Is the lead-lag relationship between financial development and economic growth symmetric ? new evidence from Bangladesh based on ARDL ad NARDL

Zahir, Faathih and Masih, Mansur

INCEIF, Malaysia, INCEIF, Malaysia

14 June 2018

Is the lead-lag relationship between financial development and economic growth symmetric ? new evidence from Bangladesh based on ARDL ad NARDL

Faathih Zahir[1] and Mansur Masih[2]

Abstract

The nexus between financial development and economic growth has been the subject of many literature. Researchers have tried to find if the causality is unidirectional, if so which variable causes the growth of the other or if it was bi-directional. However, the results of these researches have been conflicting and no definitive solution to this has been discovered. The purpose of this paper is to apply time series techniques to investigate this relationship. The focus of this study was based on Bangladesh because it was very recently classified by the UN as a developing country and such a study would help the government with critical information for formulating policies for its development. To the best of our knowledge, Bangladesh has not been the interest of such a study in the past. Time series techniques such as Autoregressive distributed lags (ARDL) and the more recent Non-linear autoregressive distributed lags (NARDL) were used. The results were paired with Variance decomposition techniques to strengthen the results. Annual data from 1972 to 2016 was obtained from the World Bank data bank. This study revealed that there is a strong positive co-integrating relationship between financial development and economic growth in Bangladesh and that the finance variable leads the economic growth variable suggesting a supply-leading hypothesis. Finally, the results revealed only a short run symmetry between the variables.

[1]Graduate student in Islamic finance at INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia.

[2] **Corresponding author**, Professor of Finance and Econometrics, INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia. Phone: +60173841464 Email: mansurmasih@gmail.com

1. Introduction

Recent studies, both theoretical and empirical, indicate that there has been a substantial interest in identifying the role of financial markets in fostering economic growth and development. However, finding common ground between promoters of both views of the supply-leading hypothesis and the demand-following hypothesis has been difficult. Empirical literature both country specific and cross countries have yielded conflicting results. As characteristics differ from country to country such as the politics, economic policies, culture, institutional arrangements, level of financial development, and role of financial institutions in the economy, the causal relationship between the two variables may also be country specific. The results also differed according to the control variables used in the studies.

Regardless there has been strong views from both sides regarding this debate. While some economists believe that a finance-growth relationship is important, some of the more sceptic developmental economists question the role of the financial system at all in fostering economic growth. And while some empirical studies also show that finance is a substantial driver of economic growth, others conclude that relationship runs from economic growth to financial development.

Why Bangladesh?

In March 2018, the UN Committee for Development Policy (CDP) announced that Bangladesh had fulfilled the requirements to be eligible for graduation from the list of least developed countries to developing countries. The eligibility criteria for graduation depends upon achieving certain scores in Gross National Income (GNI) per capita, the Human Assets Index (HAI) and the Economic Vulnerability (EVI) Index and other country-specific information. They had been on the list of least developed countries since 1975. While accepting the letter of graduation, the Bangladesh Permanent Ambassador to the UN Masud Bin Momen announced that Bangladesh was setting its goal to be listed as a developed economy by the year 2041. For the country to graduate in little over twenty years, the fiscal and economic policies have to be formulated in ways that would achieve the maximum growth. Understanding which areas to focus is therefore of great necessity.

Lying on the Bay of Bengal, east of India, this small island nation's economy ranks 44th in nominal terms of gross domestic product (GDP) at USD221 billion expected to grow at 7.3%.

According to IMF, the Bangladesh economy is the second fastest growing major economy at the end of 2016 and was classified among the Next Eleven emerging market economies and a Frontier market. The economy of Bangladesh has been largely driven by the export of readymade garments, remittances and the domestic agriculture sector. It is one of the largest textile exporters trading across the globe. With a population of 160 million, the unemployment rate is 4.2% while a 2016 World Bank study revealed that 24.3% of the population still live in poverty of which 12.9% live in extreme poverty. The progress to eradicate poverty has been steadily rising however it is slow.

In keeping with the developmental goals, the annual budget for 2017/18 was increased by 20.76%. The main source of income for the Bangladesh government is taxes therefore to finance the budget a number of tax reforms both legal and administrative were also adopted during the year. The 2017 government debt to GDP ratio was 27.1% and the current account to GDP ratio was -0.6%. The country's inflation rate is 5.68%. The Dhaka stock exchange (DSE) is still very small with a market capitalization of $39.28 billion ranked 48th in the world.

Despite the developmental goals achieved, the financial sector of Bangladesh does not grow at par with the economic growth. This results of this study may help the country to better understand this nexus to formulate policies for both its economic and financial growth.

Research Gap

Bangladesh has not been the interest of a research to study the causal relationship between financial development and economic growth using NARDL techniques. Also, in spite of the numerous studies to identify this relationship using other time series techniques, no consensus has been achieved in both theoretical and empirical researches. Therefore, an humble attempt has been made to research the causality between these variables.

Our research questions are as follows;

1. Is there a relationship between development of the financial sector and the economic growth of a country? If so, is it a positive relationship or a negative relationship?
2. What is the lead-lag relationship between the variables and which variable is the leader (exogenous) and which variable is the follower (endogenous)?
3. Is the short run relationship between the variables maintained in the long run?

Contributions of the study

In addition to the Autoregressive Distributed Lags (ARDL), we have used in this study the most recent time series technique, Non-linear autoregressive Distributed Lags (NARDL) which unlike ARDL does not assume that the adjustment of the error term will be linear or symmetric. This new technique would help us better investigate the causal relationship between these two variables.

Data from Bangladesh used from 1972-2016 has not, to the best of our knowledge, been the interest of another study investigating this relationship.

Major findings and policy implications

The results indicate that the effect of financial development on growth is positive, and the causality runs from financial variables to the economic variables. However, the symmetry between the variables is only short run.

As a policy implication, we recommend that supply side policies that foster the growth of the financial sector to mobilize the economy. Also, efforts to increase financial investments to the country should be explored. Finally, government stance on exporting cheap labour could also be revisited to be more limited to increase the supply of labour in the country.

Structure of the paper

The paper is structured as follows. Section II reviews the past theoretical and empirical literatures on this subject. Section III presents the methodology adopted for this study and findings. Section IV presents the analysis of the empirical results and the findings. Section V is focuses on the policy implications of the findings. Section VI summarizes the research with conclusion.

2. Literature Review

The literature on the granger causality between financial development and economic growth is divided. Countless researches, both theoretical and empirical, have tried to fill this gap with conflicting results. This section tries to support the research questions of this study with past theoretical and empirical literature.

- Is there a relationship between development of the financial sector and the economic growth of a country? If so, is it a positive relationship or a negative relationship?
- What is the lead-lag relationship between the variables and which variable is the leader (exogenous) and which variable is the follower (endogenous)?
- Is the short run relationship between the variables maintained in the long run?

2.1 Theoretical answers to the questions

In 1966, Hugh T. Patrick identified the directions of causality between financial development and growth as the supply-leading and demand following hypotheses. He posited that in a supply leading hypothesis the causal relationship leads from financial to economic growth. According to this hypothesis, a deliberate creation of financial institutions and markets increases the supply of financial services which in turn leads to real economic growth. On the other hand, he postulates that in a demand-following hypothesis, the causal relationship leads from economic growth to financial development. He described that as the real economy grows it might induce an increasing demand for financial services leading to the expansion in the financial sector. Additionally, Patrick (1966) proposed a hypothesis for stage of development. This hypothesis theorizes that supply leading financial development induces formation of real capital for economic development in its early stages. This leads to the development of new financial services and opportunities for investors and savers thus forming a self-sustained economic growth. Further, the theory states that as financial and economic development proceed, the supply leading characteristics of financial development gradually diminishes and is dominated by demand following financial development.

More recently, the relationship concerning financial development and growth has been identified to be of three types. They are growth driven finance, finance led growth and the two way causal relationship known as the feedback hypothesis.

The finance led growth hypothesis suggests that the development of the financial sector has an important role in the growth of the economy. It states that an efficient financial sector is able to pool the limited credit resources from the surplus units and direct them to deficits. The financial sector promotes efficient allocation of resources Akinlo and Egbetunde (2010) and Ghali, (1999) are among the researchers whose work support this hypothesis. The endogenous growth theory (Lucas, 1988) highlights the positive role of the financial sector in boosting economic growth, by allocating resources to the most productive investments, mobilizing savings, reducing information, transaction and monitoring costs, diversifying risks, and facilitating the exchange of goods and services. This results in a more efficient allocation of resources, more rapid accumulation of physical and human capital, and faster technological progress.

On the other hand, some economists support the growth driven finance hypothesis and argued that is the increase in growth that leads to the improvement in financial sector. The argument is that the high economic growth increases demand for some categories of financial assets and arrangement and that financial market reacts passively to these increasing demands. This hypothesis is supported by scholars such as Agbetsiafa (2003) and Robinson (1952). Interestingly, Cecchetti and Kharroubi (2012) argued that the relationship of the finance-growth nexus is non monotonic and as bank credit to private sector/ GDP increases, finance becomes a drag on growth. They postulated that a faster rate of growth of the financial sector may be in fact be detrimental to economic growth because the financial sector will start competing for resources with the rest of the economy.

Further, Lewis (1955) postulated that a two way relationship exists between the two variables where the financial market develops as a result of economic growth, which in turn feeds back as a stimulant of real economic growth. This hypothesis is supported by Hussein (1996).

2.2 Empirical answers to the questions

Researcher Goldsmith (1969) in a cross country study of 34 countries showed that the size of the financial system contributes positively to growth. His study assumed that both financial intermediation and growth were endogenous. Levine (1993) criticized Goldsmiths approach and suggested that in addition to the sample size of his study being small and the focal point of causality not being tested, the variables that could impact growth were not accounted for and the operation of the financial organization was not assessed. Following the neo-Schumpeterian

model, King and Levine (1993) improved on the study of Goldsmith and increased the sample size to 77 developing countries during 1960-1989 including control factors. The result indicated a positive relation between each one of the economic growth and financial indexes. However, they too did not address the causality issue. Further, a study by Beck et al. (2000) of seventy one countries during 1960-1995 for the causality between financial intermediaries and economic growth revealed that improvement of financial intermediaries has significant impact on economic growth. Rioja and Valev (2004) concluded that the development of the financial sector has a greater impact on economic growth in affluent countries compared to low-income countries.

A research by Odhiambo (2007) of three Sub-Saharan African countries yielded conflicting results. He concluded that Kenya and South Africa showed evidence of a demand following hypothesis while a supply leading hypothesis was evidenced in Tanzania. Additionally, a study by Naceur and Ghazouani (2007) empirically concluded that the simultaneous effect of banks and financial system development on economic growth and there no significant relationship between banking, stock market development and growth. They further concluded that the association between bank development and the growth of the economy is negative. However, they did disclose that this might be attributed to the underdeveloped financial systems in some of the sample countries.

Additionally, while examining the long-run relationship between financial development and economic growth with evidence from Poland, Kenougios and Samitas (2007) concluded that one the main driving forces for long-run growth is credit to the private sector. Allen and Ndikumana (1998) also found a long run positive correlation between economic growth and intermediation of the financial sector in the South African Development Community (SADC). On the other hand, Le Roux and Moyo (2015) used GMM estimates for SADC countries and found only a short run positive relationship between the variables. Moreover, a study emphasizing the difference between short-run and long-run impacts of financial sector development of economic growth, Loayza and Ranciere (2002) empirically concluded that the negative short-term relationship is related a surge in financial crisis.

3. Methodology

3.1 Data Description

The empirical analysis is based on annual data from 1972 to 2016 (45 years). All the annual data was obtained from the World Banks' World Development Indicators (WDI) online database. The econometrics analysis was carried out using Microfit and Stata.

3.2 Model Specification

GDP per capita growth (annual %) was taken as a proxy for economic growth. It is denoted by GDP. Financial Development is measured as a ratio of broad money (M2) to GDP and is represented by BRD. This variable shows the financial depth of a growing economy. This variable is therefore expected to increase overtime if the financial sector develops faster than the real sector on one hand, and decrease if the financial sector develops slower than the real sector. The second proxy of financial development is domestic credit to the private sector as a percentage of GDP which is denoted as CRE. It is assumed that credit provided to the private sector will generate larger increases in investment and productivity. The ratio of gross national expenditure to GDP denoted by EXT is used as an indicator of macroeconomic stability. And finally, Foreign Direct Investments to GDP denoted by FDI was used as a control variable.

$$GDP = \int (BRD, CRE, EXT, FDI)$$

3.3 Motivating the methodology

Auto Regressive Distributed Lag (ARDL) is used for testing presence of a long term co-integrating relationship between lagged levels of variables and helps to identify endogeneity and exogeneity of variables. The ARDL test proposed by Paresan, Shin and Smith in 2001 was free from the limitations of the unit root and co-integration tests that used in time series techniques. This new model did not warrant the variables to be $I(0)$ or $I(1)$ and was more robust despite a small sample size (Pattichis, 1999; Mah, 2000, and Tang and Nair, 2002).

The ARDL model specifications of the functional relationship between GDP per capita growth (GDP), Broad money as a share of GDP (BRD), domestic credit to private sector as a share of GDP (CRE), gross national expenditure as a share of GDP (EXT) and foreign direct investments as a share of GDP (FDI) can be estimated as follows;

$$DGDP_t = \alpha_0 + \sum_{i=1}^{k} b_1 DGDP_{t-i} + \sum_{i=1}^{k} b_2 DBRD_{t-i} + \sum_{i=1}^{k} b_3 DCRE_{t-i} + \sum_{i=1}^{k} b_4 DEXT_{t-i}$$

$$+ \sum_{i=1}^{k} b_5 DFDI_{t-i} + b_6 LGDP_{t-i} + b_7 LBRD_{t-i} + b_8 LCRE_{t-i} + b_9 LEXT_{t-i}$$

$$+ b_{10} LFDI_{t-i} + \mu_t$$

Further, the non-linear ARDL technique developed by Shin et al (2014) is used to estimate short and long run dynamics. This model relaxes the assumption used by ARDL that the adjustment of the error term is both linear and symmetric. Further, when the time series are noted to have co-integration using their positive and negative components the case of nonlinear co-integration is applied. The NARDL framework allows modelling asymmetric co-integration using positive and negative partial sum decompositions and detecting the asymmetric effects both in the short- and long- run. It also allows the joint analysis of the issues of non-stationarity and nonlinearity in the context of an unrestricted error correction model.

The nonlinear co-integrating regression (Shin et al., 2014) is specified as:

$$y_t = \beta^+ X^+ + \beta^- X^- + \mu_t$$

where β^+ and β^- are the long term parameters of $kx1$ vector of regressor X_t, decomposed as:

$$X_t = X_0 + X_t^+ + X_t^-$$

where X_t^+ (X_t^-) are the partial sums of positive (negative) change in X_t as follows:

$$X_t^+ = \sum_{k=1}^{t} \Delta X_k^+$$

$$X_t^- = \sum_{k=1}^{t} \Delta X_k^-$$

4. Analysis of Results and Findings

The unit root tests help us to identify is the variables used in the study are I(0) or I (1) using the tests of stationarity and non-stationarity. If the variable is stationary it shows that the variance is finite and the shocks are only transitory. On the other hand, if it is non stationary it means that the shocks would be permanent and variance is infinite.

Since the variables of the study were already in percentage form, it was used as is, and was not converted into its log form to make the variance stationary though signified by L. Next, the first difference of the variables was taken to make the mean stationary.

4.1 Unit Root Tests

Table 1: Results of the Augmented Dicky Fuller (ADF) Test of Non Stationarity

	VARIABLE	ADF	VALUE	T-STAT.	C.V.	RESULT
LOG FORM	LGLD	ADF(3)=AIC	- 68.6056	- 2.988	- 3.528	Non stationary
		ADF(4)=SBC	- 73.5963	- 2.988	- 3.528	Non stationary
	LBRD	ADF(5)=AIC	- 84.7272	- 1.464	- 3.528	Non stationary
		ADF(5)=SBC	- 91.3815	- 1.464	- 3.528	Non stationary
	LCRE	ADF(5)=AIC	- 71.5833	- 1.186	- 3.528	Non stationary
		ADF(5)=SBC	- 78.2376	- 1.186	- 3.528	Non stationary
	LEXT	ADF(3)=AIC	- 64.6576	- 1.618	- 3.528	Non stationary
		ADF(3)=SBC	- 69.6482	- 1.618	- 3.528	Non stationary
	LFDI	ADF(5)=AIC	5.9547	- 1.359	- 3.528	Non stationary
		ADF(4)=SBC	- 0.2169	- 1.069	- 3.528	Non stationary

	VARIABLE	ADF	VALUE	T-STAT.	C.V.	RESULT
1st DIFFERENCED FORM	DGLD	ADF(2)=AIC	- 63.2480	- 6.408	- 2.940	Stationary
		ADF(2)=SBC	- 66.5231	- 6.408	- 2.940	Stationary
	DBRD	ADF(5)=AIC	- 84.7475	- 2.736	- 2.940	Non Stationary
		ADF(5)=SBC	- 90.4791	- 2.736	- 2.940	Non Stationary
	DCRE	ADF(5)=AIC	- 70.4669	- 2.266	- 2.940	Non Stationary
		ADF(5)=SBC	- 76.1985	- 2.266	- 2.940	Non Stationary
	DEXT	ADF(1)=AIC	- 62.5622	- 4.561	- 2.940	Stationary
		ADF(1)=SBC	- 65.0186	- 4.561	- 2.940	Stationary
	DFDI	ADF(5)=AIC	4.5858	- 3.090	- 2.940	Stationary
		ADF(4)=SBC	- 0.7358	- 2.634	- 2.940	Non Stationary

Table 2: Results of PP and KPSS Tests

VARIABLE	PP TEST			KPSS TEST		
	T-STAT.	C.V.	RESULT	T-STAT.	C.V.	RESULT
LGDP	-14.0052	-3.469	Stationary	0.1463	0.190	Stationary
LBRD	-1.364	-3.469	Non Stationary	0.138	0.190	Stationary
LCRE	-1.518	-3.469	Non Stationary	0.138	0.190	Stationary
LEXT	-4.951	-3.469	Stationary	0.115	0.190	Stationary
LFDI	-2.905	-3.469	Non Stationary	0.139	0.190	Stationary
DGDP	-31.970	-2.925	Stationary	0.299	0.371	Stationary
DBRD	-5.630	-2.925	Stationary	0.289	0.371	Stationary
DCRE	-6.395	-2.925	Stationary	0.279	0.371	Stationary
DEXT	-17.351	-2.925	Stationary	0.142	0.371	Stationary
DFDI	-9.448	-2.925	Stationary	0.182	0.371	Stationary

It is evident from the results that unit root tests of all the variables are consistent across different tests. First difference form of Engle Granger test and Level form of PP test yield conflicting results. It is evident from the results that the variables used in this analysis are I(0) and I (1). Due to this inconsistency we decided to use the ARDL techniques to test the long run relationship among the variables. However, before we move on to that test, we will try to determine the order of the vector auto regression (VAR).

4.2 VAR Order Selection

Order	AIC	SBC	p-Value	C.V.
2	1636.7	1539.8	[.123]	5%

While trying to determine the optimal order of the VAR, we identify the highest AIC and SBC values. Another method is to look at the adjusted LR test. Our findings show that the optimal lag order for this study is two lag order.

4.3 Testing for Co-integration

Table 3: Engle – Granger (EG) Test

	Test Statistic	LL	AIC	SBC	HQC
DF	-7.9697	-82.6147	-83.6147	-84.4202	-83.8987
ADF(1)	-4.9315	-82.5832	-84.5832	-86.1941	-85.1511
ADF(2)	-3.0080	-81.7486	-84.7486	-87.1650	-85.6005

95% critical value for the Dickey-Fuller statistic = -4.8026

According to our results, the test statistic for the highest AIC and SBC values is lower than the critical value at 95%. This indicates that the variables we have chosen, in some combination results in a stationary error term. However, the EG test has a limitation can only test for one co-integration and the variables may be fractionally co-integrated. Therefore we decided to go for Johansen co-integration test.

Table 4: Johansen Co-integration Test

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r = 1	87.616	37.860	35.040	1 cointegration
r<= 1	r = 2	30.434	31.790	29.130	

Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r>= 1	157.234	87.170	82.880	2 cointegration
r<= 1	r>= 2	69.617	63.000	59.160	
r<= 2	r>= 3	39.184	42.340	39.340	

The Maximal Eigenvalue and Trace test results of the Johansen co-integration tests are not uniform and it contradicts with the results of the Engle Granger test. Therefore, we decided to test co-integration using the ARDL technique as it addresses the limitations of both the EG and Johansen Test.

Before we test the co-integrating relationship between the variables, we check for the existence of a long run relationship between the variables. It is necessary to establish that the variables have an long run relationship to rule out the possibility of a spurious relationship between he variables. We can only proceed to the ARDL co-integration tests if the variables show evidence of a theoretical relationship between them.

Table 5: F-Statistics for testing the existence of Long-Run relationship (Variable Addition Test)

	F Statistic	Critical Value Lower	Critical Value Upper
LGDP	26.9004*	2.649	3.805
LBRD	2.4949	2.649	3.805
LCRE	0.73875	2.649	3.805
LEXT	4.5145*	2.649	3.805
LFDI	3.7912	2.649	3.805
The critical values are taken from Pesaran et al. (2001), unrestricted intercept and no trend. *denotes rejecting the null at 5 percent level			

The results confirm that the F statistic for LGDP and LEXT are above the Paresan et al (2001) critical values at 95% significance level, thus ruling out the hypothesis of no long run relationship between the variables.

Table 6: ARDL Bounds Test for the existence of a Level Relationship

	F Statistic	Lower Bound	Upper Bound
LGDP	34.0461*	3.1778	4.4343
LBRD	1.547	3.3294	4.4942
LCRE	6.1693*	3.3294	4.4942
LEXT	5.1224*	3.3294	4.4942
LFDI	4.5742*	3.3294	4.4942
The critical values are taken from Pesaran et al. (2001), unrestricted intercept and no trend. *denotes rejecting the null at 5 percent level			

The results of the tests for existence of a level relationship between the variables, we can rule out any possibility of a spurious relationship between the variables. The F-statistics for all varibales except for LBRD are above the Paresan et. Al (2001) critical values giving compelling evidence of co-integration between financial development and economic growth.

The empirical results thus far support a supply leading hypothesis that finance development leads to economic growth in Bangladesh. In order to achieve more economic growth, the government policies should revolve around the supply side of the chain such as strengthening the financial markets of Bangladesh and allow for more credit to be dispersed into the private sector to mobilize the economy. Additionally, since government should strengthen and widen political and economic ties to increase the flow of FDI into the country. FDI is also found to be an integral part of economic growth of Bangladesh.\

Table 7: Results for Estimated Long-Run Coefficients using the ARDL Approach

Estimated Long Run Coefficients using the ARDL Approach
     ARDL(1,0,0,0,0) selected based on Schwarz Bayesian Criterion
****
 Dependent variable is LGDP
 44 observations used for estimation from 1973 to 2016
****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LBRD	.13986	.087407	1.6001[.118]*
LCRE	-.084858	.11205	-.75730[.454]*
LEXT	.052728	.12936	.40760[.686]
LFDI	.43978	1.1029	.39876[.692]
INPT	8.5828	13.3381	.64348[.524]

****
Note: * denotes significant at 5 percent level

According to the results of the ARDL estimated long run coefficients, BRD and CRE are found to have a significant impact on the economic growth of Bangladesh. It shows that for every 1% increase in M2 money supply, GDP will rise by 1.6% and for every 1% increase in domestic credit to private sector, GDP will increase by 0.75%. However, these results are do not reflect to be economically sound. GDP represents a plethora of variables and it is unlikely that the changes in the financial variables will have a definitive reflection on the growth variable.

Regardless, the ARDL test also has its limitations. It assumes that the adjustment of the error correction term is both linear and symmetric. Therefore, we decided to test the variables using the non-linear ARDL technique which relaxes these limitations.

NARDL Test for long-run co-integration using bounds testing for co-integration

Co-integration test statistics: $t\_BDM =$ -4.7352

                                     $F\_PSS =$ 7.7234

	Lower Boundary	Upper Boundary
95% critical value bounds	3.79	4.85

The F-statistic of the NARDL co-integration shows an F-statistic greater than the upper boundary of the Paresan et. al (2001) critical values thus confirming co-integration between

the variables. We therefore, decide to test of this relationship between the variables in the short run or long run.

Asymmetry statistics:

	Long-run effect [+]			Long-run effect [-]		
Exog. var.	coef.	F-stat	P>F	coef.	F-stat	P>F
brd	0.087	19.06	0.000	0.103	.4001	0.534
	Long-run asymmetry			Short-run asymmetry		
	F-stat	P>F		F-stat	P>F	
brd		1.641	0.213		.4695	0.500

Note: Long-run effect [-] refers to a permanent change in exog. var. by -1

The results of the test reveals that the p value of the long-run symmetry is below the 5% significance value thus ruling out the possibility of a long run symmetry between the variables. However, the short-run symmetry p value shows that it is significant at 5% significance thus ruling out the hypothesis of no short run relationship. The data and variables of this research reveal only a short run symmetric relationship between the variables but no long-run symmetry.

Figure 1 below shows the cumulative effect of the finance proxy of this research on the economic proxy.

Note: 90% bootstrap CI is based on 100 replications
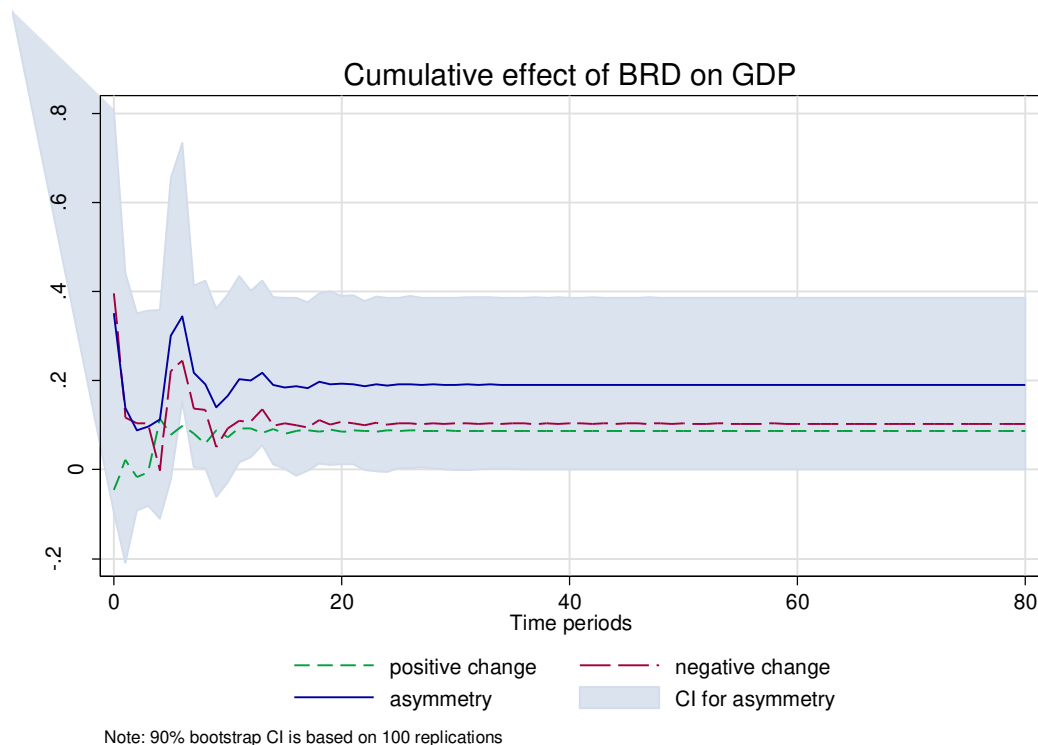
Next, we used LRSM exact and over identifying methods to normalize the coefficients by imposing restrictions on the focus variable and subsequently to the insignificant variables.

4.4 Long Run Structural Modelling

Table 8: LRSM with exact and over identification

	A1=1	A1=1; A2=0	A1=1; A4=0	A1=1; A2=0; A4=0
	Vector 1	Vector 2	Vector 3	Vector 4
LGDP	1.0000	1.0000	1.0000	1.0000
	(*NONE*)	(*NONE*)	(*NONE*)	(*NONE*)
LBRD	-0.052975	0.0000	-0.049593	0.0000
	-0.040083	(*NONE*)	-0.040831	(*NONE*)
LCRE	0.24017	0.18977	0.21846	0.17264
	-0.068433	-0.058585	-0.066774	-0.056515
LEXT	-0.094625	-0.087634	0.0000	0.0000
	-0.085567	-0.089211	(*NONE*)	(*NONE*)
LFDI	-2.1967	-2.6212	-2.4444	-2.828
	-0.63672	-0.57871	-0.61261	-0.54999
Trend	-0.23095	-0.23498	-0.19637	-0.20259
	-0.053464	-0.055732	-0.043864	-0.045225
		CHSQ(1)= 1.6522[.199]	CHSQ(1)= 1.1991[.273]	CHSQ(2)= 2.6054[.272]

LRSM results show that, broad money variable and the gross expenditure of the government variable are insignificant. The p value of the Chi Square both individual and joint restrictions show that is it significant revealing that the restrictions are correct and these variables could be dropped from the research. However, these variables though insignificant may be the variables that bring about the cointegration of all the variables. Thus, we decide not to drop these insignificant variables from the research.

Next, we move on to the vector error correction model. VECM helps us to identify the variables that are exogenous (leaders) and exogenous (followers). We used the ARDL model of the VECM and the below results were selected using the SBC criterion. The coefficient of the variables represent the speed of adjustment of the variables to equilibrium. If the values are negative and between 0 and -1, it means that the variables have moderate to fast speed of adjustment to equilibrium. If it is 0 it means there is no equilibrium. And if it is positive, it means that the variable moves away from equilibrium in the long run.

4.5 Vector Error Correction Model

Table 9: Error correction model of ARDL

Variables	Coefficients	Standard Error	T Value [p-value]	Decision
ecm(-1) dLGDP	-1.1861	0.091474	-12.9670[.000]	Endogenous
ecm(-1) dLBRD	-0.19672	0.1052	-1.8701[.069]	Exogenous
ecm(-1) dLCRE	-0.19221	0.077673	-2.4746[.018]	Endogenous
ecm(-1) dLEXT	-0.65832	0.14943	-4.4055[.000]	Endogenous
ecm(-1) dLFDI	-0.54784	0.14208	-3.8559[.000]	Endogenous

The t-ratio or the p value indicate whether the feedback effect on the dependent variable is significant or not. The results display that broad money (M2 money supply) is the only exogenous (leader) variable in the study. All the other focus and control variables are endogenous (followers).

Regardless of the whether the variable is endogenous or exogenous, a significant error correction coefficient signifies that there is a long-run co-integrating relationship between the variables.

However, this result contradicts the NARDL long run symmetric test results that only showed a short run significant relationship between the variables.

4.6 Variance Decompositions
Table 10: Generalized VDC

The ECM model only shows the absolute endogenity or exogeneity of the variables. However, a variance decomposition test would help us to identify their relative exo/endogeneity.

	HORIZON	LGDP	LBRD	LCRE	LEXT	LFDI	TOTAL	SELF-DEP	RANKING
LGDP	5	49.06%	13.15%	8.55%	4.64%	24.60%	100.00%	49.06%	5
LBRD	5	12.46%	81.49%	3.93%	1.80%	0.33%	100.00%	81.49%	2
LCRE	5	12.82%	30.83%	50.98%	5.24%	0.14%	100.00%	50.98%	4
LEXT	5	2.94%	1.51%	9.35%	85.80%	0.40%	100.00%	85.80%	1
LFDI	5	12.90%	9.61%	0.98%	0.17%	76.35%	100.00%	76.35%	3

	HORIZON	LGDP	LBRD	LCRE	LEXT	LFDI	TOTAL	SELF-DEP	RANKING
LGDP	10	39.85%	16.53%	9.74%	3.38%	30.50%	100.00%	39.85%	5
LBRD	10	12.26%	82.52%	3.25%	1.75%	0.20%	100.00%	82.52%	2
LCRE	10	12.96%	32.13%	49.52%	5.29%	0.10%	100.00%	49.52%	4
LEXT	10	2.07%	0.90%	10.47%	86.28%	0.28%	100.00%	86.28%	1
LFDI	10	13.40%	10.37%	0.14%	0.12%	75.98%	100.00%	75.98%	3

The results of the VDC conflict with the ARDL ecm tests. Therefore, we rely on the results of the VDC to identify the exo/endogeneity of the variables as VDC uses the model of exogeneity using the variable that can be explained mostly by its own past. Further, the generalized VDC does not rely on any particular ordering of the variables and does not assume that when one variable is shocked, the others are switched off.

4.7 Impulse Response Function
Figure 2: Impulse Response

**Generalised Impulse Responses to one SE shock in the equation for DBRD**
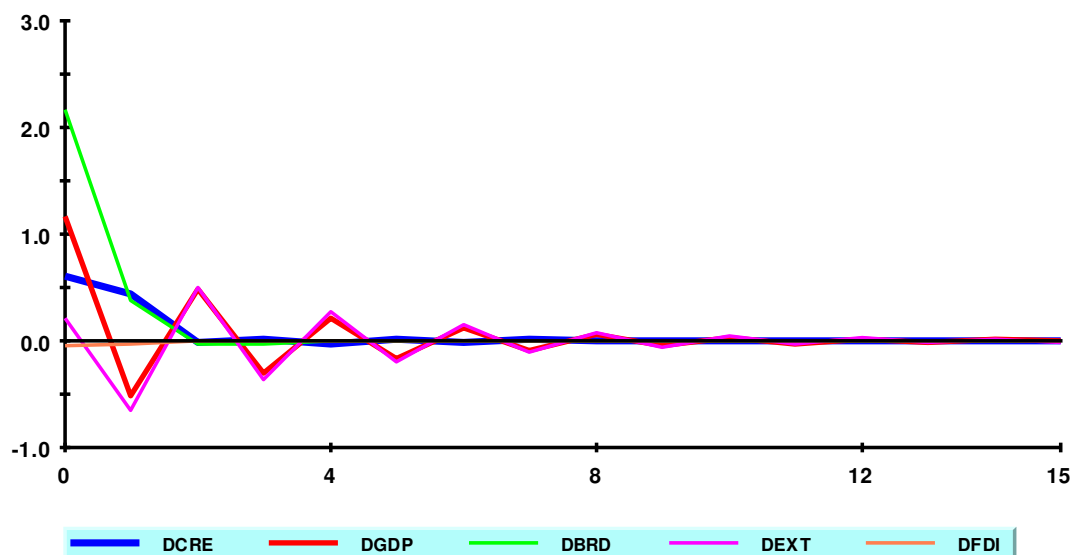
The Impulse response and VDCs essentially provide the same results but IR can be displayed graphically as above.

4.8 Persistence Profile Function

Unlike the variable specific shock as displayed in Impulse Response, the persistence profile function is a system wide shock to check how long it takes for the whole system to recover and go back to equilibrium. The results are shown graphically in figure 3.

Figure 3: Persistence Profile

Persistence Profile of the effect of a system-wide shock to CV(s)
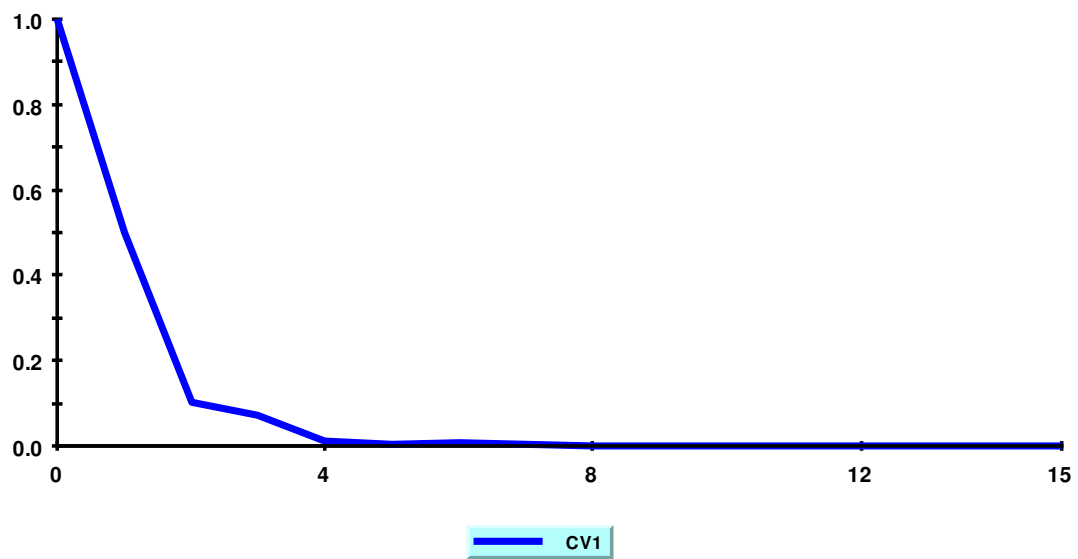
5. Policy Implications

The results of the both ARDL and NARDL empirically prove a co-integrating relationship between financial development and economic growth in Bangladesh. However, both tests show conflicting results as to whether the relationship is short run or long run. NARDL empirically showed that the resultant co-integrating relationship between the growth and finance variables did not display a symmetry of long run information but we could not rule out the possibility of a short run symmetry. While the results show the effect of financial development on growth is positive, different indicators of financial development display different levels of effect on growth. The results support a supply leading hypothesis for the Bangladesh economy.

Therefore, as for policy implications for the Bangladesh government, we recommend policies that strengthens the financial sector of the country to deepen the financial markets, and enforce institutional measures to strengthen creditor and investor rights. Also, the financial system of the country is still young and has the potential to grow exponentially, therefore it could also be recommended to open the doors for more foreign financial investments in the banking sector that would increase the credit to the private sector. Government incentives such as tax breaks and reduced withholding taxes could help attract foreign investments. More investments would increase demand and employment opportunities resulting in an increased productivity of the real economy.

Bangladesh is also known to be an exporter of cheap labour. The government could rethink its initiatives to keep the labour force in the country rather than exporting it. Further, the government should also take steps to reduce their income dependence on taxes. More avenues to increase their exports should be explored. Increased exports equal increased demand for labour and more opportunities in the market. Businesses would prosper and a more global brand could be established for the country that brings in even more opportunities.

However, the government should avoid implementing demand side monetary policy that might bring about a shock to the economy that may be permanent and difficult to reverse.

6. Conclusion

In conclusion, our humble attempt yielded fruitful results for all three of our research questions. This empirical study shows that there exists a positive co-integrating relationship between financial development and economic growth in Bangladesh. Secondly, the finance variable leads the economic variables suggesting a supply leading hypothesis and thirdly, our results from NARDL suggest that there only lies a short run symmetry between the variables.

Thus, as evidenced by the results of the research, fostering financial sector development of Bangladesh would accelerate its economic growth and bring them closer to achieving their 2041 goals of being listed as a developed nation.

6.1 Limitations and Future Research

Despite the encouraging results, this research has a lot of limitations. Firstly, due to time constraints a more comprehensive study of the country could not be conducted. With more time, a thorough study could have helped us to identify the most appropriate determinants that our country of choice. The determinants for this research were selected based on past literature of similar studies. Secondly, the frequency of the data available is very low. Only annual data could be found from the World Bank Indicators, and high frequency data has not been published by the central bank of Bangladesh. A higher frequency of data would explore a more accurate result of this relationship.

Therefore, further studies that can be explored on this topic for Bangladesh include investigations of the implications of past government policies. Such a study could enforce or denounce the findings of empirical study to study the co-integration, causality and long run relationship. In addition to this, exploring an empirical study to study this relationship based on findings of government annual and monthly fiscal reports could better streamline the study to be country specific.

7. References

Ahmed, A. D., & Mmolainyane, K. K. (2014). Financial integration, capital market development and economic performance: Empirical evidence from Botswana. *Economic Modelling*, *42*, 1–14.

Arestis, P., & Demetriades, P. (1997), Financial Development and Economic Growth: Assessing the Evidence, Economic Journal, 107, 783-799

Akinlo, A. E. & Egbetunde, T. (2010). Financial Development And Economic Growth: The Experience of 10 Sub-Saharan African Countries Revisited, *The Review of Finance and Banking*, 2(1), 17-28

Beck, T., Levine & R., Loayza, N., 2000. Finance and the Sources of Growth. *Journal of Financial Economics*. 58, 261-300

Choong, C-K. & Chan, S-K. (2011). Financial Development and Economic growth: A Review, *African Journal of Business Management*, 5(6), 2017-2027

Goldsmith, R.W., 1969. Financial Structure and Development. Yale University Press, New Haven CN.

Herwartz, H., & Walle, Y. M. (2014). Determinants of the link between financial and economic development: Evidence from a functional coefficient model. *Economic Modelling*, *37*, 417–427.

King, R.G. & Levine, R., 1993a. Finance and Growth: Schumpeter Might Be Right. Quarterly Journal of Economics 108, 717--38.

Patrick, H.T. 1966. Financial Development and Economic Growth in Underdeveloped Countries. Economic Development and Cultural Change, 14, 174--89.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289-326.

Samargandi, N., Fidrmuc, J, & Ghosh, S. (2015). Is the Relationship Between Financial Development and Economic Growth Monotonic? Evidence from a Sample of Middle-Income Countries, *World Development*, 68, 66–81

Ziaurrahman, M. & Masih, M. (2016). Is financial sector development an engine of economic growth? Evidence from India. *MPRA*, No. 72121.