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DYNAMIC NEXUS BETWEEN SAVING, GDP AND FOREIGN EXCHANGE RESERVE IN BANGLADESH: ARDL APPROACH

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Abstract: The study has been endeavored to unveil the nexus among national savings (NS), gross domestic product(GDP) and foreign exchange reserve (FER) in context of Bangladesh by using yearly data from 1990 to 2018 trough pragmatic analysis by using autoregressive distributed lag (ARDL) approach. The study revealed that the variables have long run (LR) association ship through the convergence to equilibrium from LR to short run (SR) 11percent every year. CUSUM and CUSUM square test signified that the coefficient of the estimators of the model are stable. The model is normally distributed and also free from heteroscedasticity, serial correlation. Compared to other variables GDP has the most significant impact on savings both LR and SR while FER has the weak impact on savings. It gives the impression that the policy makers and govt. should assign rules and policies that will accelerate the savings to increase the real GDP.

Index Terms **– FER, NS, GDP, ARDL, CUSUM.**

1. INTRODUCTION

Savings is the prominent factor to accelerate the economic growth in any country. According to Solow model capital accumulation caused economic growth along with explained the LR economic growth. In the less-developed nation, the low rate of saving causes the low level of economic growth. Higher rate of saving causes higher rate of investment and higher level of investment causes greater output in the economy. The amplified proficiency of investment stipulates a comparative benefit to the capital scant economies to catch-up or to congregate with the richer economies in the LR. (Romer, 1986; Lucas, 1988).

Economics are observed to be witnessing a rapid economic growth for example in India, China, Malaysia, Indonesia, Singapore, Thailand and South Korea also boast with high saving rates. Likewise, many Sub-Saharan African and Latin American countries encounter slow growth because they archetypally save at a low rate. In this context, the study of savings factors for an economy is immensely important to formulating effective policy initiatives that encourage higher savings for superior economic growth.

In FY2018-19, GDS increased from 22.83% a year earlier to 23.93% of GDP. However, as a percentage of GDP national savings amplified from 27.42% in FY2017-18 to 28.41% in FY2018-19. In FY2018-19, whereas, the investment-GDP ratio increased from 31.23% in the previous fiscal year to 31.56%. The pattern of the gross saving (% of GDP) are given below with diagram. The contribution of the gross saving (% of GDP are increasing since 1993. And it reaches its peak in 2012 then the trend are becoming fallen.

Foreign exchange reserve is an important factor for developing countries. The FER in Bangladesh were estimated at $31.3 billion in May 2020, compared to $31.0 billion in the previous month. The trend of the foreign exchange reserves in Bangladesh is given below at Figure-2.

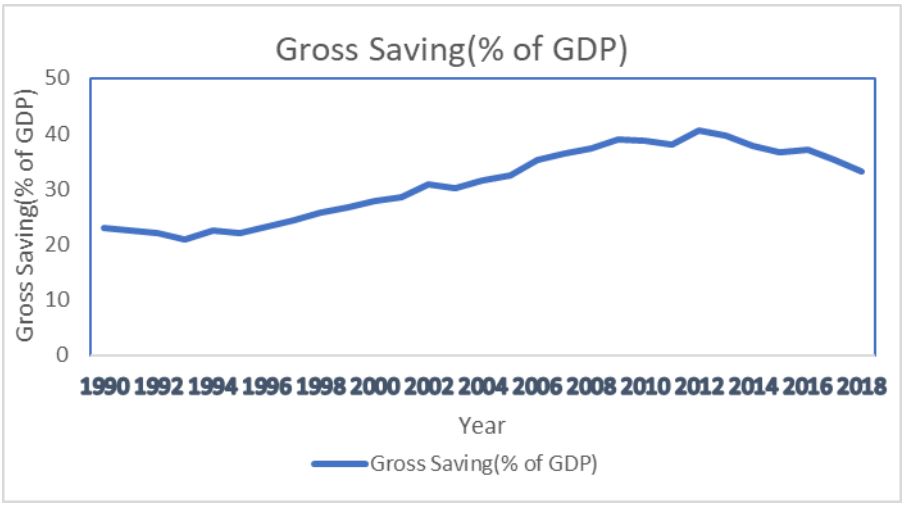


Figure 1: The Trend of the Gross Saving (% of GDP)

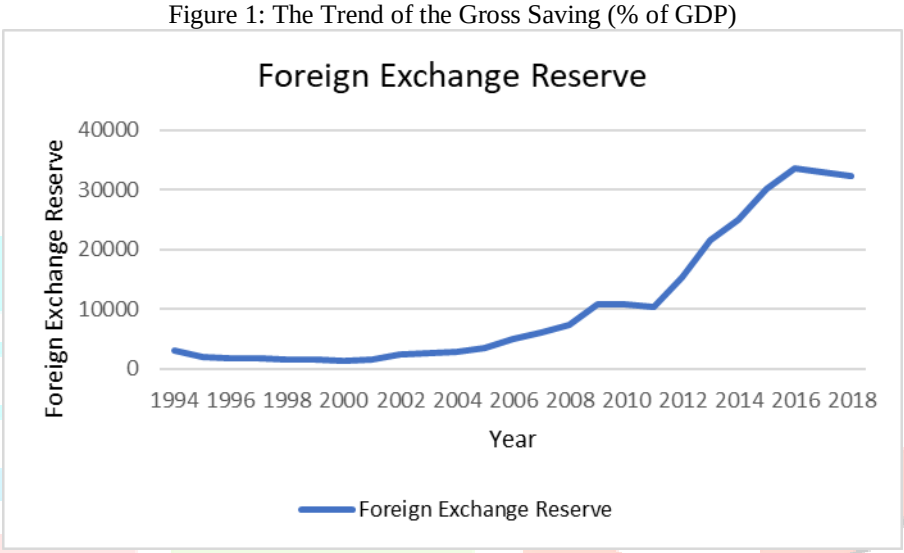


Figure 2: Trends of the Foreign Exchange Reserve

2. LITERATURE REVIEW:

Using the 1970-2010 yearly data from Iran applying ARDL approach, the variables were co-integrated. Long-term relationship established by estimating the estimating error correction model(ECM). In this model long-term coefficients are greater than short-term coefficients. Among variables the labor force and education are important effect to analyze growth in the long-run. In addition to saving, oil revenues have a strong influence on growth in the short term. The equilibrium is adjusted 79% from short-run to long-run. (Mehrara & Maysam, 2013). The annual time series data from 1980 to 2008 used for Botswana. In the inspect of the growth, the domestic saving is an important factor whereas there would be a direct connection between these variables both the SR and LR. In long run, the impact of the saving on GDP is stronger than the short run equilibrium. There is a 1.45% increase in growth produced by one percent increase in savings-GDP ratio changes. (Amusa, 2013)

There is cointegration between variables in Morocco, but not in Tunisia. Although the saving and GDP growth have long-run association for Morocco, no long-run association for Tunisia. Because of no cointegration in the case of Tunisia, instead of using the VECM used the VAR model for causality test. Even though there exist bi-directional affiliation between saving and GDP growth for Morocco, a unidirectional relationship from saving to GDP growth for Tunisia. (AbuAl-Foul, 2010)

Shimelis (2004) studied the link between savings, investment along with economic growth, labor force and human capital in Ethiopia utilizing data covering the period from 1969/70-2010/11. Both the LR and the SR the labor force and gross domestic investment is statistically significant to analyze the RGDP. Gross Domestic Saving is statistically insignificant to affect the RGDP in LR and the SR. Granger causality showed that savings doesn't cause economic growth whereas economic growth causes saving. However, the bi-direction relationship achieved between saving and investment. Thus, the saving causes investment and vice-versa. Along with the investment and growth are two-way associations.

Saltz (1999) surveyed the connection between savings and GDP growth for the seventeen countries. The four countries with 5% significance level no association were established. The outcomes of the studies showed that economic growth was instigated by the intensified domestic savings of nine countries. The reverse relationship was noticed in two countries whereas in four other countries no causal relationship was identified between economic growth and GDS. Finally, the existence of a two-way causal relationship between the variables analyzed was confirmed for two countries.

Misztal (2011) examines the causality between growth as well as savings in different levels of development countries. In Advanced nation GDP doesn't cause GDS. In advanced nations GDS caused a changing GDP. Thus, a one-way relationship confirmed by Granger Causality. Empirical findings also confirmed that saving caused the change of GDP in emerging nations along with developing nations. He also claims that the existence of causal connection between savings and economic growth were not ascertained significantly by the level of economic progress.

Oluwafemi and Laseinde (2019) examined the dynamic relationship between the selected variables and GDP growth in Nigeria. They used the annual data from 1981 to 2015. Empirical findings of co-integration test supported that long-run association is possible. The FDI along with trade openness are related to analyze the growth in long-run. Both these factors stimulate the economic output. In the short-run, the important factors that affect the RGDP are FDI and trade openness.

Anoruo and Ahmad (2001) explores the causality between savings and economic growth for seven African nations such as Zambia, Ivory Coast, Nigeria, Kenya, Ghana and South Africa and Congo. To identify the link between variables used for cointegration and causality test. They used to cover the period from 1960 to 1997 for seven countries. Johansen Cointegration test showed that long-run association was found except Nigeria. Bidirectional causality for South Africa and Ivory Coast between saving's growth and economic growth. For the rest of the nation one-way causality identified. For Congo the growth of savings causes economic growth.

Hazel, Tugcu and Coban (2014) investigates the interlink between inflation, economic growth as well as saving in case of Turkey by applying ARDL approach. Long-run parameters are consistent and have a positive impact on saving. Rather than economic growth, inflation and interest rate are not statistically significant. Thus, the most influential factor is economic growth to analyze saving.

Chowdhury, Uddin and Islam (2015) studied to determine the important factors for foreign exchange reserve (FER) in Bangladesh. Except remittance, foreign aid and import all other explanatory variables are statistically significant to impact FER. The estimated model also passed the diagnostic test.

Chaudhry *et al*. (2011) investigates the link between inflation and FER using ARDL approach in Pakistan. From estimation foreign exchange reserves are important and statistically significant on inflation. Rising foreign exchange reserves will lead to lower the inflation rate in long-run. Also, the Error Correction Model (ECM) shows the negative but statistically significant value is .13 means that there is 13% corrected through short-run detachment to long-run equilibria.

Bhasin and Khandelwal (2019) explores the link between exchange rate, foreign institutional investment (FII) and FER in India by applying ARDL approach. The cointegration test supports that long-run associations are found. Besides the causality runs from FER and exchange rate to FII. There are 38% adjustment by creating a short-run detachment.

3. Estimation Method

In order to identify the nexus between the GDP, saving and foreign exchange reserve in Bangladesh time series data of Bangladesh Economic Review over the period 1993-2018 have been used. Real GDP is used as GDP, national saving is treated as the saving. The logarithmic transformation has been performed for all variables. For this research paper we used the statistical packages Microfit 5 and EViews 9.0.

Table 1: Variables and Description

Variables	Description
LGDP	Natural log of real GDP
LNS	Natural log of national saving
LFER	Natural log of foreign exchange reserve

3.1 Unit Root Test

Before progressing with standard time series modeling it is obligatory to check if any variable seems to have unit root problems. It appears that most time series variables in level form posses unit root problem. For this reason in time series analysis OLS becomes unfitted because it means non-constant mean and variance, which might lead to spurious regression. To detect unit root problem we will conduct Augmented Dickey-Fuller (1979). Which variable is stationary in level form is called Integrated Order of 0(zero), shortly I(0) and after differencing which variable is stationary is called I(1). The ADF test for every variable possesses following regression form:

$$\Delta y_t = \alpha_1 + \alpha_1 t + \beta y_{t-1} + \delta_i \sum_{i=1}^{n} \Delta y_{t-i} + u_t$$

In this equation,

$u_t =$ a white noise error term and n refers to the number of lags is based on lag selection criteria.

So, we may refuse the null hypothesis when the value of $|t_{cal}| > |\tau_{cri}|$, otherwise not.

The ARDL model is ripened by Pesaran, Shin, and Smith (2001). ARDL method has been employed to find the LR and SR elasticities and the SR deviations from the LR equilibrium path and at what speed these deviations have adjusted towards the LR equilibrium path each year. Lag length and Integrated Order are very important to run an ARDL model. In recent years the ARDL approach has become popular because it has specific advantages than other approaches. All the time series variables are not the same order of integration. The ARDL model are used to the both I(0) and I(1) and a combination of I(0) and I(1). But if any variable is I(2) or more order of integration we do not use ARDL model. We can also justify the long run cointegration and ECM regression this model. LNGDP is regarded as the dependent variable of the model, ARDL model can be identified as follows:

$$\Delta LNS = \alpha_1 + \alpha_2 t + \alpha_3 LNS_{t-1} + \alpha_4 LGDP_{t-1} + \alpha_5 LFER_{t-1} + \sum_{I=1}^{P} \beta_i \Delta LNS_{t-i} + \sum_{I=1}^{P} \gamma_i \Delta LGDP_{t-i} + \sum_{I=1}^{P} \mu_i \Delta LFER_{t-i} + U_t \quad (3.1)$$

3.2 Error Correction Model (ECM):

To run ECM, we need to know whether the variables of the model are cointegrated or not. From ECM we know the speed of adjustment from SR to LR equilibrium without neglecting any information. The ECM can be identified as follows:

$$\Delta LNS = \alpha_1 + \alpha_2 t + \sum_{I=1}^{P} \beta_i \Delta LNS_{t-i} + \sum_{I=1}^{P} \gamma_i \Delta LGDP_{t-i} + \sum_{I=1}^{P} \mu_i \Delta LFER_{t-i} + \omega ECM_{t-1} + U_t \quad (3.2)$$

3.3 Granger Causality Test

To examine the nature of causality the study performs pairwise Granger causality (Granger, 1969) techniques. The test helps to explain the SR causality from one variable to another variable.

4. Result and Discussion:

4.1 Unit root test:

At the level form LGDP, LNS and LFER are the nonstationary. After first differencing the variables are stationary at the 5% significance level.

Table 2: Results of Unit root test

Variables	t-value	Critical Values		
		1%	5%	10%
LGDP	-0.2096	-3.72	-2.98	-2.63
LNS	0.13	-.372	-2.98	-2.63
LFER	0.71	-3.72	-2.98	-2.63
First Difference				
ΔLGDP	-4.787	-3.737	-2.99	-2.635
ΔLNS	-4.42	-3.737	-2.99	-2.635
ΔLFER	-3.27	-3.73	-2.99	-2.635

Using EViews 9.0

4.2 Bound test:

To estimate the ARDL bound test there are two steps performed. First, we requisite to pick out the maximum lag length. For these we need to run the unrestricted VAR model. Then according to Schawz Criteria (SC) we find the maximum lag length which directs the maximum lag length is one. Based on the Schawz Bayesian Criteria (SBC), the desired ARDL model is found ARDL (1,0,0). The following table shows the lower and upper value of the bound test. At 5 % level of significance the test statistic value is higher than the upper bound which signifies that H_0 of no cointegration is rejected that signifies the variables are cointegrated and there is a LR nexus among the variables. Thus, the LR association is existing.

Table 3: Upper and Lower Bound(Restricted constant)

Critical Value	F-statistic= 48.85964	
	Lower Bound	Upper Bound
90%	2.63	3.35
95%	3.1	3.87
99%	4.13	5

Using EViews 9.0

4.3 Long-run and Short-run Results:

As saving and RGDP and FER are cointegrated, then it is possible to estimate the long-term connection between them. Here LNS is the dependent variable and the other variables are the explanatory variables. The LR findings of the model are shown in Table 4.

Table 4: Long-run Results

ARDL (1,0,0) (Restricted constant)			
Regressor	Coefficient	Standard Error	T-ratio [Prob.]
LGDP	1.4886	.4434	3.3501[.003]
LFER	.049545	.25389	.19514[.847]
CONSTANT	-4.5432	1.5716	-2.8907[.009]

Using EViews 9.0

If the RGDP rises by one percent in the LR, savings will increment by 1.488 percent as well as one percent rise in Foreign Exchange Reserve, saving will increment by .0495 percent. Here real GDP is the statistically significant at 5% significance level but Foreign Exchange Reserve is not statistically significant.

Now the short-run findings are given at Table 5. If the RGDP rises by 1% in the short-run, savings will increment by .17228 percent as well as if the FER rises by 1%, savings will increment by .0057342 percent. The negative but statistically significant value of ECM(-1) -.11574 results in support of a long-term relationship. The value of ECM demonstrations the speed of convergence from SR to LR equilibrium. Approximately 11 percent of this model is corrected each year from short-term deviation to long-run equilibrium.

Table 5: Short-run Results(Restricted constant)

Regressor	Coefficient	Standard Error	T-ratio(prob)
dGDP	.17228	.073843	2.331 (.030)
dFER	.0057342	.030428	.18845 (.852)
ECM (-1)	-.11574	.052835	-2.190 (.040)

4.4 GRANGER CAUSALITY TEST:

The pairwise Causality relationship is presented on the following Table 6

Table 6: Results of Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
LGDP does not Granger Cause LNS LNS does not Granger Cause LGDP	25	2.66188 2.42018	0.1170 0.1341
LFER does not Granger Cause LNS LNS does not Granger Cause LFER	25	0.10646 11.4489	0.7473 0.0027
LFER does not Granger Cause LGDP LGDP does not Granger Cause LFER	25	0.00369 15.6807	0.7473 0.0027

Using the EViews 9.0

The above table shows the pairwise relationship among the variables. There is a unidirectional affiliation between saving and FER reserve as well as real GDP and FER. Here, only saving Granger causes Foreign Exchange Reserve not vice-versa and Real GDP Granger causes Foreign Exchange Reserve.

4.5 DIAGNOSTIC TEST:

The diagnostic test of the model is performed to examine the serial correlation, functional form, heteroscedasticity among the variables. The results of the diagnostic test are given below at Table 7.

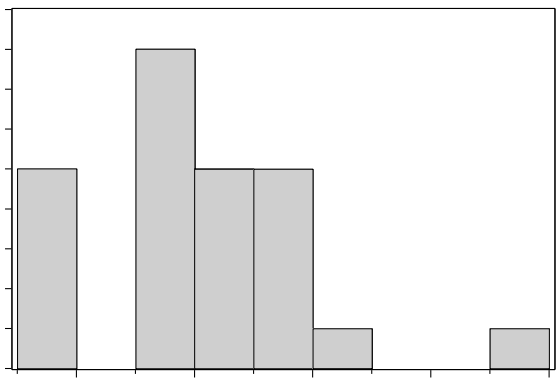
Table 7: Results of Diagnostic Test

Test Statistic	F-version
Serial Correlation (χ^2)	F(1,20)= .066190 [.800]
Functional Form (χ^2)	F(1,20)= .90327 [.353]
Heteroscedasticity (χ^2)	F(1,23) = 1.7067 [.204]

The Lagrange Multiplier tests are performed for the serial correlation of residuals where the H_0 is no serial correlation. For the functional form test we use Ramsey's RESET test where the H_0 is the model is correctly specified. For the heteroscedasticity test the H_0 is homoscedastic. Here there is no serial correlation among the residuals as the H_0 cannot be rejected because the p-value is higher than 5%. The model is also satisfied the Ramsey's RESET test that is the functional form is correct. And the model is also free from heteroscedasticity. The normality test of the model can be depicted below. For obtaining the BLUE estimators of the model the residuals of the model must be normally distributed. Here we use Jarque- Bera test to check whether the residuals are normally distributed or not. This test also plot a histogram. If the data are normally distributed then the shape of the histogram will be bell-shaped. In this test the H_0 is that the residuals are normally distributed. We cannot reject the H_0 if the calculated p- value is more than 5%.

Table 8: Results of Normality Test

Jarque-Bera	1.85642 (0.395)
Kutosis	3.885909
Skewness	0.499332



The value of Jarque- Bera is 1.856420 and the p-value is .39 that means 39% which is more than 5% and the value of skewness is .49(near to 0) and the value of kurtosis is 3.88 (near to 3) which ensure that the residuals of the model is normally distributed.
To check the stability of the model we use the CUSUM and CUSUM squares.

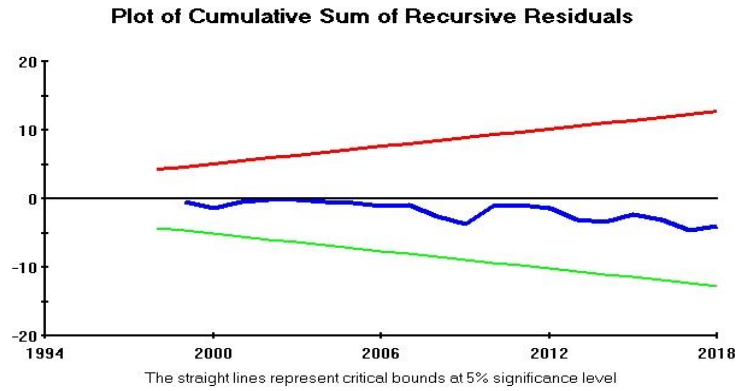


Figure 3: CUSUM TEST

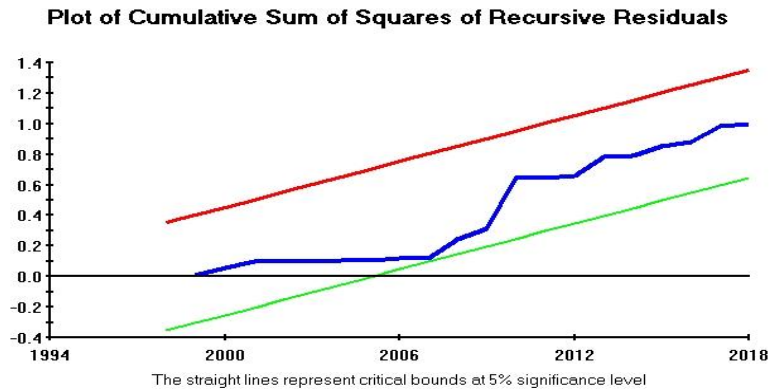


Figure 4: CUSUM square

Here at the 5% significance level the cumulative sum of recursive residuals and the cumulative sum of the square of the recursive residual are bounded. This implies that there is a stability in the model. Thus, the model is stable in the long-run.

5. CONCLUSION:

This study explores the link between the Real GDP, foreign exchange reserve and national saving by performing ARDL bounds approach. Data makes the stationary at the first difference at the Augmented Dickey Fuller test. The study reveals that there is a short-run and long-run relationship between the variables. Foreign exchange reserve plays a statistically insignificant both short and long-run. The negative of statistically significant value of ECM is .11574. The value of ECM shows the speed of adjustment which is 11.57 percent is adjusted from short-run equilibrium to long-run equilibrium. The model is suited and free from functional error as well as heteroscedasticity. The model is stable which is performed by the CUSUM test. The Granger causality test shows the unidirectional relationship between saving and foreign exchange reserve as well as real GDP and foreign exchange reserve. Here, only saving Granger causes Foreign Exchange Reserve not vice-versa and Real GDP Granger causes Foreign Exchange Reserve. Although the two variables real GDP and savings are related significantly, the foreign exchange reserves cannot explain properly in terms of savings. Based on the result of the study the following issue may be considered. Firstly to expansion the savings raise the savings interest rate and reduce the lending interest rate to increase the investment of the country. Secondly the policy makers should take monetary and fiscal policy that will allow more savings and FER to help the economic growth of the country.

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