

Dynamic Nexus between Economic Growth and Total Reserve and Aggregate Consumption Expenditure: An ARDL Approach

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Abstract— This paper tries to see the association among reserve, aggregate consumption expenditure, and economic growth by employing the autoregressive distributed lag (ARDL) model. Both the explanatory variables such as consumption and reserve are statistically significant. The consumption expenditure is strongly affecting the economic growth both in the short and long-term. Performing the ADF and PP test the variables are integrated order of one I(1). The bound test confirmed that the long-term association exists between the variables. There is a unidirectional association found among the variables.

Index Terms— ARDL approach, Granger causality, Cointegration, aggregate consumption expenditure, Total reserve, Real Gross Domestic Product, ADF test, PP test

1 INTRODUCTION

Countries around the world typically hold international reserves at a favorable exchange rate, especially to stabilize them and retain other economic activities, as the status of the international reserve defines the country's ranking in the competitive global market. In other words, these advocates assume that a strong level of reserves would make the nation look financially prudent and creditworthy.

Today, the top ten international reserve holders account for almost two-thirds of the total international reserves in the world. China, with USD 3.308 trillion as of Aug 2020, tops the list. Japan stood second with USD 1.403 trillion as of July 2020. The list is going on but Bangladesh comes in Forty-six position with USD 39 billion as of September 2020. ("List of Countries by Foreign-Exchange Reserves," 2020)

In developing countries, reserve management is driven by precautionary purposes against financial crises. The number of international reserves worldwide is one of the highest in Bangladesh's history.

The use of goods and services by households is commonly referred to as consumption, whereas spending on consumption refers to the acquisition of goods and services for household use. The growth of an economy is generated by consumption as the demand for goods and services. People directly spend cash to meet this demand, which is then further applied to national growth. Consumers work as labor forces to receive incomes to alleviate the need for consumption. To meet customer demand, producers often operate their companies, leading to economic

development. Consumption is also pivotal to economic development. Bangladesh with a huge population is an emerging market-based economy that helps to create massive demand for consumption. (Dey & Islam, 2019)

Several studies have been performed over the past decades to investigate the interrelationship between consumer spending (mostly government expenditure) and economic development. In the short and long term for Bangladesh, few forms of study have also attempted to highlight their causal relationship. (Amin, 2011)

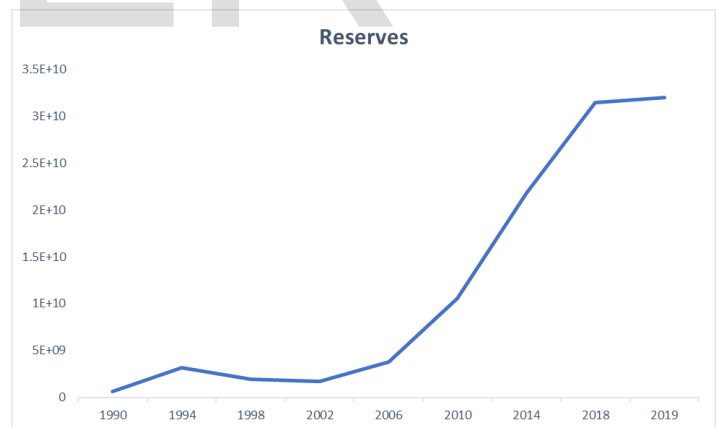


Figure 1: Trends of Total Reserve

Figure 1 shows the trends of the total reserve for Bangladesh throughout 1990-2019. The amount of reserve is increasing day by day. Although there was some declining trend after 1994, it increases faster after the starting of the 21st century.

Figure 2 shows the trends of per capita GDP at constant 2010. This shows clearly that Bangladesh is racking up RGDP at a rapid pace. It also demonstrates that RGDP has been growing continuously since 1990.

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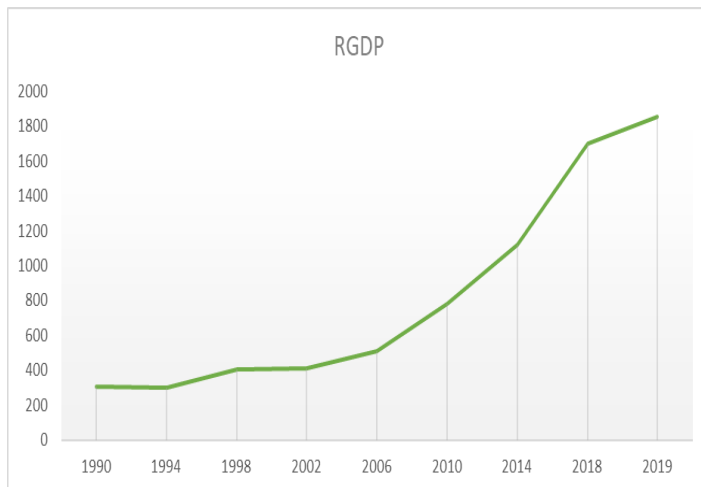


Figure 2: Trends of Real GDP per capita

This paper tries to see the relationship among aggregate consumption expenditure, international reserves & economic growth with the help of the autoregressive distributed lag (ARDL) model, then it would be possible to determine, which policy is the most appropriate for Bangladesh.

2 LITERATURE REVIEW

Bentum-Ennin (2014) examined the result of international reserves accumulation on economic growth. Besides it conjointly shows whether or not there's a threshold result within the international reserves and economic growth nexus. The analytical technique of the study followed domestically weighted scatterplot smoothing (LOWESS) and therefore the panel cointegration to look at the link between economic growth and international reserves. The study reported that international reserves accumulation flourish economic growth. Kashif & Sridharan (2015) are especially centered on the influence of the economic process on international reserves in India. For the analysis, they used the ADF test, Johansen Cointegration test, Vector error correction model. A strong association was established between international reserve and economic growth.

Kashif et al. (2017) studied to know the effect of economic growth on Brazilian international reserves holdings. They followed the Error Correction Mechanism over the 1980-2014 period's data. According to the survey study, economic growth and international reserves have a positive long-run relationship.

Amin (2011) tried to explore the causal association between consumption expenditure and economic growth in Bangladesh over the period 1976-2009. To run the study, Dickey-Fuller (ADF) and Phillips-Perron (PP), Johansen cointegration, ARDL approach, and Granger causality are used. The study findings declared that consumption is the result instead of the reason behind growth, for Bangladesh.

Dey & Boston (2018) are assessing the link between mixture consumption expenditure and the economic growth of Bangladesh utilizing the ARDL Bounds approach. This

assessment report reflects that consumption enhance monetary and financial policies will boost economic growth for Bangladesh.

Alper (2018) examined the link of economic growth, unemployment, consumption, saving rates investment, and portfolio investments in Brazil, India, Turkey, Russia, India, and African countries. They favor Prais-Winsten Panel correlated Standard Errors and Feasible Generalized least squares method to analyze the study. The study found that a tenth rise in saving rates will increment economic growth by 0.50%. Also, a rise in consumption expenditure by 1% will cause to increase growth by 0.41% and an increment of 1% in investment expenditure will lead to raising economic growth by 0.25%. Also, there is an opposite association between unemployment and growth.

Chioma (2009) used the annual for Nigeria and performed the regression analysis to check the causal association between GDP and consumption expenditure. It reported that a rise in the GDP has no significant in consumption expenditure in Nigeria. GDP is explained by 3.5% of the personal consumption expenditure.

Mishra (2011) examined the dynamics association within consumption expenditure (real) and economic growth for India. The study takes with cointegration test and VECM to check the long-term association. The cointegration and VECM test are confirmed for the long-term association within the variables.

Bekhet & Othman (2011) investigate the link between client indicator (CPI), electricity consumption (EC), gross domestic product (GDP), and foreign direct investment (FDI). They used the VECM model analytical estimation transpire victimization of the vector error correction model (VECM). The outcomes confirmed that determining economic growth, electricity consumption is a significant element and a strong tool in assessing government policy for energy saving.

In the years 1980 to 2009, Charles (2012) attempted to investigate external reserves: the causal effect of macro-economic variables in Nigeria. His research shows that the degree of trade openness, exchange rate, GDP, and inflation rate are factors that influence the level of foreign reserves. GDP levels and trade openness have been shown to have a positive association with foreign reserves, supporting the theoretical foundation of self-insurance for foreign reserves. Whereas the amount of foreign capital inflow and inflation had a negative relationship with foreign reserves. The study confirmed that the accumulation of foreign reserves does not generate satisfactory returns for Nigeria, but efforts should be made to build jobs and an open-trade climate that in turn increases the Nigerian economy's GDP.

3 DATA AND METHODOLOGY

To check the dynamic nexus between the variables we select data from the secondary sources. For this analysis, we collect the data from the World Bank Development Indicators. We are using real GDP per capita to measure economic growth, aggregate consumption expenditure, and total reserves minus gold over the period 1990-2019. Here the RGDP represents the economic growth of the economy. The ARDL approach is employed in the dynamic of the variables. To find the nexus

between the variables, we employed a statistical package like EViews 9.0. The variables description is given below.

Table 1: Variables Description

Variables	Nature
LRGDP	Log of RGDP per capita
LRES	Log of Reserve
LCON	Log of Consumption Expenditure

3.1 Unit Root Test

Usually, time-series data possess the unit root problem. So, it is necessary to check the unit root problem before the estimation process has proceeded. The regression of the non-stationary data will lead to a spurious result. (Gujarati, 2004) Various tests are utilized to check the unit root problem. The popular method is such as the Augmented Dickey-Fuller Test (Dickey & Fuller, 1979), Phillips Perron Test(Phillips & Perron, 1988), etc. The variable which is stationary at level form is called I(0). If the data are stationary at the first difference is called I(1). The ADF test for each variable is employed through the following process.

$$y_t = \sigma_0 + \sigma_1 t + \beta y_{t-1} + \delta \sum_{i=1}^n \Delta y_{t-i} + u_t \quad (1)$$

Here, u_t = a white noise error.

Here the critical value of the ADF test is tau (τ). If the $|t_{cal}| > |\tau_{cri}|$ the null of unit root is rejected and the data are stationary.

The LR and SR model is employed to run the dynamics of the variables. For this, we used the ARDL approaches which are formed by Pesaran, Shin, and Smith (2001). In recent times, the ARDL approach is popular in the time series analysis. There are various advantages of the ARDL model over the other model. For the small sample size, the ARDL approach is good. We can use the ARDL model of the different integration of order. Irrespective of I(0) or I(1), we can use the ARDL model. But neither of the order of I(2) or more is not applied to the ARDL model. Here the dependent variable is real GDP per capita. The ARDL model is specified by the following equation.

3.2 Error Correction Model(ECM)

The ECM model shows the deviation from the short-run to long-run deviation. The term error-correction refers to the deviation of the last period from the long-term equilibrium, the error, influences its short-term dynamics. ECMs therefore easily calculate the speed at which the dependent variable returns to equilibrium after the change in other variables. Before estimating the ECM, the variables should be co-integrated. For the long-run test, we used the bound test. If the estimated F value is more than the upper bound at the given significant level, it will confirm that the variables are cointegrated. That is there is a long-term association ship that exists.

3.3 Diagnostic Test

After performing the regression analysis, we perform the diagnostic test of the model. In the diagnostic test, we test the serial correlation, heteroscedasticity, normality test, functional

form. For the structure break, we use the CUSUM test.

3.4 Granger Causality Test

The pairwise causality tests are executed in this research to assess the causal association ship.

4 RESULT AND DISCUSSION

4.1 Unit Root Test

Integrated order is necessary for the ARDL approach. If the series are integrated in order is I(2) or more, we can't use this approach. Performing the PP and ADF test, all the series are integrated order is 1 that's I(1). The results of the ADF and PP tests are given below in Table 2.

Table 2: Stationary Test

Variables	ADF Test		PP Test	
	Test Statistic	Prob.	Test Statistic	Prob.
LRGDP	1.355	.998	2.736	1.00
LRES	-0.735	.822	-.817	.7992
LCON	3.3	1.00	3.558	1.00
First Difference				
Δ LRGDP	-3.370	.0209	-3.379	.0205
Δ LRES	-4.3267	.0021	-4.325	.0021
Δ LCON	-3.735	.0089	-3.735	.0089

4.2 Bound Test

To estimate the ARDL model, it is necessary to know the optimal lag. To find the optimal leg, we run the unrestricted VAR model. The results of the Unrestricted VAR are given below in Table 3.

Table 3: Lag Length Criteria

VAR Lag Order Selection Criteria					
Lag	LogL	LR	FPE	AIC	SC
0	71.18	NA	1.06e-06	-5.24	-5.09
1	193.28	206.63*	1.78e-10*	-13.95*	-13.36
2	201.38	11.84	1.97e-10	-13.88	-12.86
3	205.82	5.46	3.04e-10	-13.53	-12.07
4	216.21	10.38	3.24e-10	-13.63	-11.74

The result shows that most of the tests support the one(1) lag criteria. Finding the optimal lag we need to estimate the ARDL model. Based on the Akaike Information Criteria(AIC), the expected ARDL model is found ARDL(1,1,1).

To check the long-run link among the variables, we perform the bound test and compare the F-statistic with the upper bound. Here the F-statistic is 17.648 is larger than the upper bound and the null hypothesis of no long-run association is rejected.

The result of the bound test is given in Table 4.

Table 4: Bound Test Outcomes

F-Statistic= 17.64862		
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.63	3.35
5%	3.1	3.87
2.5%	3.55	4.38
1%	4.13	5

4.3 Long-Run and Short-Run Result

Since economic growth, consumption and reserve are cointegrated, then the long-run association ship is established. Here, LRGDP is the dependent variable and the explanatory variables are reserve and consumption. The LR outcomes are given below in Table 5.

Table 5: Long-Run Outcomes

ARDL(1,1,1) Based on AIC Dependent Variable: LRGP				
Regressor	Coefficient	Std. Error	t-Statistic	Prob.
LRES	0.208011	0.074775	2.781816	0.0106
LCON	1.229350	0.208606	5.893170	0.0000
CONSTANT	-12.442651	1.667292	-7.462791	0.0000

Here, if the consumption increases by 1%, on average, economic growth will rise by .21 percent as well as a one percent rise in reserve, economic growth will lead to a rise by 1.23 percent in the long-run. Both variables are significant at a 5% significant level. The short-run outcomes are given in Table 6.

Table 6: Short-Run Outcomes

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRES)	-0.048954	0.020800	-2.353583	0.0275
D(LCON)	-0.686317	0.248414	-2.762795	0.0111
ECM(-1)	-0.271619	0.030405	-8.933223	0.0000

The short-run coefficient outcomes are significant at the 5% level of significance. In SR, with the rise in consumption by one percent, the economic growth will be decreased by .04 percent. Also, the rise in reserve by one percent, on average, the economic growth will decrease by 0.68 percent. Although the short-run coefficients are statistically significant, the sign of the coefficient is not the same. Explanatory variables will cause to decrease the economic growth in the SR but the LR coefficients are led to an increase the economic growth. The negative but statistically significant value of ECM(-1) shows the speed of adjustment which supports long-run equilibrium. The ECM shows the deviation from the short-run to long-run equilibrium. There is a 27.16% of this model is corrected each year from SR deviation to LR equilibrium.

4.4 Diagnostic Test

There are many tests performed to diagnosis the model such as serial correlation, heteroscedasticity, normality test, functional form. For the normality test, the null hypothesis is residuals are normally distributed. The probability is greater than 5%, thus the residuals are normally distributed.

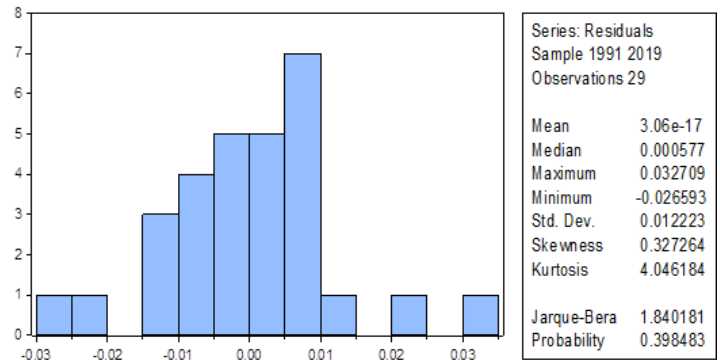


Figure 3: Normality Test

According to the Ramsey RESET test, the null of the model is fitted isn't rejected because the value of probability is higher than the 5% significance level. Thus, the model is good. The heteroskedasticity test is performed where the null of no heteroscedasticity cannot be rejected so the model is homoscedasticity. The model is also free from serial correlation where the null of no serial correlation is not rejected both the F-version and LM version. Thus, the model are good and passes through all diagnostic tests. The Table 7 shows the summary of the diagnostic test.

Table 7: Diagnostic Test

Ramsey RESET Test			
	Value	df	Probability
t-statistic	0.279309	22	0.7826
F-statistic	0.078014	(1, 22)	0.7826
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.758219	Prob. F(5,23)	0.5889
Obs*R-squared	4.103670	Prob. Chi-Square(5)	0.5346
Scaled explained SS	3.931499	Prob. Chi-Square(5)	0.5593
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.053639	Prob. F(1,22)	0.8190
Obs*R-squared	0.070534	Prob. Chi-Square(1)	0.7906

For the stability test, we employ the CUSUM test. Figure-4 shows the plot of CUSUM and Figure-5 shows the plot of CUSUM square. Here the CUSUM square shows the stability where the stability line touches the straight line. It represents that the economy faces structural change from 2003-04. The following figures show the CUSUM and CUSUM square test.

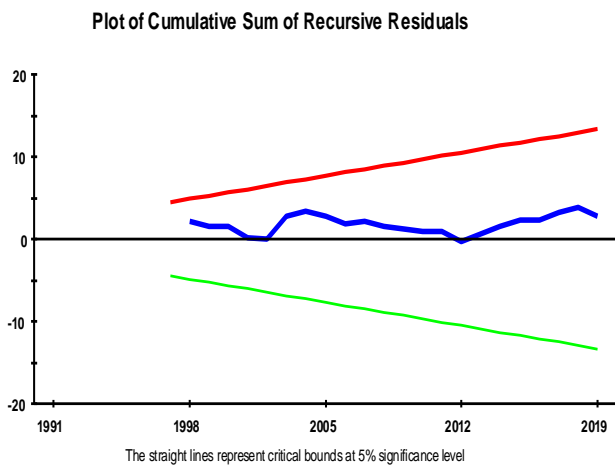


Figure 4: CUSUM test

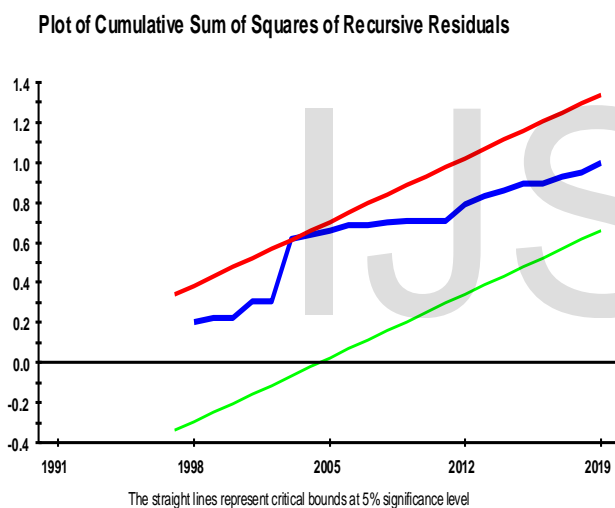


Figure 5: CUSUM Square test

4.4 Granger Causality Test

The results of the Granger Causality test are performed by the following Table.

Table 8: Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob.
LRES does not Granger Cause LGDP	29	18.0896	0.0002
LGDP does not Granger Cause LRES		2.18222	0.1516
LCON does not Granger Cause LGDP	29	9.77721	0.0043
LGDP does not Granger Cause LCON		0.13627	0.7150
LCON does not Granger Cause LRES	29	5.01400	0.0339
LRES does not Granger Cause LCON		0.17384	0.6801

The above table shows the outcomes of the causality test. Here, there is a one-way association ship that exists among the variables. The reserve causes economic growth where growth doesn't cause the reserve at the 5% significance level. Consumption causes growth where growth doesn't cause consumption. Also, between consumption and reserve, consumption causes the reserve and not vice-versa.

5 CONCLUSION & RECOMMENDATIONS

This paper assesses the dynamic nexus between reserve, consumption expenditure, and economic growth. Both the long and short-term analyses are conducted through the ARDL approach. According to the ADF and PP test, all the variables are I(1). We governed time series data with the annual frequency with 1990-2019. The model passes all the diagnostic tests except CUSUM square there may be a structural break in the FY2003-04. In SR, there are negative but statistically significant to analyze economic growth. Considering reserve and consumption, the consumption expenditure is more effective to impact the economic growth in the SR. In the long-term, both reserve and consumption expenditure are statistically significant to affect economic growth. If we consider that consumption expenditure is risen by 1%, on average, economic growth will be surged by 1.23% in the LR. And if reserve increased by 1%, on average, economic growth will rise by 0.21% in the LR. Granger causality test confirms that there is a one-way association among the variables. The unidirectional relationship is found from consumption to economic growth but not vice-versa. Also, reserve causes economic growth not vice-versa. The consumption expenditure causes the reserve not vice-versa.

This implies that Bangladesh has to involve more actively in foreign reserve management practices as a tool to promote economic growth. The policymakers should put in place appropriate policy measures that will help promote a sustained increase in the reserve holdings of Bangladesh. In general, most economic research suggests policies based on the supply side of economic growth, but in the case of Bangladesh, the demand side is more powerful. Since, theoretically, we are constrained by innovative technology, infrastructure, and improved developed human resources. The findings show that final consumption expenditure and GDP have an important influence on each other. Higher production can, therefore, provoke consumption by influencing economic growth. Oppositely our external sources of revenue stimulate our consumption behavior, such as rapid cash flow and remittances, which are mostly spent on consumption expenditure. In general, given the constraints of technology and the pattern of consumption, the government can pursue monetary and fiscal policies that increase consumption. Since our domestic market is quite large and we have a demand-driven economy, a jump in domestic consumption can boost our production and growth.

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