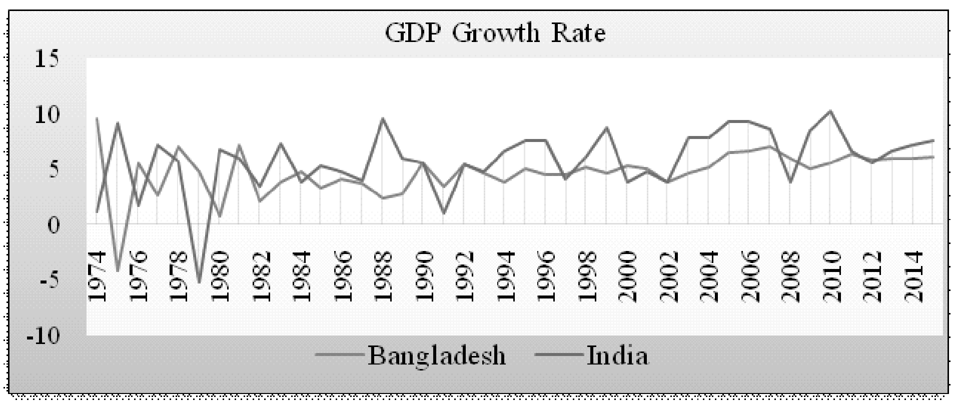


*Figure 1: GDP Growth Rate of Bangladesh and India*

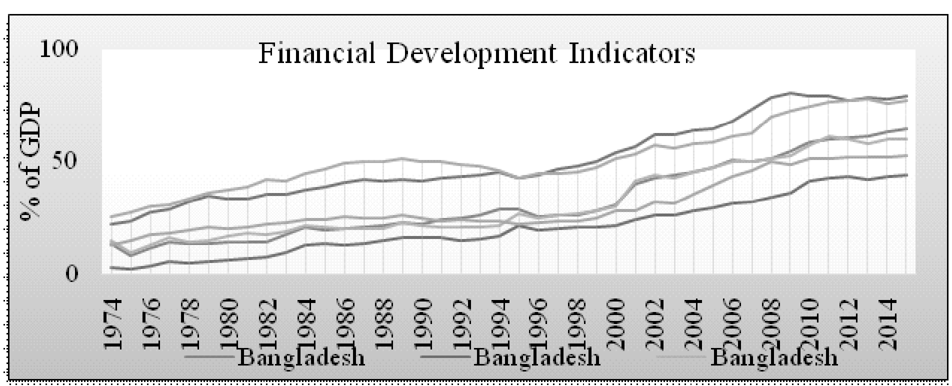


*Figure 2: Financial Development Indicators Growth Rate of Bangladesh and India*

production was low at an average rate of 10.5%. From 1980s, beginning of every decade India has launched a new set of economic reforms targeting different set of aspects of the economy and as a result, India India has experienced higher average rate of growth than Bangladesh over the years.

Figure*2shows financial development indicators growth rate of Bangladesh and India*. *T*rends of M2*, DCPS and DCBS* as*percentage*of GDP conclusively suggest that the growth rate*s* gradually rise over time from 197*4* to 2015 *in Bangladesh and India*. Average rate*s* of growth of M2 in *Bangladesh and*India is *32.09% and* 50.75% *respectively, while* DCPS of Bangladesh and India grow with 20.30% and 30.14% *respectively* over the 42 years. India also provides more DCPS over years relative to Bangladesh.

### 3.2 Methodology

There are many distinct methodologies developed in recent years for econometric analysis of time series data. In this section, the dynamic relationships between financial development and economic growth are modelled through relevant econometric modeling, such as, unit root tests, Johansen cointegration test and vector error correction mechanism.

#### 3.2.1 Unit Root Test

A test of stationarity or non-stationarity that has become widely popular over the past several years is the unit root test. There are several unit root tests to examine stationarity of the time series. The first unit root test that was introduced in econometrics by Dickey and Fuller (1979). In statistics, the Dickey–Fuller (DF) test examines the null hypothesis of whether a unit root is present in an autoregressive model. The alternative hypothesis is different depending on which version of the test is used, but is usually stationarity or trend-stationarity. The Dickey Fuller test is based on linear regression. Serial correlation can be an issue, in which case the Augmented Dickey-Fuller (ADF) test can be used. The most famous test is the augmented Dickey–Fuller test (ADF). Another test is the Phillips–Perron (PP) test. Both these tests use the existence of a unit root as the null hypothesis. ADF and PP test are used in this study to fulfill the precondition of cointegration analysis for the data series of the variables.

Dickey and Fuller (1981) have developed an augmented version of DF test, known as the Augmented Dickey Fuller (ADF). This test is conducted augmenting the preceding three equations by adding the lagged values of the variable. To be specific, Augmented Dickey Fuller (ADF) unit root test is based on the following regression equations.

$$\Delta Y_t = \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (no trend, no intercept)} \quad (1)$$

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (intercept only)} \quad (2)$$

$$\Delta Y_t = \alpha + \beta T + \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (trend and intercept)} \quad (3)$$

where $\alpha$ is a interecpt (constant), $\beta$ is the coefficient of time trend T, $\gamma$ and $\delta$ are the parameters where, $\gamma = \rho - 1$, $\Delta Y_t$ is the first difference of $Y_t$ series, m is the number of lagged first-differenced term, and $\varepsilon_t$ is the error term.

The test for a unit root is conducted on the coefficient of $Y_{t-1}$ in the regression. If the 't' statistic is less than the critical 't' values, the null hypothesis of a unit root cannot be rejected for the time series and hence, one can conclude that the time series is non-stationary at their levels.

This study also uses Phillips-Perron (PP) unit root test due to the some drawbacks of the ADF Test. Phillips-Perron (1988) develops a non-parametric unit root test. The PP test is modified from DF test so that serial correlation does no longer affect their asymptotic distribution. Whilst the ADF test addresses lags of $\Delta Y$ as regressors in the test equation, the PP test makes a non-parametric correction to the t-test statistic. The PP tests correct for any serial correlation and heteroscedasticity in the errors $\varepsilon_t$ of the test regression by directly modifying the test statistic.

### 3.2.2 Test of Cointegration

In economics, cointegration is most often associated with economic theories that imply equilibrium relationships between time series variables. Finance-Growth theory implies cointegration between GDP growth and financial development indicators. The equilibrium relationships implied by these theories are referred to as long-run equilibrium relationships, because the GDP growth and financial development indicators that act in response to deviations from equilibrium may take a long time to restore equilibrium. As a result, cointegration is modeled using long spans of low frequency time series data measured monthly, quarterly or annually. Once variables have been classified as integrated of order I(0), I(1), I(2) etc., it is possible to set up models that lead to stationary relations among the variables, and where standard inference is possible. The necessary criteria for stationarity among non-stationary variables are called cointegration.

Two formal approaches are commonly employed to observe the presence of co-integration among included series in the model. These approaches are the augmented Dickey-Fuller residual-based test approach proposed by Engle and Granger (1987) and the Johansen's Full Information Maximum Likelihood (FIML) approach (Johansen and Juselius, 1990). We apply Johansen's muitivariate cointegration procedure to test the long run relationship. Johansen's muitivariate cointegration test is based on VAR model. Gujrati (2007) argues that 'according to Sims, if there is true simultaneity among a set of variables, they should all the treated on an equal footing; there should not be any priory distinction between endogenous and exogenous variables. It is in this spirit that Sims developed his VAR model'.

Johansen methods allow us to determination of the number of cointegrating vector. These tests directly investigate the integration in VAR model. Johansen and Juselius approach based on VAR model can be expressed mathematically as:

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

where $Y_t$ is a vector containing n variables of I(1) at time t, α is an (n × 1) vector of constants, $A_\rho$ is an (n × n) matrix of coefficients, ρ is the maximum lag included in the model and $\varepsilon_t$ is an (n × 1) vector of error terms. As in Enders (2004), Equation (4) can be written in the form of the error correction model assuming cointegration of order ρ as:

$$\Delta Y_t = \alpha + (A_1 - I)Y_{t-1} + A_2 Y_{t-2} + \cdots + A_\rho Y_{t-\rho} + \varepsilon_t \tag{5}$$

or in a final broad form as:

$$\Delta Y_t = \alpha + \Gamma_1 \Delta Y_{t-1} + \cdots + \Gamma_{\rho-1} \Delta Y_{t-\rho+1} + \Pi Y_{t-\rho} + \varepsilon_t \tag{6}$$

Where, $\Gamma_i = (A_1 + A_2 + \cdots + A_{\rho-1} - I)$ represents the dynamics of the model in the short run. In Equation (5.21), $II = (A_1 + A_2 + \cdots + A_\rho - I)$ 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 Johansen and Juselius approach is to determine the rank of the matrix *II*, which represents the number of independent cointegration relationship.

Johansen (1988) suggests two test statistics named trace and eigenvalue test statistic for estimating the number of cointegrating vectors or equations. According to the Trace test, the null hypothesis ($H_0$) is that the number of distinct cointegrating vector is less than or equal to r against the alternative hypothesis of more than r cointegrating vectors. The trace statistic is computed from the following equation:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\lambda_i) \quad (7)$$

According to the maximum eigenvalue test, the null hypothesis ($H_0$) is that the number of cointegrating vectors is r, against an alternative of (r+1) vectors. The maximum eigenvalue statistics is computed as:

$$\lambda_{max}(r, r+1) = -Tln(1-\lambda_{r+1}) \quad (8)$$

Where, denotes the estimated values of the characteristic roots obtained from the estimated; *T* is the number of observations. In order to perform the Johansen cointegration test, the first step is to calculate the trace and maximum eigenvalue statistics then compare these to the appropriate critical values.

### 3.3.3 **Error Correction Model (ECM)**

Having verified if the variables under study (GDP, DCBS, DCPS and M2) are cointegrated, vector error correction model can be formulated to determine the direction of causality among the variables in case of Bangladesh and India. According to Granger representation theorem, the relationship among GDP, DCBS, DCPS and M2 can be expressed in the error correction mechanism as follows:

$$\Delta GDP_{i,t} = \alpha_1 + \sum_{i=1}^{\rho}\alpha_i\Delta GDP_{t-i} + \sum_{j=1}^{\rho}\alpha_j\Delta DCBS_{t-j} + \sum_{k=1}^{\rho}\alpha_k\Delta DCPS_{t-k} + \sum_{s=1}^{\rho}\alpha_s\Delta M2_{t-s} + \theta_1 ECT_{t-1} + \varepsilon_i \quad (9)$$

$$\Delta DCBS_{i,t} = \beta_1 + \sum_{i=1}^{\rho}\beta_i\Delta GDP_{t-i} + \sum_{j=1}^{\rho}\beta_j\Delta DCBS_{t-j} + \sum_{k=1}^{\rho}\beta_k\Delta DCPS_{t-k} + \sum_{s=1}^{\rho}\beta_s\Delta M2_{t-s} + \theta_2 ECT_{t-1} + \varepsilon_i \quad (10)$$

$$\Delta DCPS_{i,t} = \gamma_1 + \sum_{i=1}^{\rho}\gamma_i\Delta GDP_{t-i} + \sum_{j=1}^{\rho}\gamma_j\Delta DCBS_{t-j} + \sum_{k=1}^{\rho}\gamma_k\Delta DCPS_{t-k} + \sum_{s=1}^{\rho}\gamma_s\Delta M2_{t-s} + \theta_3 ECT_{t-1} + \varepsilon_i \quad (11)$$

$$\Delta M2_{i,t} = \delta_1 + \sum_{i=1}^{\rho}\delta_i\Delta GDP_{t-i} + \sum_{j=1}^{\rho}\delta_j\Delta DCBS_{t-j} + \sum_{k=1}^{\rho}\delta_k\Delta DCPS_{t-k} + \sum_{s=1}^{\rho}\delta_s\Delta M2_{t-s} + \theta_4 ECT_{t-1} + \varepsilon_i \quad (12)$$

Where, difference operator is indicated by Δ while ECT shows residual or error correction term resulted from long run cointegrating equation represents the deviation from the equilibrium in time period *t,* (-1 <θ<0). The short run parameter represents the response of dependent variable in each period starts from equilibrium. The constant terms are denoted by $\alpha_1$,$\beta_1$, $\gamma_1$ and $\delta_1$ in VECM equations and the residual terms $\varepsilon_1$ (i=1, 2, 3, 4) is assumed to be normally distributed.

The difference from Granger causality test of VAR model is that, in this case, we can test for different type of causality. While applying t-test of the error correction term, we can observe the results about long run causality. The second test for joint significance of the lagged variables indicates the short run causality. And finally the t-test for joint significance of both the lagged variables and the error correction term shows if this causality is strong or not.

## 4. Empirical Results

This section gives the empirical results of the study. It starts with presenting the results of unit root test to check the stationary properties of the data. Then, results of cointegration are presented to show the long run relationship between economic growth and index of financial development. Finally results of ECM based causality are given to show the causal relationship between financial development and economic growth in Bangladesh and India.

Financial systems vary across different countries, but in different countries these financial institutions play different roles. Some countries have the market based financial system; others have the financial system that is oriented to the financial institutions. The country selection in this research is based on different forms of financial system. There are no generally adopted rules for defining the bank-based and the market-based financial system. In this case, it is necessary to provide measures, which can partly show the form of the financial system.

### 4.1 Results of Unit Root Tests

We perform ADF and PP unit root tests on all four series in levels and first differences in order to determine the univariate properties of the data employed in the analysis. To investigate the stationary properties of the variables we run the regression analysis with an intercept term, and with intercept and trend term, and none. ADF unit root results of Bangladesh and India are presented in Table 1 to 2 respectively.

It is clear from Table 1 and 2 that all of the variables are nonstationary in their level forms with all three terms as the calculated ADF statistics are smaller than the critical values except for GDP with intercept, and with intercept and trend forms. But, GDP of Bangladesh and India are also non-stationary in level without intercept and trend term as the calculated values are smaller (in absolute form) than the critical values. Results reveal that all the variables are stationary in their first difference form with intercept, and with intercept and trend, and without intercept and trend at 1% level of significance. Results also show that first

*Table 1: Results of ADF Unit Root Test for Bangladesh*

| | Levels | | | First Differences | | |
|---|---|---|---|---|---|---|
| | Intercept | Intercept & Trend | None | Intercept | Intercept & Trend | None |
| GDP | -8.7811 | -13.5468 | 0.2649 | -8.3093 | -8.2160 | -8.3130 |
| | (0.00) | (0.00) | ( 0.76) | (0.00) | (0.00) | (0.00) |
| M2 | 1.12207 | -2.0615 | 3.6832 | -6.1552 | -6.1238 | -4.5526 |
| | (0.99) | (0.55) | ( 0.99) | (0.00) | (0.00) | (0.00) |
| DCPS | 0.7766 | -1.7239 | 4.2527 | -6.2821 | -6.3057 | -4.2749 |
| | (0.99) | (0.72) | (1.00) | (0.00) | (0.00) | (0.00) |
| DCBS | 0.4598 | -2.0393 | -2.5973 | -6.5816 | -6.4937 | -5.4076 |
| | (0.98) | (0.56) | (0.99) | (0.00) | (0.00) | (0.00) |

Note: MacKinnon (1996) one-sided p-values are presented in first brackets.

*Table 2: Results of ADF Unit Root Test for India*

| | Levels | | | First Differences | | |
|---|---|---|---|---|---|---|
| | Intercept | Intercept & Trend | None | Intercept | Intercept & Trend | None |
| GDP | -6.7202 | -7.8743 | -1.0336 | -11.5263 | -5.1595 | -11.6816 |
| | (0.00) | (0.00) | (0.27) | (0.00) | (0.00) | (0.00) |
| M2 | -0.4671 | -1.9221 | 2.1041 | -4.1186 | -4.0641 | -3.0369 |
| | (0.88) | (0.62) | (0.99) | (0.00) | (0.01) | (0.00) |
| DCPS | -0.0632 | -2.6659 | 1.0677 | -2.4899 | -2.6475 | -2.1879 |
| | (0.95) | (0.25) | (0.92) | (0.12) | (0.26) | (0.02) |
| DCBS | -0.7621 | -2.2798 | 1.0134 | -2.4826 | -4.6196 | -2.1012 |
| | (0.82) | (0.43) | (0.91) | (0.13) | (0.00) | (0.03) |

Note: MacKinnon (1996) one-sided p-values are presented in first brackets.

differences with trend for the DCPS and first differences with intercept for the DCBS are nonstationary in case of India, however; all the variables are stationary in their first difference form without intercept and none term.

The PP unit root results of Bangladesh and India are presented in Table 3 to 4 respectively.From Tables, it is clear that all of the variables are nonstationary in their level forms with all three terms as the calculated PP statistics are smaller than the critical values except for GDP. GDP is found to be stationary at level as we accept the null hypothesis of nonstationary. When we first differencs the levels forms with all terms, then the results show that all the variables are stationary in their first difference form. The combined results from the entire test therefore suggest that all the variables are I(1*)* in the levels but I (0) in first differences.

*Table 3: Results of PP Unit Root Test for Bangladesh*

| | Levels | | | First Differences | | |
|---|---|---|---|---|---|---|
| | Intercept | Intercept & Trend | None | Intercept | Intercept & Trend | None |
| GDP | -8.2436<br>(0.00) | -12.7544<br>(0.00) | -2.2371<br>( 0.03) | -25.7730<br>(0.00) | -22.9279<br>(0.00) | -23.0284<br>(0.00) |
| M2 | 1.1852<br>(0.99) | -2.1265<br>(0.52) | 3.7904<br>( 0.99) | -6.1552<br>(0.00) | -6.1487<br>(0.00) | -4.6814<br>(0.00) |
| DCPS | 1.4978<br>(0.99) | -1.6877<br>(0.74) | 4.5851<br>(1.00) | -6.3393<br>(0.00) | -6.8085<br>(0.00) | -4.2161<br>(0.00) |
| DCBS | 0.6420<br>(0.98) | -2.0298<br>(0.57) | 2.9846<br>(0.99) | -6.6365<br>(0.00) | -6.5816<br>(0.00) | -5.4343<br>(0.00) |

Note: MacKinnon (1996) one-sided p-values are presented in first brackets.

*Table 4: Results of PP Unit Root Test for India*

| | Levels | | | First Differences | | |
|---|---|---|---|---|---|---|
| | Intercept | Intercept & Trend | None | Intercept | Intercept & Trend | None |
| GDP | -6.7001<br>(0.00) | -9.3585<br>(0.00) | -1.4344<br>( 0.14) | -29.9742<br>(0.00) | -30.0325<br>(0.00) | -28.3544<br>(0.00) |
| M2 | -0.3954<br>(0.90) | -1.6229<br>(0.76) | 3.3815<br>( 0.99) | -4.1077<br>(0.00) | -4.0527<br>(0.01) | -3.0369<br>(0.00) |
| DCPS | -0.0095<br>(0.95) | -1.0026<br>(0.93) | 2.5688<br>(0.99) | -5.4887<br>(0.00) | -5.5019<br>(0.00) | -4.3903<br>(0.00) |
| DCBS | -0.6827<br>(0.84) | -1.6842<br>(0.74) | 2.5732<br>(0.99) | -4.8261<br>(0.00) | -4.7678<br>(0.00) | -3.7388<br>(0.00) |

Note: MacKinnon (1996) one-sided p-values are presented in first brackets.

## 4.2 **Results of Cointegration**

Having established that all variables are integrated of the same order, we proceed with the Johansen multivariate cointegration tests which allow us to test for long-run relationship between financial development and economic growth. The initial step for establishing the presence of a long-run relationship among the variables is to determine the optimal lag length for the VAR system. Lag-length misspecification for the VAR model often generates autocorrelated errors (Lütkepohl, 2005). To perform this step, five different criteria including the sequential modified likelihood ratio (LR) teststatistic, final prediction error criteria (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ) are used to determine the lag lengths used in the VAR. These criteria are widely used in the literature

(Lütkepohl, 2005; Enders, 2007). We proceed for each criterion with a maximum of 4 lags. Residual Serial Correlation Lagrange multilplier (LM) Test is also performed to find out if there is mutual statistical independence for the different error terms. If the residuals do not fulfill the condition, then linear dependencies exist among the residuals and hence, they are said to be autocorrelated. The presence of residual serial correlation makes the result less efficient. Thus, we proceed to conduct LM tests for each suggested lags up to maximum 4 lags. Using 1 lag produces no autocorrelation in the VAR model for up to 4 lags. So, we accept VAR (1) model for cointegrating analysis. Tables 5 to 6present the Johansen cointegration test results.

*Table 5: Cointegration Results of Bangladesh*

| Variables | $H_0$ | $H_A$ | Trace statistics | 5% critical value | Maximum eigenvalue statistics | 5% critical value |
|---|---|---|---|---|---|---|
| No deterministic trend | | | | | | |
| GDPM2 DCPS DCBS | r = 0 | r=1 | 42.0932 * | 40.1749 | 25.2951 * | 24.1592 |
| | r=1 | r=2 | 16.7981 | 24.2760 | 11.7010 | 17.7973 |
| No deterministic trend (restricted constant) | | | | | | |
| GDP M2 DCPS DCBS | r = 0 | r=1 | 65.2283 * | 54.0790 | 33.0968 * | 28.5881 |
| | r=1 | r=2 | 32.1315 | 35.1928 | 22.7231 | 22.2996 |

Note: Both trace and Maximum-eigenvalue test indicate 1 cointegrating equation at the 5 percent level.

*Table 6: Cointegration Results of India*

| Variables | $H_0$ | $H_A$ | Trace statistics | 5% critical value | Maximum eigenvalue statistics | 5% critical value |
|---|---|---|---|---|---|---|
| No deterministic trend | | | | | | |
| GDP M2 DCPS DCBS | r = 0 | r=1 | 46.89187* | 40.17493 | 29.11982* | 24.15921 |
| | r=1 | r=2 | 17.77205 | 24.27596 | 11.86805 | 17.79730 |
| No deterministic trend (restricted constant) | | | | | | |
| GDP M2 DCPS DCBS | r = 0 | r=1 | 57.85348* | 54.07904 | 30.05043* | 28.58808 |
| | r=1 | r=2 | 27.80306 | 35.19275 | 17.72633 | 22.29962 |

**Note:** Both trace and Maximum-eigenvalue test indicate 1 cointegrating equation at the 5 percent level.

Tables 5 and6 show the cointegration results among the variables for Bangladesh and India respectively. According to Tables, both trace and maximum eigenvalue test indicates the rejection of null hypothesis of no cointegrating relationship at 5 percent level of significance as the calculated statistics are greater than the critical values and hence accept the alternative hypothesis that there is cointegrating relationship among the variables. This indicates the existence of one cointegrating relationship among the variables in Bangladesh and India. It suggests the presence of a long term relationship among the variables – GDP, DCBS, DCPS and M2 in Bangladesh and India.

The long run impact of financial development on economic growth in Bangladesh can be explained with the equation13 which is derived from Table 7.Equation 13 indicates that GDP is positively related to M2 and DCBS, while negatively related to DCPS in Bangladesh.

$$GDP = 3.33 + 0.01\ M2 - 0.10\ DCPS + 0.12\ DCBS \quad (13)$$

*Table 7: Long Run Relation between Financial Development and Economic Growth in Bangladesh*

| Cointegrating Equation | Coint. Eq1 |
|---|---|
| GDP(-1) | 1.000000 |
| M2(-1) | -0.013696 |
| | (0.10676) |
| | [-0.12829] |
| DCPS(-1) | 0.096128 |
| | (0.08287) |
| | [ 1.16003] |
| DCBS(-1) | -0.121212 |
| | (0.08191) |
| | [-1.47978] |
| C | -3.326912 |
| | (0.41583) |
| | [-8.00071] |

GDP is positively related to M2 and DCBS, while negatively related to DCPS in long run.

$$GDP = 2.14 + 0.09\ M2 - 0.09\ DCPS + 0.04\ DCBS$$

*Table 8: Long Run Relation between Financial Development and Economic Growth in India*

| Cointegrating Equation | Coint. Eq1 |
|---|---|
| GDP(-1) | 1.000000 |
| M2(-1) | -0.085741 |
| | (0.07490) |
| | [-1.14480] |
| DCPS(-1) | 0.089086 |
| | (0.10043) |
| | [ 0.88704] |
| DCBS(-1) | -0.041159 |
| | (0.09281) |
| | [-0.44345] |
| C | -2.143706 |

Note: Standard errors in ( ) & t-statistics in [ ]

The long runimpact of financial development on economic growth in India can be explained with the following equation 14 which is derived from Table 8. Equation 14 for India shows that GDP is positively related to M2 and DCBS, while negatively related to DCPS in long run.

$$GDP = 2.14 + 0.09\ M2 - 0.09\ DCPS + 0.04\ DCBS \tag{14}$$

## **4**.3 **Results of ECM**

Results of Granger causality based on error correction models for Bangladesh and Indiaare presented in Tables 9 to 10. In Table 9, results of Granger causality based on error correction models for Bangladesh are presented. Coefficient of the error correction term for the cointegrating equation *GDP= f (DCBS, DCPS, M2)* is negative and significant. It indicates that the causal relationship is running from $M_2$, DCPS and DCBS to GDP. Moreover, error correction term of $M_2 = f\ (DCBS, DCPS, GDP)$ and $DCPS = f\ (DCBS, GDP, M_2)$ are significant and negative. Thus, the causal relationship is running from economic growth (GDP growth) to financial development ($M_2$ and DCPS). This result implies that bi-directional causality exists between financial development and economic growth in Bangladesh. Results imply that the finance-led growth and growth-lead finance hypothesis exists for Bangladesh.

In Table 10, results of Granger causality based on error correction models for India are presented Coefficients of the error correction terms for the cointegrating equation  and  are significant. It reveals that the causal relationships exist between financial development and economic growth. We also find that M2, DCBS and DCPS stimulate economic growth, while GDP stimulates DCBS. Results imply the finance-led growth and growth-lead finance hypothesis for India.

## **5. Conclusion**

In this study, the dynamics of the relationship between financial development and economic growth in Bangladseh and India is analyzed using time series econometric techniques for the period 1974 to 2015. Johansen based cointegration results reveal the presence of a long term relationship between financial development and economic growth in both countries. The long run impact of financial development on economic growth is also examined. We find that DCBS is the largest positive determinant of economic growth in case of Bangladesh. On the other hand, M2 is the most effective financial development variable to increase the economic growth for India. After that we verify the causal relationship between the variables in South Asian countries by using ECM based

*Table 9: Vector Error Correction Estimates for Bangladesh*

| Error Correction | D(GDP) | D(M2) | D(DCPS) | D(DCBS) |
|---|---|---|---|---|
| | -0.840770 | -0.704534 | -0.473048 | -0.499146 |
| Cointegrating Equation 1 | (0.19793) | (0.30922) | (0.19376) | (0.36700) |
| | [-4.24792] | [-2.27845] | [-2.44143] | [-1.36006] |
| D(GDP(-1) | -0.182209 | 0.229388 | 0.186682 | 0.147113 |
| | (0.11889) | (0.18574) | (0.11639) | (0.22045) |
| | [-1.53259] | [ 1.23499] | [ 1.60398] | [ 0.66733] |
| D(M2(-1) | -0.146111 | 0.600152 | 0.509898 | 0.622243 |
| | (0.15598) | (0.24369) | (0.15270) | (0.28923) |
| | [-0.93672] | [ 2.46279] | [ 3.33926] | [ 2.15139] |
| D(DCPS(-1) | -0.240663 | -0.131934 | 0.110760 | 0.075588 |
| | (0.21500) | (0.33589) | (0.21047) | (0.39866) |
| | [-1.11936] | [-0.39279] | [ 0.52624] | [ 0.18960] |
| D(DCBS(-1) | 0.096571 | -0.349600 | -0.358603 | -0.385294 |
| | (0.16183) | (0.25282) | (0.15842) | (0.30007) |
| | [ 0.59675] | [-1.38278] | [-2.26359] | [-1.28401] |
| R-squared | 0.742675 | 0.017778 | 0.167651 | 0.052922 |
| Adj. R-squared | 0.713267 | -0.094476 | 0.072526 | -0.055316 |
| Sum square residuals | 63.29968 | 154.4990 | 60.66291 | 217.6398 |
| S.E. equation | 1.344828 | 2.101014 | 1.316520 | 2.493648 |
| F-statistic | 25.25372 | 0.158369 | 1.762420 | 0.488943 |
| Log likelihood | -65.93756 | -83.78371 | -65.08660 | -90.63678 |
| Akaike AIC | 3.546878 | 4.439185 | 3.504330 | 4.781839 |
| Schwarz SC | 3.757988 | 4.650295 | 3.715440 | 4.992949 |
| Mean dependent | 0.254250 | 1.404000 | 1.045250 | 1.253750 |
| S.D. dependent | 2.511468 | 2.008286 | 1.367026 | 2.427415 |

Note: Standard errors are in ( ) & t-statistics in [ ]

causality analysis. The ECM results show that there is bidirectional causal relationship running between financial development and economic growth in Bangladesh and India.

The study suggests that financial development has a significant effect on economic growth and vice versa in Bangladseh and India. Hence, the contribution of financial development to economic growth is considerable. It may therefore be recommended that policies ought to be directed to accelerate improvements in the financial sector. Future researches can be focused on the impact of financial liberalization on financial development and thereby economic growth.

*Table 6.10: Vector Error Correction Estimates for India*

| Error Correction | D(GDP) | D(M2) | D(DCPS) | D(DCBS) |
|---|---|---|---|---|
| Cointegrating Equation 1 | -1.561185 | 0.301748 | 0.171390 | 0.376419 |
| | (0.26106) | (0.15850) | (0.14849) | (0.18233) |
| | [-5.98017] | [ 1.90375] | [ 1.15426] | [ 2.06448] |
| D(GDP(-1)) | 0.234051 | -0.021589 | 0.093799 | -0.020139 |
| | (0.16461) | (0.09994) | (0.09363) | (0.11497) |
| | [ 1.42181] | [-0.21601] | [ 1.00181] | [-0.17517] |
| D(M2(-1)) | -0.354413 | 0.513031 | 0.308792 | 0.318752 |
| | (0.30943) | (0.18787) | (0.17600) | (0.21611) |
| | [-1.14538] | [ 2.73081] | [ 1.75454] | [ 1.47494] |
| D(DCPS(-1)) | 0.677052 | 0.248868 | 0.232965 | -0.154963 |
| | (0.39315) | (0.23870) | (0.22361) | (0.27458) |
| | [ 1.72213] | [ 1.04260] | [ 1.04182] | [-0.56435] |
| D(DCBS(-1)) | -0.271664 | -0.188078 | -0.222925 | 0.297482 |
| | (0.32494) | (0.19728) | (0.18482) | (0.22694) |
| | [-0.83605] | [-0.95334] | [-1.20620] | [ 1.31082] |
| C | 0.095129 | 0.669575 | 0.560057 | 0.566617 |
| | (0.52940) | (0.32142) | (0.30111) | (0.36975) |
| | [ 0.17969] | [ 2.08315] | [ 1.85996] | [ 1.53244] |
| R-squared | 0.661422 | 0.386112 | 0.319861 | 0.289309 |
| Adj. R-squared | 0.611632 | 0.295835 | 0.219841 | 0.184796 |
| Sum square residuals | 207.1121 | 76.34723 | 67.00274 | 101.0292 |
| S.E. equation | 2.468103 | 1.498501 | 1.403805 | 1.723788 |
| F-statistic | 13.28402 | 4.276943 | 3.197957 | 2.768159 |
| Log likelihood | -89.64515 | -69.68579 | -67.07462 | -75.28814 |
| Akaike AIC | 4.782258 | 3.784289 | 3.653731 | 4.064407 |
| Schwarz SC | 5.035590 | 4.037621 | 3.907063 | 4.317739 |
| Mean dependent | -0.039750 | 1.382500 | 0.948500 | 1.227500 |
| S.D. dependent | 3.960421 | 1.785747 | 1.589334 | 1.909197 |

Note: Standard errors in ( ) & t-statistics in [ ]

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