

Savings and Economic Growth in Sub-Saharan Africa: A Panel Co-Integration and Granger Causality Test

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Abstract: This study examined the relationship between domestic savings and economic growth in selected Sub-Saharan African countries during the period 1980-2010. The researchers employed the Granger causality and panel co-integration techniques to analyze the relationship between savings and economic growth. The Granger causality test revealed that causality runs from savings to economic growth in Sub-Saharan Africa. Thus, researchers accept the Solow's hypothesis that savings precedes economic growth but reject the Keynesian theory that it is economic growth that leads to higher savings. The researchers recommended that governments and policy makers should employ policies that would accelerate domestic savings, so as to increase economic growth.

Key words: Causal relationship, domestic savings, economic growth, co-integration, Granger causality

INTRODUCTION

The relationship between savings and economic growth is not only an important but also a controversial issue for both academicians and policy makers. A group of economists favour capital fundamentalists point of view that savings cause growth but others are in favour of Keynesian theory that savings depend upon the level of output.

However, the mixed nature of the recent empirical findings shows that the debate on savings and growth remain inconclusive. Studies by Carroll and Weil (1994), Sinha and Sinha (1998), Saltz (1999), Agarwal (2001), Narayan and Narayan (2006) and Abu (2010) among others revealed that economic growth rates preceded savings growth rates while Harrod (1939), Domar (1946), De Gregorio (1992), Cullison (1993), Krieckhaus (2002), Alguacil *et al.* (2004), Lorie (2007) and Singh (2010) among others found the reverse causality. But, Mavrotas and Kelly (2001) found no causality between GDP growth and private savings for India and a bi-directional relationship for Sri Lanka.

This study examined the cause and effect relationship between savings and economic growth in Sub-Saharan Africa (SSA) in order to provide the policymakers in these countries with a planning tool that can help them in formulating policies that are related to savings and economic growth. Most studies on the

subject matter to the best of researcher's knowledge did not focus specifically on SSA countries but this present study intends to fill this gap.

The study covers between 1980-2010 year. Total 35 SSA countries (Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape-verde, Central Africa Republic, Chad, Comoros, Cote d, Ivoire, Ethiopia, Gabon, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Seychelles, Togo, Uganda, Zambia and Zimbabwe) were selected for this study. The choice of the period of study, as well as the countries was guided by data availability considerations.

MATERIALS AND METHODS

Model specification: To analyze the relationship between savings and economic growth, the researchers used panel co-integration methods and Granger causality test which are the most frequently used methods of analyzing relations between savings and economic growth in economics. The econometric model used in this study is based on the Keynes (1936) Model and the Solow (1956) hypothesis. According to the Keynes Model, savings (S) are the function of economic growth (Y) which can be shown by Eq. 1:

$$S = \alpha_0 + \alpha_1 Y + \mu_1 \quad (1)$$

Where:

- S = Savings
- Y = Economic growth
- α_0 = Free term in the equation
- α_1 = Savings to economic growth sensitivity coefficient
- μ_1 = Random component

On the other hand, according to the Solow hypothesis, savings are a determinant of economic growth. In this way, economic growth is the function of savings which can be presented by Eq. 2:

$$Y = \beta_0 + \beta_1 S + \mu_2 \tag{2}$$

Where:

- S = Savings
- Y = Economic growth
- β_0 = Free term in the equation
- β_1 = Economic growth to savings sensitivity coefficient
- μ_2 = Random component

To assess the relation between economic growth and savings, 2 econometric models centred on the basis of Eq. 1 and 2 were used:

$$\log GDS_{it} = \alpha_0 + \sum_{t=1}^n \alpha_1 \log GDS_{it-1} + \sum_{t=1}^n \alpha_2 \log GDP_{it-1} + \mu_{1,it} \tag{3}$$

$$\log GDP_{it} = \beta_0 + \sum_{t=1}^n \beta_1 \log GDP_{it-1} + \sum_{t=1}^n \beta_2 \log GDS_{it-1} + \mu_{2,it} \tag{4}$$

Where:

- logGDS = Log of Gross Domestic Savings
- logGDP = Log of Gross Domestic Product
- α, β = Sensitivity coefficient
- μ = Residual component
- t = Period of analysis

All the mentioned earlier time series had annual frequency and covered the 1980-2010 period. All the variables are expressed in logarithm form.

Data: The current study used annual data from 1980-2010. All data came from the Statistical Bulletin of the Central Bank of Nigeria (2010). Variables used in this study and the definitions are logGDS (log of Gross Domestic Savings) and logGDP (log of Gross Domestic Product). All the data used is in terms of a constant Local Currency Unit (constant LCU).

Estimation technique: The analyses in this study are carried out in 3 phases. First, researchers conduct panel unit roots using the prominent tests namely Levin, Lin and Chu, Breitung, Im, Pesaran and Shin, ADF fisher Chi-square and PP fisher Chi-square test. Second, researchers perform panel co-integration tests using the pedroni residual co-integration test and Johansen fisher panel co-integration test (Baltagi, 2008) for a comprehensive theoretical exposition on panel unit root tests and panel co-integration tests). Third, the researchers estimate the pair wise Granger causality test.

RESULTS AND DISCUSSION

Panel unit root test: Table 1 shows the result of the unit root tests conducted for variables used both first difference. The test was conducted for the selected SSA countries. The results show that all the variables (both exogenous and endogenous) are stationary at their first difference with individual effects and individual linear trend. Having established the order of integration of the variables, researchers move on to conduct the panel co-integration test.

Panel co-integration test: As earlier noted, having established that all the variables are integrated of the same order, researchers adopt both the pedroni residual co-integration test and Johansen fisher panel co-integration test to examine if there exists a long run relationship between the variables used. As shown in Table 2, the null hypothesis of no co-integrating relationship between the variables (logGDP and logGDS) can be rejected and the researchers accept that there is at least one cointegrating vector for the selected SSA countries at 5% level of significance.

Table 1: Panel unit root test result (at first difference)

Countries	At first difference					Order of integration
	LLC	BR	IPS	ADF	PP	
All selected SSA countries						
logGDP	-20.64 (0.00)	-9.89 (0.00)	-24.50 (0.00)	566.17 (0.00)	7254.52 (0.00)	I (1)
logGDS	-10.44 (0.00)	-9.72 (0.00)	-12.29 (0.00)	278.42 (0.00)	576.87 (0.00)	I (1)

Researchers' Computation; LCC, BR, IPS, ADF and PP implies Levin, Lin and Chu test; Breitung test; Im, Pesaran and Shin test; ADF Fisher Chi-square test and PP Fisher Chi-square tests, respectively; p-values are in brackets

Table 2: Panel cointegration test result

Countries	Pedroni residual co-integration test	Johansen fisher panel cointegration test	
	Test statistics [*]	Trace test ^{**}	Maximum eigen-value test ^{**}
All selected SSA countries	2.945	239.1	229.5

Researchers' computation; For all the counties, researchers have at most 1 co-integrating relationship between the variables used; p = 0.002^{*}, 0.000^{**}

Table 3: Pair wise Granger causality results

Null hypothesis	F-statistics	Probability
logGDS does not Granger cause logGDP	1.111	0.330
logGDP does not Granger cause logGDS	4.076	0.017

Researcher's computation

Pair wise Granger causality test: Using Table 3, the decision rule for the test is where the value of the F-statistic is low and the probability value is high, researchers reject the null hypothesis. On the contrary where the F-statistic value is high and the probability value low, researchers accept the null hypothesis.

Overall empirical results revealed that the growth rate of gross domestic savings Granger caused economic growth rate in the selected sub-Saharan African countries, therefore researchers accept the Solow's hypothesis that savings precedes economic growth and reject the Keynesian theory that it is economic growth that leads to higher savings. This finding is in agreement with Bacha (1990), De Gregorio (1992), Cullison (1993), Kriekhaus (2002), Alguacil *et al.* (2004) and Lorie (2007).

But the finding is in disagreement with Sinha and Sinha (1996, 1998, 1999), Saltz (1999), Sinha (2000), Agarwal (2001) and Abu (2010) which stated that economic growth rate Granger caused the growth rate of savings thus reject the Solow's hypothesis that savings precedes economic growth and accept the Keynesian theory that it is economic growth that leads to higher savings.

CONCLUSION

The primary purpose of this study was to investigate the relationship between the domestic savings and economic growth for selected sub-Saharan Africa countries. Using time series annual data between 1980 and 2010. Panel Unit Root, Panel Co-integration and Granger causality tests were conducted. The objective was to determine the direction of causality in the countries.

RECOMMENDATIONS

The empirical results suggested that the growth rate of domestic savings Granger causes economic growth rate in the selected countries. In this study, the direction of causality in the empirical results was unidirectional. The government and policy makers should employ policies that would accelerate domestic savings so as to increase economic growth in selected sub-Saharan African countries.

REFERENCES

- Abu, N., 2010. Saving-economic growth nexus in Nigeria, 1970-2007: Granger causality and co-integration analyses. *Rev. Econ. Bus. Stud.*, 3: 93-104.
- Agarwal, P., 2001. The relation between savings and growth: Cointegration and causality evidence from Asia. *Applied Econ.*, 33: 499-513.
- Alguacil, M., A. Cuadros and V. Orts, 2004. Does saving really matter for growth? Mexico (1970-2000). *J. Int. Dev.*, 2: 281-290.
- Bacha, E.L., 1990. A three-gap model of foreign transfers and the GDP growth rate in developing countries. *J. Dev. Econ.*, 32: 279-296.
- Baltagi, B.H., 2008. *Econometric Analysis of Panel Data*. 6th Edn., Wiley, Chichester, UK.
- Carroll, C.D. and D.N. Weil, 1994. Saving and growth: A reinterpretation. *Carnegie-Rochester Conf. Econ. Ser. Public Policy*, 40: 133-192.
- Cullison, W.E., 1993. Saving measures as economic growth indicators. *Contemp. Policy Issues*, 11: 1-8.
- De Gregorio, J., 1992. Economic growth in latin America. *J. Dev. Econ.*, 39: 59-84.
- Domar, E.D., 1946. Capital expansion, rate of growth and employment. *Econometrica*, 14: 137-147.
- Harrod, R.F., 1939. An essay in dynamic theory. *Econ. J.*, 49: 14-33.
- Keynes, J.M., 1936. *The General Theory of Employment, Interest and Money*. Macmillan Cambridge University Press, Cambridge, UK.
- Kriekhaus, J., 2002. Reconceptualizing the developmental state: Public savings and economic growth. *World Dev.*, 30: 1697-1712.
- Lorie, H., 2007. Mobilizing savings for sustainable high growth: Lesson from Asia for Pakistan. A Presentation at PIDE, Islamabad, Pakistan. <http://www.pide.org.pk/pdf/seminar/seminar96.pdf>.
- Mavrotas, G. and R. Kelly, 2001. Old wine in new bottles: Testing causality between savings and growth. *Manchester School*, 69: 97-105.
- Narayan, P.K. and S. Narayan, 2006. Savings behaviour in Fiji: An empirical assessment using the ARDL approach to cointegration. *Int. J. Social Econ.*, 33: 468-480.
- Saltz, I.S., 1999. An examination of the causal relationship between savings and growth in the third world. *J. Econ. Finance*, 23: 90-98.
- Singh, T., 2010. Does domestic saving cause economic growth? A time-series evidence from India. *J. Policy Model.*, 32: 231-253.
- Sinha, D. and T. Sinha, 1996. The role of saving in Pakistan's economic growth. *J. Applied Bus. Res.*, 15: 79-85.

- Sinha, D. and T. Sinha, 1998. Cart before the horse? The saving-growth nexus in Mexico. *Econ. Lett.*, 61: 43-47.
- Sinha, D. and T. Sinha, 1999. Saving and economic growth in Sri Lanka. *Indian J. Applied Econ.*, 8: 163-174.
- Sinha, D., 2000. Tests of granger causality between saving and economic growth in the Philippines. *J. Social Econ. Dev.*, 3: 200-207.
- Solow, R.M., 1956. A contribution to the theory of economic growth. *Q. J. Econ.*, 70: 65-94.