External Reserves and Economic Growth in Bangladesh: An Empirical Analysis Using the Autoregressive Distributed Lag–Bound Testing Approach

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ABSTRACT

Purpose: This study aims to examine the effect of external reserves on economic growth in Bangladesh so that the government of Bangladesh can focus on different external reserves management policies which would benefit the economy most.

Methodology: This study is based on the Autoregressive Distributed Lag - Bound test method of econometric analysis using annual time-series data from the period 1974 to 2019. Data are collected from the World Development Indicators and the International Monetary Fund databases.

Findings: The study results confirm the existence of a long-run relationship between external reserves and economic growth in Bangladesh. The study findings show that foreign reserves positively impact economic growth, after controlling the influences of other factors such as trade openness, external debt and exchange rate.

Practical Implications: The research findings will be a useful source of information for the government of Bangladesh to take better external reserves policy that would benefit the economy. This study will also enlarge the body of existing literature on external reserves in Bangladesh.

Originality: This research expands on earlier findings which overlook incorporating the major determinants of economic growth and the ability to accumulate foreign reserves such as exchange rate, external debt and trade openness. This study also uses a long span of data and unique econometric methodology to investigate the long-run impact of foreign reserves on economic growth.

Limitations: Major study limitations include a lack of previous research studies on the issue for Bangladesh and limited access for collecting data on relevant covariates.

1. Introduction

External reserves accumulation has numerous advantages, including improving foreign debt service and international trade activities, serving as self-insurance against external shocks, serving as an instrument for the low exchange rate, promoting trade and international competitiveness, demonstrating creditworthiness in the eyes of other countries, supporting monetary policy operations, enhancing transaction needs, and fostering confidence in government policies and its ability to fulfill international obligations (Aizenman & Lee, 2007; Drummond 2009, Elhiraika & Ndikumana, 2007; Kashif, Sridharan, & Thiyagarajan, 2017; Samuel, Alani, Author, & Samuel, 2019).

On the other hand, holding a large amount of external reserves has some cost (Nwosa, 2017; Elijah, 2020) which would inversely affect the economy. In such a circumstance, to find out the impact of foreign reserves on the economy, there are two opposite arguments prevail. One is that

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the accumulation of external reserves will absorb shock in the period of economic slowdown. The second argument is that building a large amount of reserve would be prejudicial to the growth and development of the economy (Elijah, 2020).

The IMF's Monetary and Capital Markets Department (2013) issued guidelines for foreign exchange reserve management in 2001, which were amended in 2012. They were created to aid in the strengthening of the international financial architecture, the promotion of policies and practices that contribute to financial sector stability and transparency, and the reduction of member nations' external vulnerabilities. The standards' goals include ensuring that appropriate foreign exchange reserves are available to satisfy a predetermined set of goals, among other things (Hakim, 2013). There is no single technique to measure foreign reserve adequacy for a country. There are several traditional measures such as import cover, ratio of reserves to short-term external debt, ratio of reserves to broad money (M2), Wijnholds and Kapteyn (2001), assessing reserve adequacy (ARA) metric and Jeanne and Rancière (2011) to assess foreign reserve adequacy for a country. These measures are a good place to start, but a full assessment must take into account country-specific characteristics (Arslan & Cantú, 2019). According to the reserve adequacy benchmark analysis by Afrin, Sarder, and Nabi (2014), Bangladesh has enough reserves in terms of traditional metrics, although the amount does not appear to be too high throughout the period (1997-2012) of their examination. Bangladesh's foreign currency reserves are adequate, not excessive, according to the IMF, and the recent surge in reserves is projected to be short-lived (Byron & Hasan, 2022).

In Bangladesh, the externalreserves are increasing day by day. Since the 1990s, Bangladesh has made significant economic growth, owing largely to the implementation of a series of structural and economic reform measures. From the 1990s to the present, economic performance as measured by Gross Domestic Product (GDP) has been rising (Bhattacharjee & Uddin, 2021).

The external reserve holding is one of the highest in the history of Bangladesh. Moreover, the external reserves holding have been growing since the 1990s and after 2006 it has been increasing sharply. (Figure 1) illustrates the volume of external reserves over the 1974 to 2019 sample period for Bangladesh. It shows that Bangladesh is rapidly building up external reserves.
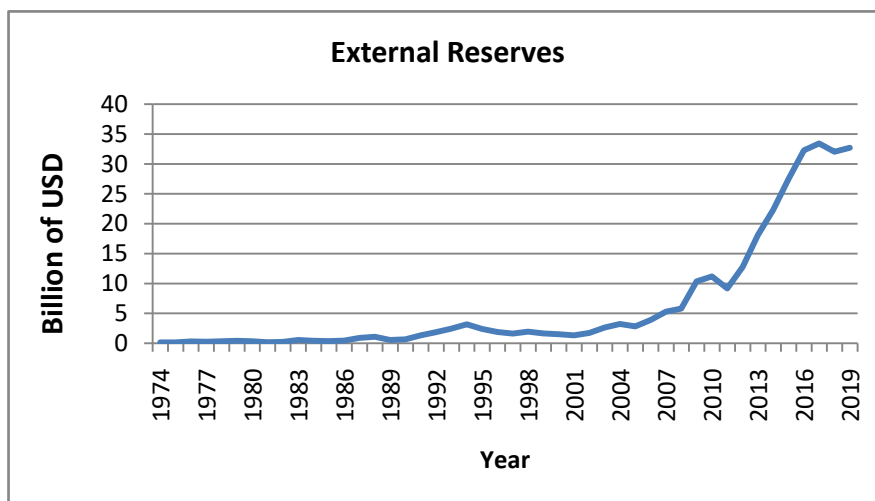

Figure 1. The volume of foreign exchange reserve from 1974 to 2019 for Bangladesh.
Source: Author's calculation based on the WDI data.

One of the key policy thrusts of governments in both developed and developing countries is to achieve high and sustainable growth. This is evident in the majority of government policy frameworks, which are primarily focused on achieving economic and financial stability to encourage economic development. One of the major policies of the government in maintaining external stability and attaining internal growth is to hold and monitor the amount of foreign reserves. Therefore, several studies have begun to examine the effect of external reserves on economic growth in different countries including Bangladesh.

So far, two studies conducted in Bangladesh to investigate the relationship between foreign reserves and economic growth. The latest (Alam, Hasan, & Hoque, 2021) found an insignificant relationship between the external reserves and economic growth in Bangladesh. This study uses time-series data from 1980-2014 and Vector Error Correction (VECM) model. It uses independent variables as foreign reserves, foreign direct investment, inflation rate and trade balance. The other study aimed at the causal relationship among external debt, foreign exchange reserves and economic growth for the period of 1976-2015 of Bangladesh economy and found bi-directional causality between international reserves and GDP in Bangladesh (Islam, Chowdhury, & Khanam, 2018).

Although the study carried out by Alam et al. (2021) aimed to investigate the impact of foreign reserves on economic growth, it misses out to include exchange rate and external debt as independent variables. Again, Islam, Chowdhury, and Khanam (2018) used external reserves and external debt as independent variables for their study. Exchange rate, trade openness, and external debt are major macroeconomic variables that influence economic growth and determine the nation's ability to accumulate foreign reserves (Elijah, 2020; Olokoyo, Osabuohien, & Salami, 2009). Alam et al. (2021) overlook incorporating the exchange rate and external debt as control variables in their study. This study, therefore, uses exchange rate and external debt and trade openness as control variables, which are the major determinants of economic growth and the ability to accumulate foreign reserves and also uses a long span of data and unique econometric methodology to investigate the long-run impact of foreign reserves on economic growth in Bangladesh which has not been done before.

The broad objective of this study is to examine the effect of external reserves on economic growth in Bangladesh. However, the specific objectives are to:

i) determine the impact of trade openness on the economic growth of Bangladesh;
ii) examine the impact of external debt on the economic growth of Bangladesh;
iii) investigate the impact of the exchange rate on the economic growth of Bangladesh; and
iv) study the short-run and long-run relationship between the external reserves and economic growth of Bangladesh.

To examine the impact of foreign reserves on economic growth, this study also analyses other macroeconomic variables such as trade openness, external debt, and exchange rate as control variables. This study uses the ARDL bound testing approach for the analysis of data. To explore the impact, the study uses the annual time series data from the period 1974 to 2019. Data are collected from the World Development Indicators (WDI) published by the World Bank (2021) and the data for the exchange rate is collected from the International Monetary Fund (IMF) (2021). The

outcomes of the study will depict the long-term relationship between foreign reserves and economic growth in Bangladesh. It will also uncover the variables' dynamics in the short run to strongly establish their long-run positions. This study result finds that external reserves and exchange rate have a positive and significant effect on economic growth whereas trade openness and external debt have a negative and significant effect on economic growth in the long run. Moreover, the short-run dynamic analysis conforms to a stable long-term relationship and the possibility of convergence of the variables from the short-run to the long-run with a high speed of adjustment.

As different studies show different results on the relationship between foreign reserves and economic growth, the purpose of this study is to evaluate the impact of external reserves on the economic growth of Bangladesh and its policy implications. Therefore, the findings of the study will be a useful source of information to policymakers at the national level as they develop policies targeted at boosting economic growth by implementing a better optimal external reserves strategy. The government will focus on the different policies which would benefit the economy. Moreover, the existing literature will also be enriched by this study results.

The rest of the paper is organized as follows. After the introduction section, the literature review of the study is discussed in section 2. Section 3 represents the data sources and variable description and methodology used in the study and after that, sections 4 and 5 present the results and discussion respectively. Finally, the conclusion is presented in section 5.

2. Literature Review

2.1 External Reserves and Growth

A large volume of published studies in the economic literature has scrutinized the long-term economic relation and the effect of external reserves (ES) on economic growth (EG). However, the generalisability of much-published research on this issue is problematic. Some of the findings suggest that ES have a positive effect on EG (Akpan, 2016; Alabi, Ojuolape, & Yusuf, 2017; Andriyani, Marwa, Adnan, & Muizzuddin, 2020; Bentum-ennin, 2014; Elijah, 2020; Johnny & Johnnywalker, 2018; Kashif, Sridharan, & Thiyagarajan, 2017; Kashif & Sridharan, 2015; Kruskovic & Maricic, 2015; Lin, 2011; Nwosa, 2017; Ojiako, 2020) and some oppose the notion (Eniekezimene & Apere, 2016; Udo & Antai, 2014).

Alam et al. (2021) examined the impact of ES on EG in Bangladesh from 1980 to 2014. The study used Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) tests, vector error correction model (VECM) and Granger-causality test and finds an insignificant positive correlation between EG and ES, a marginal positive correlation between EG and inflation and with FDI a modest correlation.

2.2 Trade Openness and Growth

The impact of trade openness (TO) on economic growth (EG) has been extensively investigated and yield to mixed and conflicting results across countries and methodologies (Keho, 2017; Makun, 2017; Nguyen and Bui, 2021; Zahonogo, 2016). In empirical studies, the impact of TO on EG is also a topic of great interest to many researchers; nevertheless, there are still conflicting views (Zahonogo, 2016). Indeed, some earlier studies, such as Chaudhary, Shirazi and Chaudhary (2007),

Chang, Kaltani, and Loayza (2009), Chandran and Munusamy (2009), Kim (2011), Jouini (2015), Keho (2017), Makun (2017), Nguyen and Bui (2021) and Sakyi (2011), imply that TO has a positive effect on EG. Hye (2012), Herzer (2013) and Kim and Lin (2009),on the other hand, suggest that TO can hamper EG in the long run if economic management measures are ineffective, as evidenced in developing nations. Meanwhile, some research suggests that TO may not be associated with EG (Ulasan, 2015), or that TO may not be a significant element in EG stimulation (Afzal & Hussain, 2010; Tekin, 2012; Trejos & Barboza, 2015).

Manni, Siddiqui and Afzal (2012) made an empirical study on TO and EG in Bangladesh's economy from 1980 to 2010 and found that greater openness positively impacts economic growth. Khanom (2019) studied the impact of trade openness on GDP growth in Bangladesh by utilizing data from 1972-73 to 2015-16. The study result shows a positive relationship between export and GDP growth, and a negative relationship between import and GDP growth. By using data from 1992 to 2019, Hasan (2021) investigated the association between trade openness and economic growth in Bangladesh. The study found that TO has positive and significant effects on economic growth. The Granger causality test shows that in the long run TO causes economic growth, however not in the short run.

2.3 External Debt and Growth

By utilizing a macroeconomic model in Nigeria, Ashinze and Onwioduokit (1996), studied the relationship between external debt (ED) and EG. The study result showed a time in which external finance was effectively utilized, resulting in significant economic expansion and when external finance was not utilized prudently, resulting in a drop in the economy. Arnone, Luca, and Andrea (2005) found that a large debt stock increases uncertainty and leads to capital flights, higher tax rates, and continuous over-borrowing, which negatively affects growth. Ayadi and Ayadi (2008) examined the impact of ED on the EG of Nigeria and South Africa. The authors used ordinary least squares (OLS) and generalized least squares (GLS) techniques and found the negative impact of debt on growth for both Nigeria and South Africa. Though, the performance of South Africa was better than Nigeria for the utilization of external loans to promote growth. Bakar and Hasan (2008) investigated the effects of ED on EG in Malaysia. By using the VAR model the authors found a positive relationship between ED and EG. Islam et al. (2018) investigated the causal relationship among ED, ES and EG in Bangladesh from 1976 to 2015. By using Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) tests, vector error correction model (VECM) and Granger-causality test the study results showed that ES have a stronger role in EG in Bangladesh. The study also found both way causal relationships between the ES and EG and unidirectional causal relationships from ED to ES.

2.4 Foreign Exchange Rate and Growth

Exchange rate (ER) and GDP growth nexus have been empirically tested for different countries using different data series and methodology. Gluzmann, Levy-Yeyati, and Sturzenegger (2012), Mario, Sebastian, and Gabriel (2011), Razmi, Rapetti, and Skott, (2011), Rodrik (2008) found expansionary effects of devaluations. Whereas Atkins (2000), Berg and Miao (2010), Kamin and Roger (2000) emphasise contractionary effects. On the other hand, Bahmani-Oskooee and Miteza

(2006), Edwards (1986) and Rhodd (1993), El-Ramly and Abdel-Haleim (2008), studied mixed results. Bahmani-Oskooee (1998), Upadhyaya and Upadhyay (1999) found no significant effect of ER movements on EG.

Uddin, Rahman and Quaosar (2014) investigated a significant positive relationship between ER and EG for Bangladesh and also found a bi-directional causality among ER and EG. By using data from 1972 to 2013, Kamal (2015) investigated the impact of the real ER on EG for Bangladesh and found mixed results. In the short run, the result shows that a lower ER has a positive significant impact on EG while in the long run higher ER has a positive effect on EG. In Bangladesh, Hassan, Chakraborty, Sultana and Rahaman (2016) investigated the short-run and long-run impact of the Real Effective Exchange Rate (REER) on real export earnings. In the long run, the authors found a significant effect of REER on real export earnings while in the short run no effect was found. For Bangladesh, this study also found that appreciation in the REER hurts real export earnings. Razzaque, Bidisha and Khondker (2017) studied the impacts of ER changes on GDP growth in Bangladesh. By applying cointegration techniques the study found that real ER depreciation has a positive effect on EG in the long run. On the other hand, real depreciation hurts EG in the short run.

3.   Research Methodology

3.1 Data Collection

This study examines the impact of external reserves on economic growth in Bangladesh. To be specific, this study uses the definition of external reserves defined by the World Bank which is "Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities." To explore the impact, the study uses the annual time series data from the period 1974 to 2019. Variables in the analysis include annual growth rate of real GDP (constant 2010 US$) as a proxy of economic growth; external reserves (current US$); exchange rate (domestic currency per US$); trade openness (the sum of exports and imports of goods and services as a ratio of GDP); external debt stock (current US$). Data on real GDP, external reserves, trade openness, external debt are collected from the World Development Indicators (WDI) published by the World Bank (2021) and the data for exchange rate is collected from the International Monetary Fund (IMF) (2021).

3.2 Empirical Model

This study uses the variables which are selected in line with the research of Awoderu, Ocalibe, and Obekpa (2017), Elijah (2020), Islam et al. (2018), Kashif et al. (2017), Nwosa (2017). The empirical model of Meshak (2014) and Elijah (2020) is adapted in modification in this research. The model defines that external reserves influence the gross domestic product in Bangladesh which has the following functional form:

$$GDP = f(TRES) \qquad\qquad (1)$$

As exchange rate, trade openness, and external debt are major macroeconomic variables that influence economic growth and determine the nation's ability to accumulate foreign reserves, those variables are also included in this model. Trade openness and exchange rate measures the

vulnerability of an economy or current account (Eniekezimene & Apere, 2016; Elijah, 2020) and external debt is a good predictor of a nation's external holdings (Kashif & Sridharan, 2015). Therefore, by modifying the model of Meshak (2014) and Elijah (2020), the empirical model for this study can be written as follows:

$$GRGDP = f(TRES, TO, ED, ER) \qquad (2)$$

Where:

GRGDP – annual growth rate of real gross domestic product,

TRES – external reserves,

TO – trade openness,

ED – external debt, and

ER – the exchange rate.

Therefore, the linear equation of the econometric model (2) is given as follows:

$$GRGDP = \beta_0 + \beta_1\, LTRES_t + \beta_2\, TO_t + \beta_3\, LED_t + \beta_4\, ER_t + \mu_t \qquad (3)$$

Where:

β_0 – the constant term,

$\beta_1 - \beta_4$ – represents parameters,

μ – an error term and

L – The logarithm form of the variables.

3.3 Econometric Methodology

3.3.1 *Unit Root Test*

For econometric analysis, it is necessary to do the unit root tests to check the stationarity of the time-series data. There are different types of tools that can be used to test the unit root of a time series data. This study uses Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) tests to test the stationarity of data.

3.3.2 *Selection of optimal lag*

To do a time series analysis an important initial step is to select the optimal lag order of the series. This can be done by using the minimum information criterion, such as Akaike information criterion (AIC), sequential modified LR test statistic, Hannan-Quinn information criterion (HQC), Final prediction error (FPE), Schwarz information criterion (SIC).

3.3.3 *The Autoregressive Distributed Lag (ARDL) Model*

To find out the relationship between the external reserves and economic growth in Bangladesh, this study uses an autoregressive-distributed lag (ARDL) test approach. The ARDL model has several advantages. Firstly, this model can be used even when the variables are integrated in a different order, such as (I(0) or I(1)) (Pesaran, Shin & Smith,2001). In addition, the ARDL model has enough lags to represent the data generation process in a general-to-specific modelling framework (Hall&

Wickens, 1993; Pesaran *et al.*, 2000). Furthermore, ARDL can be transformed into a dynamic Error Correction Model (ECM) using a simple linear transformation, allowing for inferences on long-run estimations (Banerjee, Dolado, Galbraith, & Hendry, 1993; Frimpong & Oteng-Abayie, 2006). This is impossible in alternative co-integration approaches, such as Engle and Granger's (Toda & Phillips, 1993).

The ARDL model is used in this study because it has the following advantages over other co-integration models. To begin with, the ARDL model outperforms other models in terms of sample size, which can be as small as 30 to 80 observations (Ghatak & Siddiki, 2001). Second, the ARDL approach can be utilized regardlessof whether the fundamental variable is I (0), I (1), or a combination of both. Third, when the lags for the ARDL model are appropriate, the model is right for serial correlation. Finally, the long-run and short-run co-integration relationships may be calculated with unbiased results using the ARDL model (Pesaran et al., 2001).

The ARDL representation of equation (3) is as follows:

$$\Delta GRGDP_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i}\, \Delta LTRES_{t-i} + \sum_{i=0}^{n} \beta_{2i}\, \Delta TO_{t-i} + \sum_{i=0}^{n} \beta_{3i}\, \Delta LED_{t-i} + \sum_{i=0}^{n} \beta_{4i}\, \Delta ER_{t-i} + \sum_{i=1}^{n} \beta_{5i}$$

$$\Delta GRGDP_{t-i} + \varphi_1 LTRES_{t-1} + \varphi_2 TO_{t-1} + \varphi_3 LED_{t-1} + \varphi_4 ER_{t-1} + \varphi_5 GRGDP_{t-1} + \mu_{1t} \qquad (4)$$

Where:

Δ – difference operator,

β_0 – constant,

$\beta_{i1} - \beta_{i5}$ and $\varphi_{t1} - \varphi_{t5}$ – coefficients, and

μ_{1t} – white noise disturbance term.

Here the null and the alternative hypothesis are as follows:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0 \qquad (5)$$

(No co-integration or no long-run relationship exists).

$$H_1: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq \varphi_5 \neq 0 \qquad (6)$$

(Co-integration or long-run relationship exists).

The upper and lower bound critical values will be compared with the calculated F statistics. Here, the null hypothesis will be rejected when the value of calculated F statistics is greater than the value of the upper bound; the null hypothesis cannot be rejected when the calculated F statistics value is less than the value of lower bound; and when the value of calculated F statistics is in between the value of lower bound and upper bound then the test result would be inconclusive (Pesaran et al., 2001).

When the variables in equation (4) are co-integrated or there is evidence of a long-run relationship among the variables, then the error correction models can be estimated as follows:

$$\Delta GRGDP_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i}\, \Delta LTRES_{t-i} + \sum_{i=0}^{n} \beta_{2i}\, \Delta TO_{t-i} + \sum_{i=0}^{n} \beta_{3i}\, \Delta LED_{t-i} + \sum_{i=0}^{n} \beta_{4i}\, \Delta ER_{t-i} + \sum_{i=1}^{n} \beta_{5i}$$

$$\Delta GRGDP_{t-i} + \Upsilon_1 ECM_{t-1} + \mu_t \qquad (7)$$

ECM_{t-1} in equation (7) represents the one-period lag error correction term. Here, Υ represents the coefficient of the ECM_{t-1} which is also known as the speed of adjustment parameter. When this parameter has a negative sign and is statistically significant then this result will further confirm the presence of a long-run (co-integration) relationship. The higher the magnitude of the adjustment parameter, the higher will be the speed of adjustment. Moreover, from equation (7), the short-run dynamics of the estimated relationship can also be found.

3.3.4 *The Diagnostic Tests*

Finally, to check the robustness of the study several diagnostic tests such as the Breusch-Pagan-Godfrey test, the Breusch-Godfrey Serial Correlation LM test, the Jarque-Bera normality test, the cumulative sum (CUSUM) test and the CUSUM of the square test has been done. Eviews 10 software has been used in this study to do the econometric analysis.

4.   Results

4.1 Unit Root Test

In (Table 1), the null hypothesis for both ADF and PP tests is that the series has unit root against the alternative hypothesis that the series has no unit root. The ADF and PP test results of (Table 1) show that the GRGDP and LED are stationary at a level that is those variables areintegrated at I(0), whereas LTRES, TO and ER variables become stationary after first differencing that is those variables are integrated at I(1). As a result, from (Table 1) it can be said that the variables are integrated of both I(0) and I(1) and no variables are integrated into I(2). The following step of this study is to perform ARDL bound test approach to investigate the existence of a co-integrating relationship among the variables.

Table 1. Unit Root Tests Results

Variable	ADF		PP	
	Levels	First differences	Levels	First differences
GRGDP	-2.8003^{*}	-	-7.5206^{***}	-
LTRES	0.3263	-7.5058^{***}	-0.1269	-11.2999^{***}
TO	-1.3889	-7.7409^{***}	-1.3889	-7.7409^{***}
LED	-3.7514^{***}	-	-3.3135^{**}	-
ER	-0.0135	-5.0201^{***}	-0.4748	-6.8327^{***}

Note: *** represents significant at 1% level, ** represents significant at 5% level, * represents significant at 10% level

Source: Author's calculation.

4.2 The Bounds Test

The ARDL bounds test approach studies the long-run co-integration relationship among GRGDP, LTRES, TO, LED and ER of Bangladesh by using equation (4). The null hypothesis which is tested here is that there is no co-integration (equation (5)) against the alternative hypothesis is that there is co-integration (equation (6)) among the variables. The results of the co-integration of the ARDL bounds tests are shown in (Table 2).

Table 2. Bound Test

Lag length	Number of variable (k) and sample size (n)	F-statistic	
ARDL (3, 2, 3, 3, 0)		9.214227	
		Critical Values	
Level of Significance		Lower bound	Upper bound
	k = 4, n = 1000		
10%		2.45	3.52
5%		2.86	4.01
2.5%		3.25	4.49
1%		3.74	5.06
	k = 4, n = 45		
10%		2.638	3.772
5%		3.178	4.45
1%		4.394	5.914
	k = 4, n = 40		
10%		2.66	3.838
5%		3.202	4.544
1%		4.428	6.25

Note: k is the number of independent variable numbers in equation (3). The actual sample size is 43.

Source: Author's calculations

Results in (Table 2) show that the calculated F-statistic is greater than the upper bound value at the 1%, 2.5%, 5% and 10% level of significance for the asymptotic (n=1000) sample. (Table 2) also show that the calculated F-statistic is greater than the upper bound value at the 1%, 5% and 10% level of significance for finite sample (n=45 or n=40). By rejecting the null hypothesis the results specify a significant co-integrating relationship among the variables. Specifically, over the study period, the results confirm that the GRGDP, LTRES, TO, LED and ER of Bangladesh have a long-run relationship.

4.3 Long Run Estimation

By applying the ARDL model stated in equation (4), the long-run relationships among the variables are examined. In this ARDL model, the lag structure is selected by Akaike's Information Criterion (AIC). The ARDL (3, 2, 3, 3, 0) model shows the optimal number of lags of each variable. (Table 3) represents the long-run results of this model. The estimated value of R-square is 0.78 which indicates that 78% variation in GRGDP has been explained by LTRES, TO, LED and ER. The value of F-statistics is 6.283963 and the corresponding probability is zero which strongly supports the statistical significance of the model.

Table 3. ARDL Estimations for Long-Run Coefficient for the Period 1974 – 2019

Dependent variable: GRGDP				
Constant	LTRES	TO	LED	ER
98.15317 $(4.024338)^{***}$	2.640317 $(2.548035)^{**}$	-0.319678 $(-2.067827)^{**}$	-6.673773 $(-2.397945)^{**}$	0.225568 $(2.417314)^{**}$
R-squared = 0.777337				
Adjusted R-squared = 0.653635				
F-statistic = 6.283963^{***}				

Note: The number inside the parenthesis is the value of the t-ratio. ***, ** and * represent significant at 1%, 5%, and 10% level respectively.

<div align="center">Source: Author's calculation</div>

The results of (Table 3) indicate that LTRES, TO, LED and ER are statistically significant in influencing GRGDP at the 5% level of significance. The estimated coefficient of LTRES shows that a 1% increase of LTRES will lead to a 0.026% increase in GRGDP in the long run, ceteris paribus. On the other hand, the real GDP growth rate is negatively influenced by trade openness. The estimated coefficient of trade openness shows that a 1% increase in trade openness will lead to a 0.32% decrease in GRGDP in the long-run, ceteris paribus. For the external debt, the value of the estimated coefficient shows that a 1% increase of LED will lead to a 0.067% decrease in GRGDP in the long-run, ceteris paribus. Furthermore, for the variable exchange rate, the estimated coefficient shows a positive and significant effect on economic growth in the long run. Moreover, both the constant term is also statistically significant in long run.

4.4 Short-Run Dynamics

Equation (7) helps to estimate the error correction model (ECM). The ECM is examined to evaluate the short-run dynamic relationship between external reserves and economic growth and also ensure the reliability of the long-term coefficient. (Table 4) represents the results of the estimated ECM.

The results of ECM in (Table 4) show that the estimated value of the error correction term (ECT) coefficient is negative and statistically significant at a 1% level. A highly significant ECT proves a stable long-term relationship (Banerjee, Dolado, & Mestre, 1998). Moreover, the negative value of the ECT coefficient indicates that the model is consistent (Makun, 2017). In this study, the value of the estimated ECT coefficient (-0.95) also determines the speed (0.95) of the correction towards an equilibrium relationship. More specifically, the ECT coefficient suggests that the deviation from the long-term GRGDP path is corrected by 95% over the following year aftershock period which implies that the adjustment is very fast. In (Table 4), it is found that the log of external reserves has a positive and significant effect on the growth rate of real gross domestic product but a negative and significant effect at lag one. Also, the result indicates that trade openness has a negative and insignificant effect on the growth rate of real gross domestic product at the current period but a positive and insignificant effect at both lag one and lag two. Furthermore, the result indicates that the log of external debt has a negative and significant effect on the growth rate of real gross domestic product at the current period but positive and significant effects at lag one and negative and insignificant effects at lag two. The ARDL model of error correction regression fits well because here the value of R-squared is 0.84 which indicates that the explanatory variables of the model can explain 84% variation of GRGDP.

Table 4. Error Correction Regression

Dependent variable: D(GGDP)	
Regressors	ARDL(3, 2, 3, 3, 0)
C	98.15317 (7.290736)***
D(GRGDP(-1))	-0.448984 (-3.580730)***
D(GRGDP(-2))	-0.267919 (-2.773423)***
D(LTRES)	1.654328 (2.807572)***
D(LTRES(-1))	-2.608258 (-5.231019)***
D(TO)	-0.065570 (-1.125137)
D(TO(-1))	0.071414 (1.554308)
D(TO(-2))	0.160156 (3.388888)
D(LED)	-10.75382 (-4.365512)***
D(LED(-1))	5.051006 (2.183185)**
D(LED(-2))	-3.082502 (-1.392666)
ECT(-1)	-0.954278 (-7.272997)***
R-squared	0.839428
Adjusted R-squared	0.782450
F-statistic	14.73266***

Note: The number inside the parenthesis is the value of the t-ratio. ***, ** and * represent significant at 1%, 5%, and 10% level respectively.

Source: Author's calculation

4.5 Diagnostic Testing

(Table 5) shows various diagnostic tests results for the study. This study uses the Breusch-Pagan-Godfrey test and the Breusch-Godfrey Serial Correlation LM test to check the heteroscedasticity and serial correlation of the residuals. For both tests, the P-values are greater than 5% which specify that the model is free from heteroscedasticity and serial correlation problems. For the test of normality, this research uses the Jarque-Bera test. The Jarque-Bera test result shows that the P-value is greater than 5 per cent which conforms to the normal distribution of the residual. Moreover, this study uses the Ramsey RESET test to test the appropriate functional form of the study. The P-value of the Ramsey RESET test is 0.2732 which specifies that the models are well specified.

Table 5. Diagnostic Testing

Test	F-Statistics /Jarque-bera	Obs*R^2	Probability
Heteroskedasticity Test	0.9089	2.8166	0.4208
Serial Correlation	0.4826	2.4465	0.4850
Normality	0.8986	-	0.6381
Ramsey RESET	1.2531	-	0.2732

Source: Author's calculation

4.6 Stability Test

To check for the model stability, this study applies the cumulative sum (CUSUM) test and the CUSUM of square test which is represented in (Figure 2) and (Figure 3) respectively.
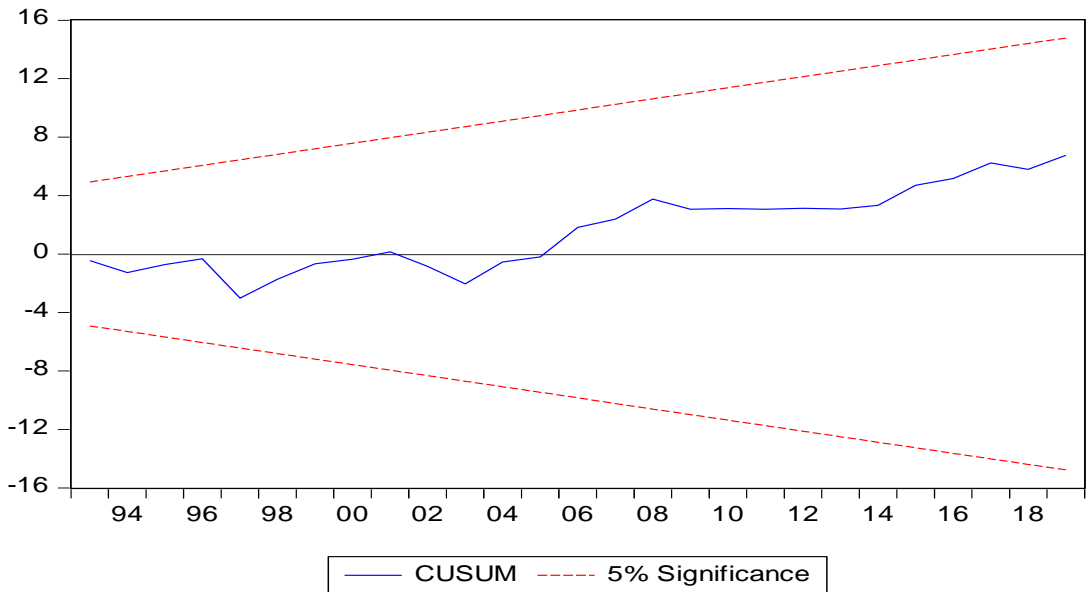
Figure 2. Cumulative Sum of Recursive Residuals (GRGDP), Source: Author's calculation
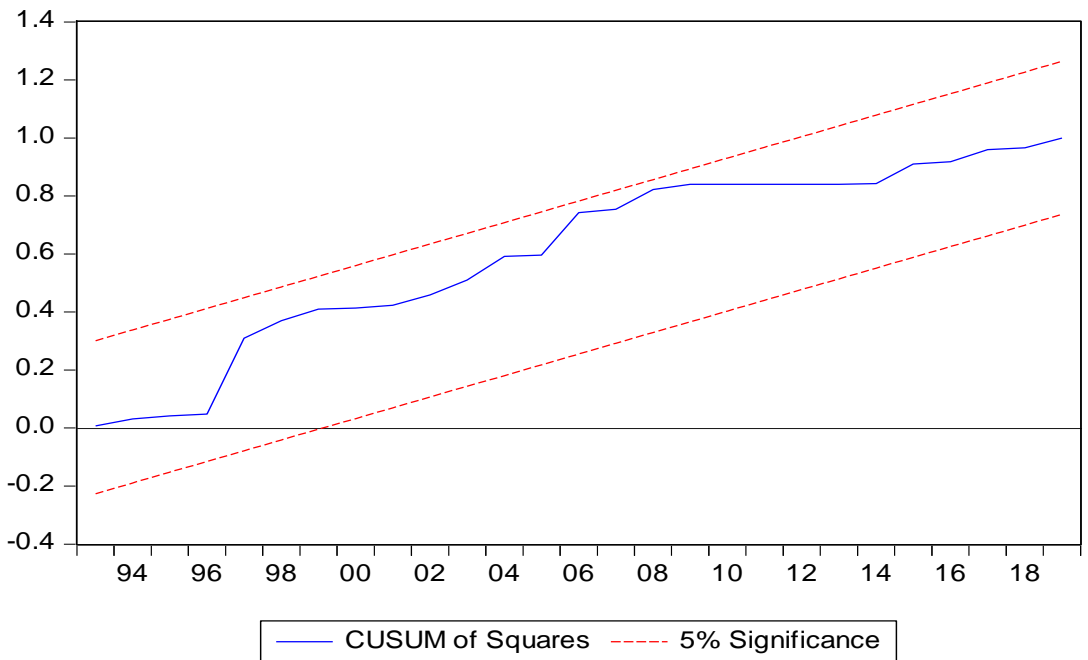

Figure 3. Cumulative Sum of Squares of Recursive Residuals (GRGDP), Source: Author's Calculation

If both the plot of CUSUM and the CUSUM of squares stay inside the 5% critical boundaries, the null hypothesis of parameter stability cannot be rejected. Both lines in (Figures 2) and (Figures

3) are within 5% critical bounds, indicating that the coefficients are not unstable during the study period. The models show desirable econometric features and are structurally stable, according to the preceding tests.

5. Discussions

The main purpose of this study is to assess the impact of Bangladesh's external reserves on economic growth and its policy implications. As a result, the study's findings will be valuable to policymakers at the national level as they establish policies aimed at enhancing economic growth through the implementation of a better optimal external reserves plan. The government will concentrate on the various initiatives that will benefit the economy.

The study's overall findings are examined using the interest variables' short and long-run dynamics. The study results show that external reserves have a positive and significant effect on economic growth in Bangladesh for both the long-run and short-run. This study justifies the result of the findings of Ojiako (2020); Alabi et al. (2017); Nwosa (2017); Johnny and Johnnywalker (2018); Elijah (2020) which shows that the external reserves positively and significantly affect economic growth. This infers that for Bangladesh there is a positive short run as well as a long-run relationship between LTRES and economic growth. These findings imply that maintaining high amounts of reserves in foreign currencies will provide a cushion to maintain internal stability during periods of economic shock, hence boosting economic growth. Although in the short-run trade openness has a negative and insignificant effect on economic growth, in the long run, it shows a negative and significant effect. This implies that for Bangladesh there is a negative relationship between TO and real GDP growth rate in the long run. This result is consistent with that of Elijah (2020), Udo and Antai (2014). This result indicates that the higher the amount of openness of the economy, the lower the growth attained, which is related to the economy's mono-product nature and a higher appetite for imported commodities, which leads to exchanging rate and reserves volatility.

For external debt, the dynamic results imply that there is a negative relationship between LED and the real GDP growth rate. The results show that external debt has a negative and significant role in the economic growth of Bangladesh. For a nation, debt is considered a liability because of its conditionality like rate of interest, time limit, service charges (Bangura, Powell, & Kitabire, 2000). The only way to have the positive effect of debt on the economy is to utilize debt for productive purposes. In that case, appropriate policies can play an important role in better utilization of external funds in various development sectors (Ostry et al., 2010). External debt hurts countries in the short and long-run, but only when it exceeds a certain level, reducing nation's repayment capacity and causing economies to withdraw funds from conducting developmental initiatives, resulting in a drop in economic growth (Zafar, Sabri, Ilyas, & Kousar, 2015).

The rationale could be because when the government's external debt grows, it is expected to repay it in foreign currency obtained from the private sector through export returns, donations, remittances from Bangladeshi overseas, and further borrowing. Given the country's weaker export base, all of the above choices worsen the country's balance of payments, crowding out vital private sector operations such as bringing in additional machinery to add value for higher levels of investment (Tehereni, Sekhampu, & Ndovi, 2013).

Furthermore, for the variable exchange rate, the estimated coefficient shows a positive and significant effect on economic growth in the long run. This means that in the long run, a stable exchange rate will be, established by the accumulation of external reserves, which will enhance economic growth.

According to the result of the study, the international reserves accumulation in Bangladesh will lead to an increase the economic growth in the long run. Here, a stable exchange rate would contribute to influencing the economy positively. This study resultis consistent with Elijah (2020) and Nwosa (2017).

Major study limitations include a lack of previous research studies on the issue for Bangladesh and limited access to data. Other researchers can expand on the work by including several countries as a sample of analysis. Cross-country comparisons can be made in the panel framework which could help to discover more facts about the external reserves. In addition, further research can be done to find out the determinants of external reserves in Bangladesh.

6. Conclusion

The macroeconomic objective of most of the developing countries like Bangladesh is to accumulate a large number of external reserves. This is because external reserves can act as a buffer against foreign exchange shocks, especially in countries that rely significantly on imports and little on export. This study investigates the impact of external reserves on economic growth along with trade openness, external debt and exchange rate of Bangladesh using the ARDL bounds testing procedure from 1974 to 2019. This research finds that international reserves and exchange rates have positive and significant effects on economic growth whereas trade openness and external debt have a negative and significant effect on economic growth in the long run. Moreover, the short-run dynamic analysis conforms to a stable long-term relationship and the possibility of convergence of the variables from the short run to the long run with a high speed of adjustment.

In conclusion, it can be said that holding external reserves will increase the economic growth of Bangladesh by enhancing the country's liquidity position, providing funds for growth-supporting investment, creating foreign exchange stability, maintaining economic stability and enhancing investors' confidence. Therefore, the government should take policy to accumulate more external reserves so that the economy will be more secure for periods of external shocks or macroeconomic instability. The level of the optimal reserve should be maintained strictly so that the excess reserves would not hamper the growth objective of Bangladesh. This is because the policy eliminates foreign exchange risk and stockpiling in the economy, boosting the currency's value and competitiveness. Government should formulate policies to improve the nation's trade performance by diversifying the nation's economy to other viable sectors such as agriculture and manufacturing, while also making locally produced goods appealing to both local and foreign consumers to boost the nation's reserves through increased export and reduce imports.

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