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SAVING-ECONOMIC GROWTH NEXUS IN NIGERIA, 1970-2007: GRANGER CAUSALITY AND CO-INTEGRATION ANALYSES

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Abstract *The controversy surrounding the direction of causality between saving and economic growth motivated this study. The author employed the Granger-causality and co-integration techniques to analyze the relationship between saving and economic growth in Nigeria during the period 1970-2007. The Johansen co-integration test indicates that the variables (economic growth and saving) are co-integrated, and that a long-run equilibrium exists between them. In addition, the granger causality test reveals that causality runs from economic growth to saving, implying that economic growth precedes and granger causes saving. Thus, we reject the Solow's hypothesis that saving precedes economic growth, and accept the Keynesian theory that it is economic growth that leads to higher saving. The author recommends that government and policy makers should employ policies that would accelerate economic growth so as to increase saving.*

Keywords*: economic growth, saving, granger causality, co-integration.*

INTRODUCTION

The examination of the causal relationship between saving and economic growth is very important because it provides useful information on which economic variable(s) that the government and relevant authorities need to control in order to attained the desired level of the targeted variable or variables (Sajid and Sarfraz, 2008). For example, if the results of causality test indicate that saving

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precedes and causes economic growth, then government and policy makers can design or employ policies that would promote the mobilization of saving in order to achieve higher economic growth. On the other hand, if econometric investigation reveals the reverse, then, efforts would be made to remove the obstacles to and accelerate economic growth in order to raise the level of saving. The importance of saving on economic growth has been discussed in details (for instance, see McKinnon, 1973; and Shaw 1973). Although the relationship between saving and economic growth is an important one, the direction of causality between the variables has continued to generate series debate among scholars (Sajid and Sarfraz, 2008). The controversy started with Solow (1956) who alleged that higher saving precedes and causes higher economic growth. In explaining the role of saving in economic growth, Sinha and Sinha (1998) asserted that increases in saving results to increases in capital formation and investment, thereby raising the growth of national output in an economy. Following the claim by Solow, authors like Jappelli and Pagano (1994), Alguacil et al. (2002) among others, reported that higher savings growth precedes higher economic growth. In fact, Olajide (2009) findings that a unidirectional causality runs from saving to economic growth suggest that the low level of saving may be responsible for the sluggish and unimpressive growth in Nigeria over time. In addition, is the World Bank (1993) submission that higher savings rates account the differences in economic growth between developed and developing economies.

However, the proponents of the Keynesian hypothesis stressed that it is growth of output (or income) that causes growth of saving. The supporters of this theory argue that increases in output of leads increases in incomes, thus raising the level of saving in the economy. For instance, the work of Carroll and Weil (1994) which suggested that economic growth preceded savings motivated further researches that aim at ascertaining the direction of causality between saving and economic growth. To this end, Gavin et al. (1997), Sinha and Sinha (1998), and Agarwal (2001) confirmed that higher economic growth precedes and causes higher saving.

An important issue that arises from the foregoing discussion is the divergence in the perception and empirical findings among scholars. Thus, the main objective of this paper is to investigate the direction of causality between saving and economic growth in Nigeria between 1970 and 2007. The paper is organized as follows. Following the introduction is the literature review and

theoretical framework. Section three is for methodology and model estimation, while section four consists of discussion of results. Section five contains conclusion and policy recommendations.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

In this section, we survey the literature on saving-economic growth relationship, as well as present the theoretical framework for the study. Scholars like Solow (1956) emphasized the importance of saving in economic growth. Following Solow, authors such as McKinnon (1973) and Shaw (1973) supported the view that saving plays a crucial role in economic development. This is true because rising saving increases the level of investment, thereby accelerating economic growth (Sinha and Sinha, 1998). In the life-cycle hypothesis, Modigliani (1970) suggested that higher growth raises the life-time wealth of young (working) savers relative to retired (non-working) dissavers, thus raising the total savings of the economy. The increase in national savings in turn leads to higher investment and expansion of output.

Some authors have attempted to examine the causal relationship between saving and economic growth. For example, Bassam AbuAl-Foul (2010) employed an econometric technique to investigate the long-run relationship between real gross domestic product and real gross domestic saving for Morocco and Tunisia during the period 1965-2007 and 1961-2007, respectively. The regression exercise reveals interesting results. For instance, it was shown that whereas a long-run relationship exists between gross domestic product and gross domestic saving in Morocco, there was no such evidence for Tunisia. Secondly, the Granger causality test indicates the existence of a two-way causal relationship between gross domestic product growth and gross domestic saving growth in Morocco. Lastly, the author observed a unidirectional Granger causality between real gross domestic product and real gross domestic saving as causality runs from gross domestic saving growth to gross domestic product growth in Tunisia. Sinha and Sinha (2007) examined the relationship between per capita saving and per capita GDP for India during the 1950-2004 period. The authors employed the Toda and Yamamoto tests of Granger causality and discovered that there is no causal relationship between per capita GDP and per capita household saving/per capita corporate saving. On the contrary, the results show the existence of a bi-directional causal relationship between per capita household saving and per capita corporate saving.

Andersson (1999) used the bivariate vector autoregressive (VAR) or vector error-correction (VEC) models to analyze the relationship between saving and GDP for a group of countries that include Sweden, UK, and USA. The results of the Granger non-causality test indicated that the direction of causal relationship between saving and output differ across the countries.

In his paper, Mohan (2006) examined the relationship between domestic savings and economic growth by taking into consideration the income levels of the different countries studied. He grouped the countries into various categories, namely low income countries (LICs), low middle income countries (LMCs), upper middle income countries (UMCs), and high income countries (HMCs). The author's results support the claim that causality runs from economic growth rate to growth rate of savings. The author submitted that the income level of a country plays an important role in determining the causal relationship between savings and economic growth. In addition, the author reported that empirical results were mixed in the LICs, while causality runs from growth rate to savings rate for most of LMCs. Finally, whereas in the HICs (except Singapore), causality runs from economic growth rate to growth rate of savings, a feedback causal relation was more prevalent in the UMCs. In the work done by Verma (2007), the regression results support the Carroll-Weil hypothesis that it is not savings that causes economic growth, but instead, it is growth that causes savings in India. Alguacil et al (2002) investigated the saving-growth nexus by taking into account the impact of foreign capital in complementing domestic saving and the beneficial effects of FDI on domestic investment and income. The Granger non-causality test revealed that higher saving precedes economic growth. Sajid and Sarfraz (2008) investigated the causal relationship between savings and output in Pakistan by using quarterly data for the period of 1973:1 to 2003:4. The authors employed both co-integration and the vector error correction techniques and discovered that bi-directional long run relationship exists between savings and output level. Moreover, the results showed that there is a unidirectional long run causality from public savings to output (GNP and GDP), and private savings to gross national product (GNP). Furthermore, the long run results favour the capital fundamentalist's point of view that savings precede the level of output in case of Pakistan. In addition, the results showed that a unidirectional short run causality runs from gross national product (GNP) to national and domestic savings; and from gross domestic product (GDP) to public savings. Besides, a short run causality was shown to run from national savings to

gross domestic product (GDP). Finally, the overall short run results favour Keynesian point of view that savings depend upon level of output.

Agarwal (2001) investigated the causality between gross domestic product (GDP) and saving for a sample consisting Asian economies. The author discovered that, in most economies causality runs from GDP to saving. In Mexico, Sinha and Sinha (1998) employed econometric techniques to validate or invalidate the claim that higher saving rate leads to high growth rate. The empirical results did not support the view that higher saving rate causes higher economic growth. The authors concluded that causality runs from economic growth to saving. Saltz (1999) examined the causal relationship between savings and growth rate of real output for a group that consists eighteen Latin American and Newly Industrialized countries between 1960 and 1991. The author found that higher growth rate of real output causes higher growth rate of savings. Anoruo and Ahmad (2001) analyzed the causal relationship between the growth of domestic savings and economic growth for a sample that consist seven African economies (Congo, Cote d'Ivoire, Ghana, Kenya, Nigeria, South Africa and Zambia). The econometric results illustrated that economic growth Granger-causes the growth rate of domestic savings for all the countries except Congo where reverse causality was found. In addition, the authors discovered a feedback causal relation for Cote d'Ivoire and South Africa. Waithima (2008) used the Hendry Model with a two-step method to model a saving function for Kenya. The author observed that a 1 percentage increase in GDP growth rate causes a 0.5 percentage increase in private saving. Moreover, the causality tests revealed a unidirectional causality that runs from per capita GDP to private saving. In Nigeria, Olajide (2009) employed the Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) methodology to investigate the direction of causal relationship between saving and economic growth in Nigeria during the 1970 and 2006 period. The causality test results showed the existence of a unidirectional causality between savings and economic growth and the complementary role of FDI in growth.

This study is very important because empirical studies that examine the causal relationship between saving and economic growth in Nigeria remain scanty (see Olajide, 2009). Besides, the study by Olajide included foreign direct investment as a complementary variable to domestic saving. Unfortunately, foreign capital inflow to Nigeria has continued to decline, thus increasing the need by government and policy makers to look inward and promote the mobilization of

domestic saving. In addition, is the desire of the Nigerian economy in attaining higher economic growth rate. Moreover, our paper employs both granger causality and co-integration techniques to analyze the relationship between saving and economic growth in Nigeria.

METHODOLOGY AND MODEL ESTIMATION

This paper employs the granger causality and co-integration techniques to examine the relationship between saving and economic growth. The econometric model to be used has its basis in the Keynesian model and the Solow hypothesis. For example, the Keynesian model states that saving 'S' is a function of income (output) 'Y'. Thus,

$$S = \alpha_o + \alpha_1 Y + U_1 \tag{1}$$

However, for the purpose of this study, we modified the equation above to derive the one below:

$$GNS = \alpha_o + \alpha_1 GRY + U_1 \tag{2}$$

Where GNS and GRY denote saving and economic growth, respectively. However, Solow argued that higher saving preceded economic growth. Therefore, the growth model specifies economic growth as a function of saving. Thus,

$$GRY = \beta_o + \beta_1 GNS + U_2 \tag{3}$$

Where α_o and β_o represent constants, and α_1 and β_1 are the slope coefficients, respectively. U_1 and U_2 refer to the disturbance term in the respective equations. The variables used in the paper are annual data (time series). They were collected from the central bank of Nigeria statistical bulletin (various issues). The variables are measured as follows. GNS is measured as the growth of gross national saving, while GRY is measured as the growth of gross domestic product.

Having specified the saving and growth equations, we conducted a unit root (stationarity) test. This is to ascertain whether the time series are stationary or not. Moreover, stationarity is required so as avoid spuriousness of the regression results. Standard economic theory requires that economic variables be stationary before estimating their relationship. Thus, we employed the Augmented Dickey-

Fuller (ADF) statistic in order to perform the stationarity test. The result of the stationarity test is presented below:

Table 7 *Results of the stationarity (unit root) test*

Variables	ADF-statistic	Critical values	Order of integration
GRY	-5.206166 (0.0001)	1% = -3.626784 5% = -2.945842 10% = -2.611531	Stationary at level
GNS	-4.286109 (0.0018)	1% = -3.626784 5% = -2.945842 10% = -2.611531	Stationary at level

The stationarity tests illustrate that the variables (economic growth and saving) are stationary at first difference at 1%, 5% and 10% critical values. The next step is to determine the direction of causality between the variables.

In order to conduct the causality test, we employed the Granger causality statistic. According to Granger (1969), variable X is said to "Granger-cause" Y if and only if Y is better predicted by using the past values of X than by not doing so with the past values of Y being used in either case. In other words, if a scalar X can help to forecast another scalar Y, then we say that X Granger causes Y. Our objective is to see whether current values of the dependent variable can be explained by past values of the explanatory variable (unidirectional relationship), or if the relationship is two-way (bi-directional or feedback), that is, both dependent and explanatory variable explain each other. The specification for the Granger causality test is;

$$GRY_t = \sum_{i=1}^{n} \alpha_1 GNS_t + \sum_{j=1}^{n} \alpha_2 GRY_{t-1} + U_{1t-1} \quad (4)$$

and,

$$GNS_t = \sum_{i=1}^{n} \alpha_3 GRY_t + \sum_{j=1}^{n} \alpha_4 GNS_{t-1} + U_{2t-1} \quad (5)$$

Where GRY_t and GRY_{t-1} represent both present and lagged values of the dependent variable, and GNS_t and GNS_{t-1}, represent the current and lagged values of the explanatory variable, respectively. The null hypothesis,

Ho: $\alpha_1=0$, that is the explanatory variable does not granger-cause the dependent variable.

Ho: $\alpha_3=0$, that is the dependent variable does not granger-cause the explanatory variable.

The decision rule for the test is where the value of the F-statistic is low and the probability value is high, we reject the null hypothesis. On the contrary, where the F-statistic value is high and the probability value low, we accept the null hypothesis.

Table 8 *Results of the Granger causality test*

Pairwise Granger Causality Tests
Date: 01/17/10 Time: 12:31
Sample: 1970 2007
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GRY does not Granger Cause GNS	35	2.98730	0.06560
GNS does not Granger Cause GRY		0.40463	0.67081

The results of the Granger causality indicate that economic growth (GRY) granger causes saving growth. However, the results reveal that saving growth does not granger causes economic growth. In fact, the causality test illustrates a unidirectional causal relationship that runs from economic growth to saving growth. Lastly, we employed the Johansen co-integration approach to examine whether the variables are co-integrated. The result of the co-integration test is presented below:

Table 9 *Results of Johansen Co-integration test*

Date: 01/17/10 Time: 12:35
Sample(adjusted): 1973 2007
Included observations: 35 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: GNS GRY
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.349940	29.16011	15.41	20.04
At most 1 **	0.331324	14.08594	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.349940	15.07417	14.07	18.63
At most 1 **	0.331324	14.08594	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

The results of the con-integration test are reported here. The Trace-Statistic value is shown to be greater than the critical values at both 1% and 5% levels, thus indicating 2 co-integrating equations at both 1% and 5% levels. However, the Max-Eigen Statistic indicates 2 co-integrating equations at 5% level, while it shows no co-integration at 1% level.

DISCUSSION OF RESULTS

This section discusses the results obtained in the previous section. The stationarity test indicates that the variables, economic growth and saving growth are stationary at level. Secondly, the co-integration test illustrates that the variables (saving and economic growth) are co-integrated, and implying that a long-run relationship exist between them. Finally, the Granger causality test reveals that causality runs from economic growth to saving growth. Thus we reject the Solow's claim that saving precedes economic growth, and accept the Keynesian theory, that it is higher economic growth that leads to higher saving growth.

CONCLUSION AND POLICY RECOMMENDATIONS

This paper investigates the causal relationship between economic growth and saving in Nigeria. The Granger causality statistic indicates that a unidirectional causality running from economic growth to saving. To this end, we recommend

that government and policy makers should employ policies that would accelerate economic growth so as to increase saving. These include among others the following. Firstly, government should increase its investment in the provision of infrastructure like power, roads, education and so on. This will help to reduce the costs of doing business as well as increase the profitability of firms, thereby raising the economy's production of goods and services. Secondly, government should encourage the monetary authority like the central bank of Nigeria to reduce interest rate so that prospective investors can increase their investment and raise the nation's production capacity. Others measures include sustenance of political stability that country current enjoys; encouragement of inflows of foreign direct investment; and sustenance of the war on corruption.

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Appendix 1: Gross national saving and Gross domestic product

Years	Gross National Saving (Nm)	Gross Domestic Product (Nm)
1970	341.6	5,205.10
1971	376.3	6,570.70
1972	461.2	7,208.30
1973	586.8	10,990.70
1974	1,137.10	18,298.30
1975	1,815.20	20,957.00
1976	2,255.30	26,656.30
1977	2,592.80	31,520.30
1978	3,009.70	34,540.10
1979	4,161.80	41,947.70
1980	5,769.90	49,632.30
1981	6,562.60	50,456.10
1982	7,514.40	51,653.40
1983	9,443.90	56,312.90
1984	10,988.10	62,474.20
1985	12,521.80	70,633.20
1986	13,934.10	71,859.00
1987	18,676.30	108,183.00
1988	23,249.00	142,618.00
1989	23,801.30	220,200.00
1990	29,651.20	271,908.00
1991	37,738.20	316,670.00
1992	55,116.80	536,305.10
1993	85,027.90	688,136.60
1994	110,966.80	904,004.70
1995	108,490.30	1,934,831.00
1996	132,803.70	2,703,809.00
1997	177,648.70	2,801,972.60
1998	198,653.80	2,721,178.40
1999	272,019.10	3,313,563.10
2000	379,528.00	4,727,522.60
2001	488,045.40	5,374,334.80
2002	592,094.00	6,232,243.60
2003	655,739.70	6,061,700.00
2004	797,517.20	11,411,066.90
2005	1,316,957.40	15,610,881.50
2006	1,739,636.90	18,564,594.70
2007	2,693,554.30	23,280,715.00

Source: Central Bank of Nigeria (various issues)