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The Long-Run and Causal Relationship among Financial Development, Openness and Economic Growth in Bangladesh: An ARDL Bound Testing and Granger Causality Approach

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Abstract
This study examines the long run and causal relationship between economic growth, financial development and openness in Bangladesh by using autoregressive distributed lag (ARDL) bound testing approach of cointegration and error-correction based Granger causality model. ARDL bounds test approach for cointegration is run with Microfit software; ADF, PP unit root tests are carried out with STATA12 software and Granger causality test (VEC model) is done with Eviews9 software. The bounds F-test for cointegration test yields evidence of a long-run relationship between economic growth, financial development and openness. The results show that the long-run estimates of gross domestic product with respect to financial development and trade openness are positive at 1% significant level. So an increase in domestic credit to private sector and foreign trade to GDP ratio results in an increase in gross domestic product in the long-run. The cumulative sum and cumulative sum of squares tests show that the estimated parameters are stable for the sample period. A causal relationship is found from openness (foreign trade) to financial development and financial development (domestic credit to private sector) to gross domestic product.
Keywords: Economic growth, financial development, trade openness, Bangladesh.

1. Introduction

Financial development in an economy is likely to increase investment, thus formation of capital. In a capital shortage economy, the marginal productivity of investment increases in the short run and this increased productivity influences economic growth in the long-run. The services provided by financial intermediaries- mobilizing savings, evaluating projects, managing risk, monitoring managers, and facilitating transactions- are essential for technological innovation and economic development (Schumpeter, 1911). The increased efficiency of investment provides a comparative advantage to the capital scarce economies to catch-up or to converge with the richer economies in the long-run (Romer, 1986; Lucas, 1988). Definitely, no one feels interested in committing long-term investment in a country that imposes tariff and non-tariff barriers on investment and creates problem in repatriating capitals as well as profits. Degree of trade openness refers to degree of comparative advantage of a country in undertaking investment. A more open trade policy assists an economy to achieve allocative efficiency of investment and augments economic growth (Solow, 1956; Balasubramanyam et al., 1996). An economy with a higher degree of economic openness can grow faster by absorbing new technologies at a faster rate than an economy with a lower degree of openness (Edwards, 1992). So, the linkage among financial development, trade openness and economic growth is generally expected to be positive. But the question remains that whether this nexus is applicable for Bangladesh or not.

Bangladesh's economy is the second fastest growing major economy of 2016, with a rate of 7.1% economic growth. In South Asia, Bangladesh has the third-largest economy after those of India and Pakistan, and top priority is to achieve the middle income country status by 2021 in its 50th anniversary of independence. Since independence, Bangladesh has had a strongly negative trade balance. With intervene of international organizations and donor agencies, particularly under US structural adjustment program; the country had to make a big shift in policies and proceed with trade policy reform and trade liberalization, especially in the early 1980s and onward. Imports steadily ran more than double the value of exports till 1991. With a surge in export growth since 1991, the trade deficit has improved; imports exceeded exports by about 56% in 1996 and by 62% in 1997 as opposed to more than 120% in 1989/90. As a result of successful export promotion measures undertaken by the Bangladesh government during the 1980s, exports of ready-made-garments and knitwear are now Bangladesh's leading earner of foreign exchange. Total foreign trade of the country is now US$76 billion.

On the other side, The Bangladesh government initially nationalized the entire domestic banking system though foreign-owned banks were permitted to continue doing business in Bangladesh. Cooperative credit systems and postal savings offices handled service to small individual and rural accounts. The primary function of the credit system throughout the 1970s was to finance trade and the public sector. The government's encouragement during the late 1970s and early 1980s of agricultural development and private industry brought

changes in lending strategies. During this time, bank brunches have expanded rapidly, particularly in the rural areas. The expansion of bank branches reduces transaction costs associated with the mobilization and transfer of funds to increase savings and investments, and deposit creation. Financial sector consists of a banking segment and an emerging but still nascent capital/equity market segment. The banking segment in the country is relatively more developed and as in many other developing country equity markets, the Bangladesh equity market is relatively underdeveloped, small, thin, non-transparent and quite inefficient (Bashar, Hasan and Islam; 2007). During the last decades, the banking sector has evolved to become the dominant financial intermediary in Bangladeshi financial system (Nguyen, et al 2011).

Bangladesh is pursuing export-oriented industrialization and the central bank of Bangladesh has announced monetary policy for second half of FY2016-17 taking into account the recent economic and financial sector developments and targets a monetary growth path aiming at higher economic growth. The policy aims at 16.4 percent growth in domestic credit and 16.5 percent growth in private sector growth by June 2017. In this regard, this study aims at investigating the long-run and causal relationship among financial development, openness and economic growth in Bangladesh.

2. Review of literature

A number of empirical studies investigated the long-run and causal relationship among financial development, openness and economic growth for a group of developed and or developing countries such as, industrialized countries, OECD countries and small-economy countries. Shahbaz et al. (2013) reveal that there is a long-run relationship among financial development, international trade and economic growth. Bidirectional causality exists between financial development and economic growth and, international trade and economic growth in China. Siddiki (2006) finds that both financial and trade liberalization, along with investment in human capital enhance economic growth in long-run. Shahbaz et al. (2013) find that in Indonesia economic growth, energy consumption, financial development, trade openness and CO2 emissions are cointegrated in long-run. Ozturk et al. (2013) find a long-run relationship between per capita carbon emissions, per capita energy consumption, per capita real income, openness and financial development. Alfaro et al. (2006) find that developed financial markets benefit a country through backward linkages between the foreign and domestic firms with positive spillovers to the rest of the economy. Hermes et al. (2003) find that a more developed financial system positively contributes to the process of technological diffusion associated with FDI and influence economic growth positively. Edwards (1993) shows that trade openness and liberalization foster economic growth. Feder (1983) shows that economic growth can be generated not only by increases in the aggregate levels of labor and capital, but also by the reallocation of existing resources from the less efficient non-export sector to the higher productivity export sector. King et al. (1993) find that the predetermined component of financial development is robustly correlated with future rates of economic growth, physical capital accumulation, and economic efficiency improvements. Ang (2007) finds that financial development leads to higher output growth via promoting both private saving and private investment. Neusser et al. (1998) find that financial sector and GDP is cointegrated in long run in many OECD countries. Fajana (1979) finds that foreign trade has been an important engine of economic growth in long-run in Nigeria.

However, Baltagi et al. (2008) reveals that marginal effects of trade (financial) openness are negatively related to the degree of financial (trade) openness, indicating that relatively closed economies stand to benefit most from opening up their trade and/or capital accounts. Yucel (2009) shows that trade openness has a positive effect but financial development has a negative effect on economic growth in Turkey. What is more, trade openness has a statistically significant impact on economic growth. Adhikary (2011) found a strong long-run equilibrium relationship between GDP growth rate, foreign direct investment, openness and capital formation. The volume of FDI and level of capital formation are found to have significant positive effect on changes in real GDP. The degree of trade openness was found to have negative influence on GDP growth rate.

Above findings from literature review exhibit positive long-run relationship among trade openness, financial development and economic growth in one hand, and opposite relationship among those in some countries on the other hand.

3. Methodology and data

The standard functional specification of long-run relationship between GDP, openness and financial development in Bangladesh may be expressed as:

$$GDP_t = \beta_0 + \beta_1 FD_t + \beta_2 OP_t + u_t \quad \text{.....(1)}$$

In Eq (1), GDP is real gross domestic product of Bangladesh measured in constant 2005 BDT, OP is openness indicator (foreign trade, % of GDP), FD is financial development indicator (domestic credit to private sector, % of GDP) and u is the disturbance term. The annual time series data for each variable was obtained from World Development Indicators online database of World Bank between the time period 1974-2009. Natural log of each series was taken to fit the model to reduce heteroschedasticity. However, the data for each variable after

2009 are not available. The parameters, βi, i= 1, 2 indicate the long-run elasticity estimates of GDP with respect to openness and financial development, respectively. In this study, we expect β1>0 and β2>0.

3.1 Cointegration methods

In time series econometrics, cointegration techniques are usually used to explore long-run relationship. The ARDL bounds testing approach of cointegration is developed by Pesaran and Shin (1999) and Pesaran et al. (2001). The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods such as Engle and Granger (1987) and Johansen and Juselius (1990) procedures: (i) no need for all the variables in the system be of equal order of integration, (ii) it is efficient estimator even if samples are small and some of the regressors are endogenous, (iii) it allows that the variables may have different optimal lags, and (iv) it employs a single reduced form equation (Ozturk et al. 2013). It is required to test for unit root to ensure that all the variables satisfy the assumptions of the ARDL bounds testing technique of cointegration before going to the estimation stage. The critical bounds provided by Pesaran et al. (2001) are not valid in case of variables' order of cointegration is greater than one. ARDL bound test allows different time series to be either stationary at levels I(0) or differenced at I(1).

Eq (1) can be written as an ARDL model with intercept:

$$\Delta GDP_t = \alpha_0 + \sum_{g=1}^{a1} P_{t-g} + \sum_{h=0}^{b1} \alpha_{2h} \sum_{i=0}^{c1} \alpha_{3i}\Delta O \; GDP_{t-1} + \alpha_5 FD_{t-1} + \alpha_6 Op_{t-1} + v_t \quad (2)$$

Where v_t and Δ are the white noise term and the first difference operator, respectively. ARDL bounds test helps to investigate the long run relationship between variables. Null hypothesis of this test implies no cointegration $H_0 : \alpha_4 = \alpha_5 = \alpha_6 = 0$ against the alternative hypothesis $H_1: \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$.The null hypothesis will be rejected if the F statistic is higher than upper bound critical value I(1) for the number of explanatory variables. If the F statistic is lower than lower bound critical value I(0), null hypothesis will be rejected. If the F statistic lies between upper bound critical value and lower bound critical value there is indecision about cointegartion. The Schwarz Bayesian Criterion (SBC) determines optimal lag value in the above mentioned equation.

The short-run estimation or error correction model of ARDL model is estimated as equation (3):

$$GDP_t = \delta_0 + \sum_{i=0}^{p} DP_{t-i} + \sum_{i=1}^{q} \delta_{2i} + \sum_{i=1}^{r} \delta_{3i}\Delta OI \; CM_{t-i} + \tau_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The Schwarz Bayesian Criterion (SBC) is generally used in preference to other criteria because it tends to define more parsimonious specifications. SBC is used to choose lag values of p, q, r in the ARDL equation. The co-efficient of the error-correction term λECM_{t-i} is expected to be negative and significant which is known as speed of adjustment parameter shows the speed of the series how quickly it reaches the long -run equilibrium. We conducted several tests such as serial correlation, normality, heteroscedasticity tests. Stability tests such as (CUSUM) and cumulative sum of squares (CUSUMSQ) by Brown et al. (1975) are performed to see the stability of the coefficients.

3.2 Causality analysis

ARDL cointegration method tests the existence or absence of long run relationships between variables. The direction of causality is not indicated by it. In this study, causal relationship between variables has been explored by using error-correction based Granger causality model. Granger (1988) emphasizes that a vector error correction (hereafter VEC) modeling should be estimated rather than a VAR as in a standard Granger causality test, if variables in model are cointegrated.

In our case, the VEC multivariate systems take the following forms:

$$\begin{pmatrix} \Delta GDP_t \\ \Delta FD_t \\ \Delta OP_t \end{pmatrix} = \begin{pmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \end{pmatrix} + \begin{pmatrix} \pi_{11,1} & \pi_{12,1} & \pi_{13,1} \\ \pi_{21,1} & \pi_{22,1} & \pi_{23,1} \\ \pi_{31,1} & \pi_{32,1} & \pi_{33,1} \end{pmatrix} \begin{pmatrix} GDP_{t-1} \\ \Delta FD_{t-1} \\ \Delta OP_{t-1} \end{pmatrix} + \ldots + \begin{pmatrix} \pi_{11,k} & \pi_{12,k} & \pi_{13,k} \\ \pi_{21,k} & \pi_{22,k} & \pi_{23,k} \\ \pi_{31,k} & \pi_{32,k} & \pi_{33,k} \end{pmatrix} \begin{pmatrix} GDP_{t-k} \\ \Delta FD_{t-k} \\ \Delta OP_{t-k} \end{pmatrix}$$

$$+ \begin{pmatrix} \Psi_1 \\ \Psi_2 \\ \Psi_3 \end{pmatrix} ECT_{t-1} + \begin{pmatrix} \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{pmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Residual terms, ε_{2t}, ε_{3t}, ε_{4t}, are independently and normally distributed with zero mean and constant variance.

4. Empirical results

The following table shows descriptive statistics of the series for Bangladesh economy:

Table-1: Descriptive statistics of variables

	Mean	Max.	Min.	St. dev.
Log levels				
Real GDP (Constant 2005 BDT)	27.99	28.86	27.31	0.46
Domestic credit to private sector (% of GDP)	2.65	3.73	0.65	0.81
Foreign trade (% of GDP)	3.19	3.75	2.4	0.34
Growth rates (%)				
Real GDP (Constant 2005 BDT)	0.15	0.26	-0.15	0.07
Domestic credit to private sector (% of GDP)	4.88	67.69	-32.29	15.20
Foreign trade (% of GDP)	1.12	29.58	-9.09	5.95

To test for stochastic stationary in the time series data, The ADF test (Augmented Dickey-fuller test) and PP test (Phillips-Perron test) are conducted. The models are considered as models with intercept for both of the tests. Schwarz information criterion has been used for determination of lag length for the ADF test and PP test. The following table shows the results of these two tests:

Table-2: Unit Root Tests

Variables	ADF		PP	
	Test Statistic	Critical Value at 1%	Test Statistic	Critical Value at 1%
LNGDP(1)	-4.121	-2.453	-6.004	-3.682
LNFD(1)	-4.469	-2.453	-4.299	-3.682
LNOP(1)	-5.632	-2.453	-8.852	-3.682

Critical values are evaluated at 1% significant level and computed by stochastic simulations for relevant numbers of lags are in ( ).

According to ADF and PP tests (Table-2), the series are stationary in their first differences that is, the test statistics are bigger than critical values at 1% implying rejection of the null hypothesis of the test that each series has a unit root at 1% critical values. Thus, we can confidently apply the ARDL method to Eqs. (1, 2).

The ARDL bound test is generally used to test for long run relationship or cointegration among the series. The ARDL bound testing approach is based on joint F statistic with which we compare the upper bound and lower bound value. If value of joint F statistic is higher than upper bound value we say there is cointegartion among the series. If value of joint F statistics is lower than lower bound value we say there is no cointegration. If value of joint F statistics lies within the range of upper bound value and lower bound value ,there is indecision about cointegration. The results of ARDL (1,0,0) model are given in the following table:

Table-3: Autoregressive Distributed Lag Estimates

ARDL(1,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is LNGDP

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNGDP(-1)	.94611	.020336	46.5243[.000]
LNFD	.024709	.0088512	2.7915[.009]
LNOP	.059237	.016476	3.5954[.001]
INPT	1.2932	.51496	2.5114[.017]

R-Squared	.99904	R-Bar-Squared	.99894
S.E. of Regression	.014723	F-Stat. F(3,31)	10717.7[.000]
Mean of Dependent Variable	28.0131	S.D. of Dependent Variable	.45299
Residual Sum of Squares	.0067200	Equation Log-likelihood	100.1023
Akaike Info. Criterion	96.1023	Schwarz Bayesian Criterion	92.9916
DW-statistic	2.2614	Durbin's h-statistic	-.77890[.436]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	90% Lower Bound	90% Upper Bound
4.5245	3.4100	4.4031

Considering SBC criterion the best model for equation (2) is ARDL (1,0,0) model which implies p = 1,q = 0 and r = 0 (Table-3). The R^2 value is high and the computed F value of about 10717.7 is highly significant, as its *p* value is zero. The bounds F-test for cointegration test yields evidence of a long-run relationship among GDP, financial development and openness in Bangladesh. The Durbin-Watson d value is sufficiently close to 2 to

suggest no autocorrelation. All the variables are individually statistically significant at a 1% level.

The diagnostic test results are reported in the following table:

Table-4: Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .89358[.345]	F(1,30) = .78599[.382]
B:Functional Form	CHSQ(1)= 2.3902[.122]	F(1,30)= 2.1989[.149]
C:Normality	CHSQ(2)= 1.4816[.477]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 4.1746[.041]	F(1,33) = 4.4690[.042]

Lagrange multiplier test was conducted to test for residual serial correlation and accepts the null hypothesis of no serial correlation for the residuals of the model. Functional form is being determined using the Ramsey's RESET test using the square of the fitted values. The value of normality was found based on a test of skewness and kurtosis of residuals. Heteroscedasticity test was performed based on the regression of squared residuals on squared fitted values.

Due to the structural changes in Bangladesh economy it is likely that macroeconomic series may be subject to one or multiple structural breaks. For this purpose, the stability of the short-run and long-run coefficients are checked through the cumulative sum (CUSUM) (Fig.-1) and cumulative sum of squares (CUSUMSQ) (Fig.-2) tests respectively proposed by Brown et al. (1975). Unlike Chow test, requires break point(s) to be specified, the CUSUM and CUSUMSQ tests are quite general tests for structural changes in that they do not require a prior determination of where the structural break takes place.

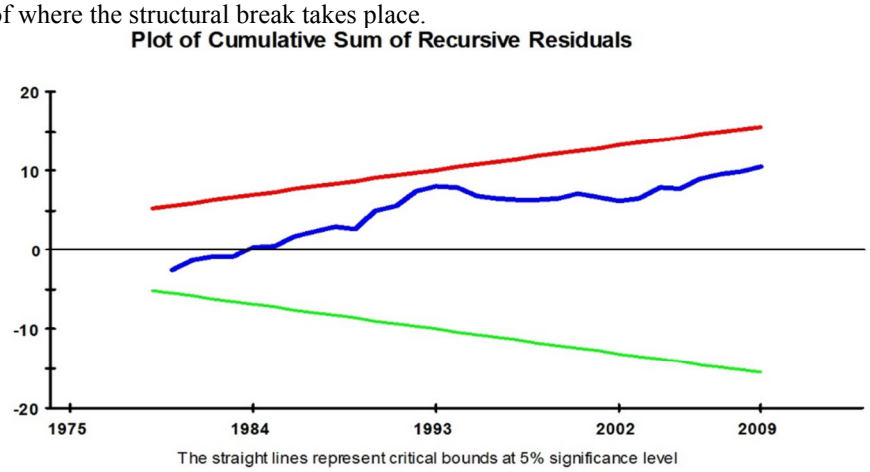

Figure-1: Plot of CUSUM test for the parameter stability

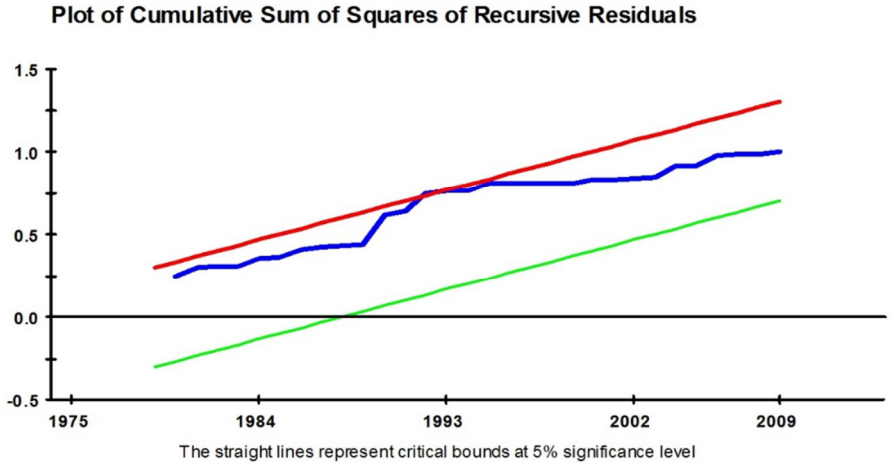

Figure-2: Plot of CUSUMSQ test for the parameter stability

Figure 1 & 2 present the plot of CUSUM and CUSUMSQ tests statistics that fall inside the critical bounds of 5% significance. This implies that the estimated parameters are stable over the periods.

The long-run estimation results are reported in the following table:

Table-5: Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0,0) selected based on Schwarz Bayesian Criterion
Dependent variable is LNGDP

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNFD	.45849	.10509	4.3630[.000]
LNOP	1.0992	.30987	3.5473[.001]
INPT	23.9977	.73578	32.6153[.000]

According to table-5, all coefficients are statistically significant at 1%. The long-run estimate of gross domestic product with respect to financial development is expected to be $\beta_1 \rangle 0$. This means as an increase in domestic credit to private sector results in an increase in gross domestic product. We found β_1 is about 0.46 at statistically highly significant level. The coefficient of openness variable is also positive at statistically highly significant level. It shows that an increase in foreign trade results in an increase in gross domestic product.

The short-run estimation results are shown in the following table where the coefficient of the error correction term is negative and significant as expected.

Table-6: Error Correction Representation for the Selected ARDL Model
ARDL(1,0,0) selected based on Schwarz Bayesian Criterion
Dependent variable is dLNGDP

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
DLNFD	.024709	.0088512	2.7915[.009]
DLNOP	.059237	.016476	3.5954[.001]
ecm(-1)	-.053891	.020336	-2.6500[.013]

List of additional temporary variables created:
dLNGDP = LNGDP-LNGDP(-1)
dLNFD = LNFD-LNFD(-1)
dLNOP = LNOP-LNOP(-1)
ecm = LNGDP -.45849*LNFD -1.0992*LNOP -23.9977*INPT

R-Squared	.53828	R-Bar-Squared	.49359
S.E. of Regression	.014723	F-Stat. F(3,31)	12.0466[.000]
Mean of Dependent Variable	.043143	S.D. of Dependent Variable	.020690
Residual Sum of Squares	.0067200	Equation Log-likelihood	100.1023
Akaike Info. Criterion	96.1023	Schwarz Bayesian Criterion	92.9916
DW-statistic	2.2614		

Results (Table-6) reveal that if gross domestic product in Bangladesh diverges away from the equilibrium level it adjusts by 5% within the first year. In the case of any external shock to GDP the speed of reaching equilibrium is significant.

A regression analysis deals with the dependence of one variable on other variables, it does not necessarily imply causation. In this study, causal relationship between variables has been explored by using error-correction based Granger causality model. The result shows that there is a causal relationship from financial development (domestic credit to private sector) to gross domestic product (Table-7). An improvement on financial sector will cause the rising of GDP. This result implies that financial development has an important role on the higher GDP in Bangladesh. So policy makers should make policies to improve financial sector in order to achieve higher economic growth. What is more, there is a causal relationship from openness (foreign trade) to financial development. An improvement on foreign trade will improve financial sector. This result implies that foreign trade has an important role on improving financial sector.

Table-7: VEC Granger Causality/ Block Exogeneity Wald Tests

Dependent variable: Δ(LNGDP)			
Excluded	Chi-sq	df	Prob.
Δ(LNOP)	1.741337	2	(0.4187)
Δ(LNFD)	16.45170	2	(0.0003)***
Dependent variable: Δ(LNFD)			
Excluded	Chi-sq	df	Prob.
Δ(LNOP)	7.841485	2	(0.0198)***
Δ(LNGDP)	1.575357	2	(0.4549)
Dependent variable: Δ(LNOP)			
Excluded	Chi-sq	df	Prob.
Δ(LNGDP)	3.278869	2	(0.1941)
Δ(LNFD)	0.647260	2	(0.7235)

Notes: The null hypothesis is that there is no causal relationship between variables. Values in parentheses are p-values for Wald tests with a $\chi 2$ distribution. Δ is the first difference operator. *** is significant at 1% level. The number of appropriate lag is one according to Akaike information criterion, Schwarz information criterion and Hannan–Quinn information criterion.

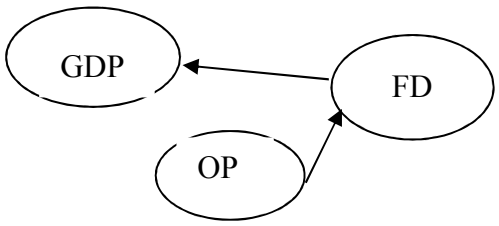

Figure-3: Granger causality relationship flows

Although there is no causal relationship from openness (foreign trade) to gross domestic product, but openness will cause financial development and financial development will cause GDP. So policy makers in Bangladesh should keep this in mind while taking policies to get Bangladesh in middle-income world.

5. Concluding remarks

This study investigates the long run and causal relationship between economic growth, financial development and openness in Bangladesh for 1974-2009 period. The ARDL bounds test for cointegration test shows evidence of a long run relationship among economic growth, financial development and openness. The coefficient of financial development variable is positive at highly significance level which reveals that an increase in domestic credit to private sector results in an increase in gross domestic product in the long-run. The coefficient of openness variable is also positive at highly significance level which shows that an increase in foreign trade results in an increase in gross domestic product in the long-run. The coefficient of estimated ECM is negative and statistically significant at 1% significance level. The value indicates that any deviation from the long-run equilibrium between variables is corrected for each period to return the long-run equilibrium level.

This study also examines causal relationship between the variables using error-correction based Granger causality models. The result reveals that there is a causal relationship from financial development (domestic credit to private sector) to gross domestic product. An improvement on financial sector will cause the rising of GDP in Bangladesh. There is also a causal relationship from openness (foreign trade) to financial development. An improvement on foreign trade will improve financial sector. Although there is no causal relationship from openness (foreign trade) to gross domestic product, openness will cause financial development and financial development will cause GDP. So policy makers in Bangladesh should keep this in mind while taking policies to get Bangladesh in middle-income world.

Finally, because of limited data availability, the findings of this study can be much enriched in future, but this study is expected to be beneficial to Bangladesh's economy to achieve its vision-2021. It is also expected that other researchers will use this findings and methodology to get more enriched insights into economic, finance, foreign trade and other sectors of Bangladesh, and of other developing countries.

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