The Relationship of Savings and Economic Growth in Developing Nations

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Abstract:

The aim of this paper is to analyze the cause and effect relationship between economic growth and savings in developing countries. In this paper I used the co-integration model and the granger causality test which are typically used in finding the relationship between savings and economic growth. Before estimating the model, it was essential to determine the stationaries of the time series. To do so I used the ADF test (augmented dickey-fuller). The results confirmed the existence of a one-way causal relationship between Gross Domestic Savings and economic growth in developing nations.

JEL Classification: D91, E21

Key words: savings, economic growth, co-integration

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1.0 INTRODUCTION

It is commonly perceived that an increase in savings leads to growth in investing and GDP growth. The relationship between saving and economic growth has puzzled economists ever since economics became a scientific discipline (Jangili, 2011). The role of domestic savings in promoting economic growth has received considerable attention in India and also in many countries around the world (Jangili, 2011). This paper focuses on the developing economies of the BRICS nation's dating back to 1960.

This study aims to enhance understanding of trends in savings within these developing nations and how it impacts the growth of the economy. In further investigations of the relationship between savings and economic growth, this study seeks whether the causality is from savings to economic growth or economic growth to savings. The numerical values of GDS and GDP growth used in this research is dated from 1960 – 2014. Due to the fall of the Soviet Union, Russian data was not recorded until 1990. The theories of economic growth stipulate that the dynamics of the country's economic growth increases if the investment in human capital or in scientific research and development grows (Misztal 2011).

It is common in recent research focusing on savings and economic growth to use the concept of the Granger causal relationship. This paper uses Granger causality to determine if there is no causality or unidirectional/bi-directional causality between savings and economic growth. This paper defers from other studies such as Mohan (2006) because Dr. Mohan researched the relationship between savings and economic growth in countries with different income levels, whereas I am focusing on developing

countries (BRICS). The developing countries I am focusing on consist of: Brazil, Russia, India, China and South Africa. Each one of these nations have experienced fluctuations in economic growth during the time periods I am researching.

The rest of my paper is organized as follows: Section 2 gives a literature review, Section 3 outlines the data, Section 4 shows graphs & trends, Section 5 presents and discusses the empirical methodology, Section 6 presents an empirical analysis which is finally followed by a conclusion.

2.0 LITERATURE REVIEW

Economic growth is a common goal that all nations share. The relationship between savings and economic growth is studied using many dynamic models. In this section, some of the studies that attempted to show the relationship of savings and economic growth are presented. Ramesh Mohan (2011) used countries with different income levels to study that relationship that savings and economic growth share and concluded that the income class of a country plays a very important role in determining the direction of the causality. In a study by Dipendra Sinha (1996) focusing on savings and growth in India, noticed that during the last few years the savings rate has fallen marginally raising concern that might adversely affect economic growth. Within his investigation he explored whether there was a long run relationship GDP and saving where he concluded that both GDS and GDPS were co-integrated within GDP.

Piotr Misztal (2011) concluded that the positive relationship between savings and economic growth can be explained by several hypothesis. The first one assumes that increased savings may stimulate economic growth through increased investment. His second hypothesis, on the other hand says that economic growth stimulates increased

savings. According to Ramesh Jangili (2011) looking at the economic growth of India from 1950-2008, the co-integration analysis suggests that there is a long-run equilibrium relationship. The results of his Granger Causality test showed that higher saving and investment lead to higher economic growth, but the reciprocal causality was not observed. It is said that countries like India are not very close to the technological frontier and hence not keeping up to date with modern technologies, resulting in less intelligence.

Using a newly developed approach to co-integration, Bassam AbuAl-Foul (2010) studied a way that performs well with small samples and regardless of the order of respective time series. This study focused on Morocco and Tunisia and the empirical results revealed that in the case of Morocco a long-run relationship exists between the variables, while no evidence of long-run relationship is seen to exist in Tunisia. Pinchawee Rasmidatta (2011) used similar time series annual data to my study, using data from 1960-2010. Focusing on Thailand only, he was able to conclude that domestic saving growth rate does not help narrowing the range of difference of income in Thailand, which means that domestic savings and growth rate do not support the convergence hypothesis.

Alexei Krouglov (2006) took a different approach with his study and introduced mathematical models to describe the long-term effects of savings on economic growth. Modeling results show a limited long-run economic growth for occasional and constant-rate systematic internal savings, a steady long-run economic growth if acceleration rate of internal savings lies within the proper limit for every industry, and a steady long-run economic decline if acceleration rate of internal savings exceeds the suitable limit for certain industry. Due to the fact that there is no savings or economic growth data on the Russian Federation until the 1990's I feel that it is essential to review the study of Natalia

Skiter et al. (2015) to better understand the model of economic growth in Russian under the conditions of integration into the world economy. In this study the author simulated the optimal parameters of macroeconomic indicators for economic growth in Russia under conditions of integration into the world economy.

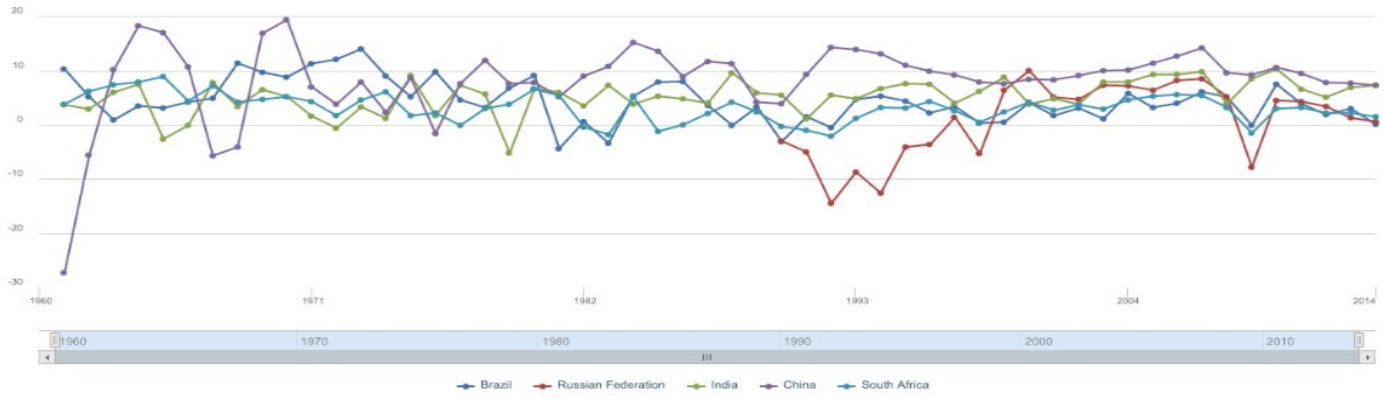
3.0 DATA

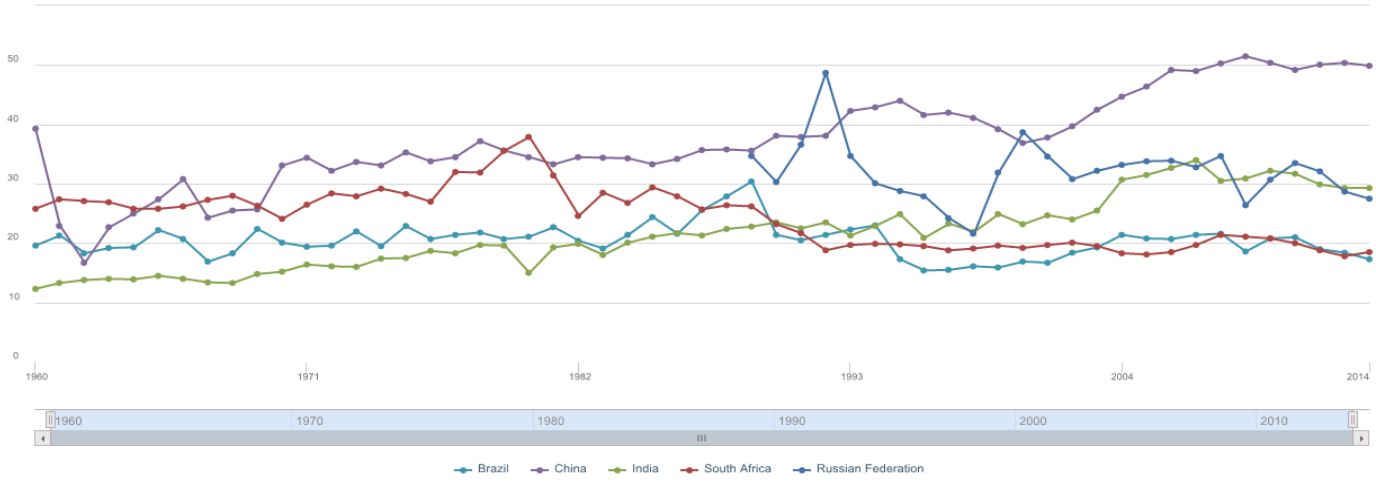
The current study used annual data from 1960-2014 for every BRICS country besides Russia, in which case annual data was used form the years 1990-2014. All data in this study was pulled from the World Bank online website. Variables used in this study and the definitions are LogGDS (log of Gross Domestic Savings) and LogGDP (log of Gross Domestic Product).

Gross Domestic Savings is calculated as GDP less total consumption. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. GDP is calculated with the addition of the variables; private consumption, gross investment, government investment, government spending and the net value of exports to imports. The nominal value of GDP changes due to shifts in quantity and price.

The aim of this study is to identify the causality between the two variables in each of the BRICS countries. These countries were selected due to their relative fluctuations in economic growth and developmental status.

4.0 GRAPHS & TRENDS





Series : Gross domestic savings (% of GDP)
Source: World Development Indicators
Created on: 04/10/2016

The graphs located above show trends in Economic Growth and Gross Domestic Savings respectively in the BRICS nations from the years 1960 to 2014. In both graphs, the data for the Russian Federation does not start until 1990 due to the collapse of the Soviet Union. Surprisingly, the lack of data for the Russian Federation did not impact my research in a negative manner. Examining the two graphs juxtaposed, you can see the way savings and economic growth impact each other which was my exact reasoning for displaying the graphs in this fashion. You can clearly see when following the trends of each nation that when Economic Growth is decreasing, Gross Domestic Savings are increasing and this is almost always the case according to the graphs.

5.0 EMPIRICAL METHODOLOGY

The econometric model used in this paper is based on the Keynes model (1936) and the Solow hypothesis (1956). According to the Keynes model, savings (S) are the function of economic growth (Y), which can be presented by the formula below:

$$S = \alpha_0 + \alpha_1 Y + U_1$$

Whereas: S= Savings, Y= Economic Growth, a_0= Free Term, a_1= Coefficient, U_1= Random Component.

Discovering whether savings causes economic growth or if economic growth causes savings in the BRICS nations is really the main result I wish to conclude through my research. In order to find out which causes which, I had to run a Granger Causality Test. The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another, first proposed in 1969. Ordinarily, regressions reflect "mere" correlations, but Clive Granger argued that causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series. Since the question of "true causality" is deeply philosophical, and because of the post hoc ergo propter hoc fallacy of assuming that one thing preceding another can be used as a proof of causation, econometricians assert that the Granger test finds only "predictive causality." The results I will be looking for when performing the Granger Causality Test are: no causality, unidirectional meaning Y causes X or X causes Y, and lastly, bidirectional which means Y causes X and X causes Y.

Before performing the Granger Causality test I must first perform an Augmented Dickey Fuller test (ADF) which is a time series test, and then a Co-integration test to see if my variables go hand in hand. To formally test for the presence of a unit root, the ADF test is used. The regression equation below is used to test for the unit root:

$$\Delta y_t = c_1 + \omega y_{t-1} + c_2 t + \sum d_i \Delta y_{t-1} + v_t$$

Where Y = Relevant time series, Δ = First-difference operator, T = Linear trend, and V_T = Error term. The results of the unit root test indicate that the unit root null hypothesis can be rejected at the 1% significance level in all five cases. This implies that both variables are stationary after converting the series through first differencing.

Given the results of the Augmented Dickey Fuller Test presented in Table 1, the second step in this process is to estimate the co-integration using the same order of integrated variables. Each of the two variables; Gross Domestic Savings and Economic Growth need to be tested for co-integration. Co-integration is a statistical property of a collection of time series variables. After ordering the variables it is essential to see if a linear combination of this collection is integrated of order zero, then the collection is said to be co-integrated. Formally, if (X,Y,Z) are each integrated of order 1, and there exist coefficients a,b,c such that aX+bY+cZ is integrated of order 0, then X,Y, and Z are co-integrated. Co-integration is a very important component in contemporary time series analysis. The co-integration equation used for my research is as follows:

$$GDS_t = \sum_{i=1}^{n} \alpha_1 GDS_{t-i} + \sum_{i=1}^{n} \alpha_2 GDP_{t-i} + U_{1,t}$$

As seen in the equation, Gross Domestic Savings is still my dependent variable meaning that the ideal result for this research is that Savings cause Economic Growth. The results of the co-integration test presented in Table 2 showed that every country except for the Russian Federation were co-integrated. Since the Russian Federation was not co-integrated I could not go ahead with the ADF test for that specific country. The other nations in this research however, were co-integrated and were ready for the unit root test.

Given the results of the co-integration test one now has to estimate the VAR to determine the direction of causality between Savings and Economic Growth. If co-integration exists, which it did for 4 out of 5 of the countries, the Granger Causality Test is performed under the vector error correction methodology. The results of the Granger Causality Test under the VAR framework can be shown in Table 3. The Granger Causality equation used in this research is as follows:

$$y = \sum_{i=1}^{m} \alpha i\, Yt - i + \sum_{i=1}^{m} \beta ixt - i + \varepsilon t$$

Whereas: the regressed variables X & Y have their own lagged values (1 & 2) to determine whether one time series is useful in forecasting another.

The results showed that there were no causality between the two variables for Brazil and the Russian Federation even though there was co-integration between the two variables for Brazil. India was found to be bi-directional, meaning that both variables Granger caused each other. Both variables in this bidirectional causation were found to be significant at the 1% level. China resulted in Economic Growth Granger causing Savings and was found to be significant at the 1% level. Lastly, South Africa showed results that Gross Domestic Savings Granger cause Economic Growth and this was significant at the 5% level.

When conducting the Granger Causality Test it was interesting that a country like India would be found bi-directional according to the data that was used. India, unlike the United States is known for saving money so my hypothesis was that Savings would cause Economic Growth. Although I was not wrong in assuming that causation, I was still surprised to see a bi-directional causation. It was recently brought to my attention that India has some of the highest interest rates in the world and this proclaimed to be factual. According to the Reserve Bank of India (RBI) the national interest rate is 6.8% and has been as high as 9% in 2008. Compared to the interest rates of the United States (.50%), Australia (2.00%) and Great Britain (.50%) India has remarkably high rates. This again leads to confusion because higher interest rates lead to an increase in savings which should cause a dip in Economic Growth. According to the Granger Causality Test, this was not the case.

6.0 EMPERICAL ANALYSIS

The hypothesis in the introduction of this study set out to test the direction of causality between Savings and Economic Growth in developing nations, more specifically the BRICS countries. The ADF test indicates that both logGDP and logGDS have unit roots in the level data. In the presence of a unit root, the two variables needed to be differenced in order for the time series to be stationary. Within this calculation I took the first difference of both variables. If the data had not been differenced the causality test would lead to misspecification. By taking the differences of logGDS and logGDP, the series then becomes the growth rate of Savings and the growth rate of Economic Growth instead of looking at the causation direction between Savings and Economic Growth, the hypothesis instead focuses on the respective growth rates.

Previous studies like Misztal (2011) have used data to find the relationship between Savings and Economic Growth in developing as well as advanced economies. Mohan (2011) also took a different approach in examining countries with different income levels by looking at the upper, middle and lower classes within his selective countries. Recent studies that use the Granger causality test to determine the relationship between savings and economic growth have to use the growth rate of savings, instead of savings, because of the unit root (nonstationary) problem.

When looking at the results in Table 3, the only countries with no clear causality are Brazil and the Russian Federation. Overall, empirical results revealed that the Granger causation was either unidirectional or bidirectional in relation to Savings causing Economic Growth. In the short run, the traditional view is that higher savings leads to higher

investment and higher economic growth. The empirical evidence in this study however, does not show any indications of supporting this conventional view of the two variables. Referring to my own study and multiple other studies, it may seem as if the causality is from Economic Growth to growth rate in Savings.

7.0 CONCLUSION

The primary goal of this study was to determine whether or not the direction of causality differs in countries with developing economies. Based on the empirical results, the main conclusion drawn from this study is that a direct conclusion cannot be drawn to whether Savings causes Economic Growth in developing countries. In this study, using time series annual data, Granger Causality Tests were conducted. The objective was to determine whether the direction of causality favored Savings to Economic Growth. In general, it is tough to predict if Savings Granger cause Economic Growth due to the fact that within this study there were two no causality trends (Brazil and Russian Federation), one bidirectional trend (India) and two unidirectional trends (China and South Africa) showing Economic Growth Granger cause Savings and Savings Granger cause Economic Growth Respectively. In summary, based on the results, the study does not favor the hypothesis that Savings growth rate Granger causes Economic Growth rate.

Table 1: Augmented Dickey Fuller (ADF) Results

Countries		
Variable	**Brazil**	
GDS	-8.799	***
GDP Growth	-4.98	***
	Russia	
GDS	-0.005	***
GDP Growth	-5.4	***
	India	
GDS	-9.017	***
GDP Growth	-2.12	***
	China	
GDS	-7.74	***
GDP Growth	-3.46	***
	South Africa	
GDS	-8.799	***
GDP Growth	-4.876	***

Note: *** denotes significance at 1%

Source: Own calculations

Table 2: Co-integration results

Country	Trace	Integration
Brazil	10.0612*	Yes
Russia	12.72	No
India	8.769**	Yes
China	10.218**	Yes
S. Africa	9.064***	Yes

Note: ***,**,* denote significance at 1%, 5%, 10% respectively

Source: Own calculations

Table 3: Granger Causality Results

Country	Result	Direction	Value
Brazil	No Causality	None	0
Russia	No Causality	None	0
India	Yes	Bidirectional	GDP → GDS 0.0103 *** GDS → GDP 0.0011 ***
China	Yes	Unidirectional	GDP → GDS 0.0026 ***
S. Africa	Yes	Unidirectional	GDS → GDP 0.0227 **

Note: ***, ** denote significance at 1% and 5% respectively

Source: Own calculations

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