Effect of GDP Growth, Inflation and Interest Rate on National Savings Rate of Bangladesh: An Assessment from 2000 to 2020

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Abstract
This present study aims at examining the relationship among national savings rate, inflation rate, gross domestic product (GDP) and interest rate prevailing in the economy of Bangladesh. For accomplishing this objective, data were collected from World Bank data based on time period from 2000 to 2020. This study uses autoregressive distributed lag model which shows that GDP has a significant (p<0.05) effect on the national savings rate in the long run but not significant in the short run which implies that a rise in income level also raise the savings rate, whereas inflation rate and interest rate both have significant positive effect on savings rate in both short run as well as long run and push up savings due to future expectation. This study concludes that a well-managed GDP growth; interest rate will ensure an organized savings rate according to economic fluctuation which in turn contributes to economic development.

Keywords: GDP, National Savings, Inflation, Interest Rate, Economic Development.

1.0 Introduction
Gross Domestic Product (GDP) is the total financial value of all final products and services produced in a country or region in a given period of time through its citizens and foreigners (Dynan and Sheiner, 2019). A country’s GDP is calculated by summing private investment, personal spending, exports and government spending (minus imports) (IMF, 2019). It provides a snapshot of a country’s economy and is used to estimate the size and growth
rate of an economy. GDP growth represents the percentage change of GDP from time to time (Quazi et al., 2005). It may be quarterly or annually. GDP growth also shows how the economy has grown compared to the previous fiscal year (Hussain and Haque, 2017). A negative growth rate means low economic output and it could trigger an economic downturn. On the other hand, a positive growth rate indicates that the economy is in good shape and the country is improving. That means productivity, national production, and money supply are increasing. When the money supply increases the value of money decreases. This money supply fuels the overall demand and price of the economy for products and services to grow faster than the productive capacity of the economy. An increase in the overall price level, which is usually expressed as a percentage, means that the actual purchase of a single currency is lower than compared to the previous year (Ha et al., 2003). This situation leads to the root of inflation. So inflation is the decrease in the purchasing power of a particular currency over time (Bozkurt, 2014). The goal of inflation is to measure the overall effects of general price changes on a diverse set of products and services. It also allows a single value to represent an increment in the price level of products and services over a particular period of time in the economy. There are many ways to control inflation such as: reduce the money supply, increase the interest rate, decreases bonds prices, increases exchange rate and tax rate, etc. (Basu, 2011). Among them, interest rate plays a significant role in the economy because it affects the likelihood of people’s borrowing decisions. So the interest rate is the amount of money that one’s has to pay for borrowing money, or, amount of money one receives for lending money (Van Wijnbergen, 1983). The central banks’ have the power to control Interest rate fluctuation. Sometimes they increase the rate of current interest rate to decline the demand in the economy. That results in lower inflation and lower economic growth for a country. The high interest rate has affected the exchange rate. It also causes to raise the cost of borrowing and makes the savings more attractive. Savings refers to the amount of money remaining after subtracting all expenses and other obligations from income (Cronqvist and Siegel, 2015). A person’s savings rate is the percentage of his disposable income. National savings are measured as additional income from national expenditure (Ahmad and Mahmood, 2013). There is a positive relationship that exists between savings and growth (Agrawal and Sahoo, 2009). That is why savings are considered an important indicator for the economic progress of a country. Most of the previous research studies were done in Bangladesh about the impact on analysis of inflation, interest rate and economic growth such as Mujeri and Younus (2009), Rahman (2015), Majumder (2016), Karim et al., (2020) and Karim and Tiasha (2020), but none of them took into consideration about the national savings but this study considers the savings rate. This study tries to investigate the association among savings rate, inflation rate, interest rate, GDP of Bangladesh as well as recommend the policy implication regarding this analysis which helps the policy makers to make decisions regarding saving rate, monetary and fiscal policy. This study will also contribute in a sense that there is no enough previous study or literature review on saving rate as well as its determinants and obviously, this is an important contribution in this sense that will also help to lead further study by questioning and supporting the results.

2.0 Literature Review

2.1 GDP Growth

GDP indicates the economic position of a county. This study incorporates GDP growth rate for assessing its effect on saving rate. Conducting time series data for 1980 to 2015, Akter, (2018) tried to examine the impact of foreign aid and remittances on gross savings in the context of Bangladesh, India, and Philippines. This study utilized the Ordinary Least Square (OLS) and GMM methods. The data set came from World Bank Development indicators during the time period 1976-2012. Hussain & Haque, (2017) measured the impact and connection between money supply and GDP growth rate in Bangladesh. Their study utilized the Ordinary Least Square (OLS) and GMM methods. The data set came from World Bank Development indicators during the time period 1976-2012. Hussain & Haque, (2017) measured the impact and connection between money supply and GDP growth rate in Bangladesh. To analyze time series data between 1972 and 2014, their study applied Vector Error Correction Model (VECM). Countries with higher GDP growth rate and so higher per capita
growth rate are expected to have higher savings ratios than countries with lower growth rates. Alternatively, the size of this effect is likely to decline as per capita income rises and may even become negative for rich countries where investment opportunities and growth are relatively lower.

2.2 Inflation

By applying the Co-integration test, Augmented Dickey Fuller test, Granger causality test, regression analysis, and VECM methodology, Majumder, (2016) aimed to identify the impact of inflation, money supply, and remittance on economic growth in Bangladesh. His study considered annual time series data for the year 1975-2013. To explore the connotation between inflation and economic growth in Bangladesh, Hossin, (2015) utilized the Co-integration test, Error Correction Model (ECM), and Granger Causality test. He collected yearly data set about Gross Domestic Product Deflator (GDPD) and real GDP for 1961 to 2013. Using the secondary data from World Bank (WB) and Monthly Economic Trends for the time period 1990 to 2010, Hossain, (2013) determined the factors of inflation in Bangladesh. To assess the relationship this study also utilized the Ordinary Least Square (OLS) model. Hossain et al. (2012) evaluated the effect of inflation on economic growth in Bangladesh. This study applied the Augmented Dickey-Fuller (ADF), Phillip-Perron (PP), Co-integration, and Granger causality test, covering the time period 1978-2010. They collected all variables from the World Development Indicators. Inflation declines the current purchasing power of people in a country. It creates a barrier to improve in GDP growth of that particular country.

2.3 Interest Rate

By using panel data of 48 Bangladeshi banks from period 2004 to 2008, Mujeri & Younus, (2009) analyzed the impact of Interest Rate Spread in the Banking sector in Bangladesh. They apply pooled OLS and fixed effect model for their study. The data set comes from bank’s annual reports. Sakib et al., (2020) study about a panel data of 30 listed commercial bank in Bangladesh. By employing descriptive analysis, analysis of variance, linear regression analysis, multivariate analysis, multicollinearity test, correlation analysis, and Durbin-Watson test, their study aimed to identify the connection and effect of interest rate changes on banks’ profitability. This study obtains data from the banks’ annual reports for 2014-2018. Mahzabeen, (2016) explored the impact of Interest Rate, Money supply and Inflation on Dhaka Stock Exchange (DSE) of Bangladesh. She obtained 144 observations from Monthly Major Economic Trend, Dhaka Stock Exchange and Economic Trend for a time period January 2001 to December 2012. Her study applied unit root test, a pairwise correlation matrix, Granger causality test and OLS regression model. Mukit, (2013) executed a study on 264 samples collects from Monthly Economic Trends published by Bangladesh Bank and Dhaka Stock Exchange website in 1991 to 2012. His analysis determined the impact on interest rates on stock market performance by incorporating Granger causality test, Co-integration test, OLS regression model, and Vector Error Correction Model (VECM). Ashrafual et al., (2014) applied an Adaptive Expectation Model and Regression model to examine the impact of conventional banks’ interest rate on Islamic bank’s profitability for 2005-2011. By utilizing the Convenience sampling method they selected 302 samples for their study. Interest rate will stimulate consumption and investment while discouraging people from saving, but low interest rates may also prompt people to increase their saving to compensate for the low rate of return.

2.4 Savings

investment and savings in Pakistan for the time period 1973 to 2006. Chaudhry et al., (2009) implemented the Augmented Dickey-Fuller test, co-integration analysis, and multivariable regression analysis. Their study accumulated data from different economic survey reports and numerous annual reports of the State Bank of Pakistan. To measure the relationship among savings, economic growth and investment, Verma, (2007) applied Autoregressive Distributed Lag (ARDL) bounds testing approach, Perron’s innovational outlier model, and Unit root test. For this purpose, his study used the annual time series data for 1951-2004. He collected data from the two publicly available sources Reserve Bank of India and Statistics of India. Savings can be considered as an increasing function of the income but in macroeconomic view, many macroeconomic variables are found that have influential factors for savings rate on GDP growth and better economic condition or GDP growth will also ensure better savings rate. Thus, savings rate of an economy is correlated and depended on other macroeconomic variables including interest rate, inflation and so on.

There are many studies in which all are tried to link GDP with other macroeconomic variables but no major study has been done on the national savings rate of Bangladesh. That is why this study may help the policy makers to adopt steps regarding savings rate as well as it depicts a clear picture of monetary and fiscal policy.

3.0 Methodology

3.1 Data Collection

This present study uses secondary data from World Bank (WB), WDI and ECIC data. The data cover time period from 2000 to 2020 of Bangladesh. The descriptive statistics includes mean, median, maximum and minimum values. The statistical analysis is performed with statistical software package STATA 15.0 version.

3.2 Model Specification

Selection of an appropriate model in case of time series data is one of the most important tasks for time series analysis. This is because the inappropriate selected model gives not only wrong estimation but also biased result (Shrestha, and Bhatta, 2018). For time series data, Autoregressive Distributed Lag model (ARDL) can be used where all the variables are stationary at level or stationary at first difference or there is a mixture of both stationary and non-stationary variables. Since all the variables are stationary at level shown in table 3. For these characteristics of variables, ARDL model is appropriate for this analysis. Following Atkinson and Hamilton (2003), Abou El-Seoud (2014), Verma (2007) and Alam et al. (2020), a multivariate model of this study is constructed as below.

\[
NSR = f(GDP, INF, INT) \\
NSR_t = \beta_0 + \beta_1 GDP_t + \beta_2 INF_t + \beta_3 INT_t + \epsilon_t
\]

Where, NS = National savings rate; GDP = Real GDP growth rate; INF = Inflation rate measured by Consumer Price Index (CPI); INT = Nominal interest rate on savings deposits; \(\epsilon\) = Stochastic disturbance term; \(t\) = Time period from 2000 to 2020.

Following Karim and Tiasha (2020), long run dynamics model is represented as:

\[
ECM_t = \gamma_0 - \gamma_1 NSR_t + \gamma_2 GDP_t + \gamma_3 INF_t + \gamma_4 INT_t
\]

Since long run correlation is present among the variables, the following error correction model is developed for short run analysis.

4.0 Analysis And Findings

4.1 Descriptive Statistics

Descriptive statistics is an important initial stage of summarizing, organizing, presenting and analyzing the status of variables in a sample or population before making any inferential statistics of a research. It contains type of data, measures of frequency, central tendency and variation (Fisher and Marshall, 2009; Kaur et al., 2018). The below table 1 shows the descriptive statistics of this present study which includes mean, standard deviation, maximum and minimum values of the variables as well as their corresponding skewness and kurtosis.
Table-1: Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF</td>
<td>1.871</td>
<td>0.221</td>
<td>1.691</td>
<td>2.433</td>
<td>0.0109</td>
<td>0.0552</td>
</tr>
<tr>
<td>INT</td>
<td>2.046</td>
<td>0.231</td>
<td>1.724</td>
<td>2.461</td>
<td>0.5143</td>
<td>0.4912</td>
</tr>
<tr>
<td>NSR</td>
<td>3.381</td>
<td>0.031</td>
<td>3.311</td>
<td>3.427</td>
<td>0.2223</td>
<td>0.2505</td>
</tr>
<tr>
<td>GDP</td>
<td>1.862</td>
<td>0.151</td>
<td>1.618</td>
<td>2.098</td>
<td>0.5499</td>
<td>0.5499</td>
</tr>
</tbody>
</table>

The mean value of inflation rate is 1.87, standard deviation is 0.22, minimum value is 1.69 and maximum value is 2.43. Skewness is closer to zero and so the data tend to normal distribution. Similarly, mean value of interest rate is 2.04, standard deviation is 0.23, minimum value is 1.72 and maximum value is 2.46. Skewness is not zero and so the data do not belong to normal distribution. The mean value of national savings rate is 3.38, standard deviation is 0.03, minimum value is 3.31 and maximum value is 3.42. Skewness is closer to zero and so the data do not belong to normal distribution. Finally, mean value of GDP growth rate is 1.86, standard deviation is 0.15, minimum value is 1.61 and maximum value is 2.09. Skewness is closer to zero and so the data do not belong to normal distribution.

Table-2: Correlation matrix

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) INF</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) INT</td>
<td>0.490</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) NSR</td>
<td>-0.011</td>
<td>0.084</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>(4) GDP</td>
<td>-0.201</td>
<td>-0.268</td>
<td>-0.161</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Table 2 shows the correlation matrix among the variables presented in the proposed model. The correlation between inflation rate and the interest rate is positive indicated by 0.49 whereas correlation between inflation rate and national savings rate is negative shown by -0.011, correlation between inflation rate and GDP is negative shown by -0.201. The correlation between national savings rate and the interest rate is positive indicated by 0.084 whereas interest rate has a negative relation with GDP indicated by -0.268. National savings rate has a negative correlation with GDP shown by -0.161.

4.2 Unit Root Test

Table 3 reveals that the variables included in the proposed model are found stationary at level. The null hypothesis is that there is presence of the stationary in data. However, this null hypothesis is rejected by all the variables included in the model i.e. inflation, interest, national savings rate and GDP and are tested with constant term. Test of co-integration need not run because of being all the variables stationary at level. This test supports that the researcher may use Autoregressive Distributed Lag (ARDL) model for time series analysis.

Table-3: Outcome of the unit root test

<table>
<thead>
<tr>
<th>Variables</th>
<th>T value</th>
<th>P value</th>
<th>Level of test</th>
<th>Decision</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF</td>
<td>-6.843</td>
<td>0.000*</td>
<td>Level and Intercept</td>
<td>As P&lt;5%, Unit root of data does not exist</td>
<td>Stationary</td>
</tr>
<tr>
<td>INT</td>
<td>-4.585</td>
<td>0.000*</td>
<td>Level and Intercept</td>
<td>As P&lt;5%, Unit root of data does not exist</td>
<td>Stationary</td>
</tr>
<tr>
<td>NSR</td>
<td>-3.831</td>
<td>0.001*</td>
<td>Level and Intercept</td>
<td>As P&lt;5%, Unit root of data does not exist</td>
<td>Stationary</td>
</tr>
<tr>
<td>GDP</td>
<td>-5.327</td>
<td>0.000*</td>
<td>Level and Intercept</td>
<td>As P&lt;5%, Unit root of data does not exist</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

Note: P value less than 5% level of significance is denoted by *.

4.3 Estimated Results of the ARDL model

Table 4 represents the estimated results regarding short run and long run analysis of the proposed model where the adjusted r squared is 64% implying that about 64 percent of the variation of national savings rate is explained by the explanatory variables during period from 2000 to 2021 that is quite satisfactory for this study. Durbin Watson statistics of 1.98 closer to 2 is also satisfactory indication of the absence of serial correlation or autocorrelation among the variables in the model.

Table-4: Estimated Short run and Long run results of the model

| Description of Variables | Short Run | Co-efficients | t-statistic | p>|t| | Long Run | Co-efficients | t-statistic | p>|t| |
|--------------------------|-----------|---------------|-------------|-----|-----------------|-----------|---------------|-------------|-----|-----------------|-----------|---------------|-------------|-----|-----------------|-----------|
| Constant                 | 1.647     | 0.71          | 0.551       |     |                 | 0.551     |                | 0.71          | 0.551 |                 | 0.551     |                | 0.71          | 0.551 |                 | 0.551     |
| ΔGDP_{t}                | 0.270     | 1.56          | 0.216       |     |                 | 0.216     |                | 1.56          | 0.216 |                 | 0.216     |                | 1.56          | 0.216 |                 | 0.216     |
| ΔINF_{t}                | -0.360    | -5.73**       | 0.010       |     |                 | 0.010     |                | -5.73**       | 0.010 |                 | 0.010     |                | -5.73**       | 0.010 |                 | 0.010     |
| ΔINT_{t}                | 0.152     | 3.72***       | 0.003       |     |                 | 0.003     |                | 3.72***       | 0.003 |                 | 0.003     |                | 3.72***       | 0.003 |                 | 0.003     |
| ΔECM_{t}                | 0.780     | 6.55***       | 0.023       |     |                 | 0.023     |                | 6.55***       | 0.023 |                 | 0.023     |                | 6.55***       | 0.023 |                 | 0.023     |
| ΔINF_{t-1}              | 0.147     | 3.12**        | 0.036       |     |                 | 0.036     |                | 3.12**        | 0.036 |                 | 0.036     |                | 3.12**        | 0.036 |                 | 0.036     |
| ΔINT_{t-1}              | 0.079     | 3.16***       | 0.006       |     |                 | 0.006     |                | 3.16***       | 0.006 |                 | 0.006     |                | 3.16***       | 0.006 |                 | 0.006     |
| ΔECM_{t-1}              | -0.295    | 6.61***       | 0.002       |     |                 | 0.002     |                | 6.61***       | 0.002 |                 | 0.002     |                | 6.61***       | 0.002 |                 | 0.002     |
| R²                      | 0.764     |               |             |     |                 |           |                |             |     |                 |           |                |             |     |                 |           |
| Adjusted R²             | 0.642     |               |             |     |                 |           |                |             |     |                 |           |                |             |     |                 |           |
| Durbin-Watson           | 1.98      |               |             |     |                 |           |                |             |     |                 |           |                |             |     |                 |           |
| No. of obs              | 21        |               |             |     |                 |           |                |             |     |                 |           |                |             |     |                 |           |
GDP growth rate as a proxy variable for representing the performance of the economy of Bangladesh is the key influential determinant for the national savings rate of Bangladesh in the long run period. It has positive effect on the national savings rate in both short run and long run period while the relation is not significant at the short run but is significant in the long run at 5% level. This result is similar to the findings of Arifuzzaman khan and Sarker (2016), Shirin Akter (2018), Abu Al-Foul, (2010) and Aboueiseoud (2014). A one percent increase of per capita income will lead to an increase of 0.78 percent of the national savings rate in the long run. This may happen due to future expectation which also provides a note that an increase in income level also supports the people to save more in general. Inflation rate has a significant negative influence on the national savings rate during the short run which is significant at 5% level whereas it has positive effect on savings rate in the long run period at 5% level of significant due to the expectation of people for uncertainty in the economy. High inflation rate may also raise the savings rate which is similar to the finding of Hussain and Haque (2017). Interest rate has a significant positive effect on the national savings in both short run and the long run period indicating that savings rate increase with the increase of interest rate. An increase in the interest rate influences to save more rather than invest that in another purpose somewhere. Table 4 also shows that the previous savings rate has a significant effect on the current savings rate estimated by 0.78 at 5% level of significance. The coefficient ECM (-1) is statistically significant at any significant level indicating the speed of adjustment from short run to long run equilibrium. The value of ECM (-1) is 0.29 implying that when the savings rate is below the equilibrium level, it will adjust by 29% within the first year. This process will happen up achieving equilibrium in the long run.

### 4.4 Diagnostic Checks

Heteroscedasticity in time series data may cause due to several reasons such as misspecification of model, incorrect data transformation etc. Breusch-Pagan test is widely used to detect heteroscedasticity (Gujarati et al., 2012 and Birau, 2012). This paper applies Breusch-Pagan test to diagnose heteroscedasticity.

**Table-5: Diagnostic Checks for validation**

<table>
<thead>
<tr>
<th>Name of test</th>
<th>Chi²/F- statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Pagan test for diagnosing heteroscedasticity</td>
<td>0.56</td>
<td>0.4535</td>
</tr>
<tr>
<td>Ramsey RESET test for omitted variable bias</td>
<td>0.15</td>
<td>0.9288</td>
</tr>
</tbody>
</table>

The result is prob>chi² = 0.4535 that is greater than α=5% or 0.05 (table 5). Therefore, null hypothesis is accepted that the model is free from heteroscedasticity problem. Ramsey introduced the RESET test in 1969. It is used to capture omitted variable bias and inappropriate functional form. This test is based on the Lagrange Multiplier rules and critical values of F-distribution (Shukur & Mantalos, 1997). The result of prob> F = 0.9288, that is greater than α = 5% or 0.05 (table 5). Therefore, null hypothesis is accepted that the model is free from specification error or omitted variable bias.

### 5.0 Conclusion

This present study captures the effect of three variables namely real GDP growth, inflation rate, interest rate on the national savings rate. For this analysis data 21 years have been considered. The results find that three variables have significant effect on the national savings rate on average. It estimates that increase in the interest rate will influence to save more in spite of investing that amount in another which supports the theory of Bofinger and Ries (2017). Another finding from GDP perspective is that higher level of income promotes to save more than before. However, this study is limited to 2000-2021. Another limitation of this study is that it did not consider the fiscal and monetary policy of the government of Bangladesh which has great impact on the national savings rate. Thus, this study can further enrich by considering more data with wider variables. This can also be done with more geographical areas such as Asian countries, South Asian countries or by subdividing income categories such as middle-income countries, low-income countries and high-income countries etc. This study provides a concrete massage that a well-organized GDP growth will ensure an organized growth in national savings rate which in turn results in moving toward a great contribution to economic development of a country. This study also...
recommends that more suitable policies regarding controlling of interest rate and inflation are required for the improvement of their aggregate condition. Though in the short run, inflation reduces the savings rate but in the long run its proper management will raise the national savings rate. On the contrary, policy makers should concern on policies that are favorable for interest rate and savings level. Thus, the savings rate should be handled in a moderated way which will pull the economy towards expansion.

References


