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Causality Analysis of Saving, Investment and Growth in Nigeria

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1. Introduction

For any economy, and especially for developing economies, the transformation of an initial growth spurt into sustained process of expansion of output and economic boom requires the accumulation of capital as well as capital financing. This would bring about a self-reinforcing process in which perceived prosperity motivates investment, actual investment motives growth while the flow of saving is generated along trend as income increases.

For Nigeria as a nation, the macro-economic development goals has, for a long time, been that of influencing the structure of production, consumption and savings so as to diversify the productivity base and reduce dependence on oil and imports. All these are done in a bid to redirect the economy on the path of self sustaining, inclusive and non-inflationary growth, thereby reducing poverty (Ajakaiye, 2002).

According to Edwards (1995) most analysis on savings and growth have been concentrated on two important aspects. First is the effect of higher saving on long run growth and second,

the impact of an increase in saving on investment. Recent models based on theories of endogenous growth and credited to Romer (1989) and Lucas (1988) predict that higher saving and corresponding increase in capital accumulation can lead to increase in growth rates. However, increases in domestic saving, especially in an open economy, may not necessarily be translated into higher domestic investment. This is because in the face of international capital mobility, changes in domestic saving and investment can be independent.

Be that as it may, if the degree of international mobility of capital is limited, then higher savings may generate higher investment and growth. Moreover, available empirical evidence show that aggregate saving is highly correlated with aggregate investment. The fact is that, on the average and over the long run, changes in capital accumulation respond positively to changes in domestic savings (Frankel 1985, Feldstein and Bacchetta 1991 and Montiel 1994).

The Problem

The problem of capital accumulation, rekindling investment and growth have taken the centre stage in macroeconomic management of less developed countries (LDCs) in the past three decades. In Nigeria, the growth performance since independent has generally been viewed to be sub-optimal, with saving and investment rates too low to act as the bed rock of any meaningful and sustainable expansion in output and employment. This is not to say that the optimum or threshold saving rate and investment that can act as the bedrock of growth and investment is easy to determine.

For a long time Nigeria has had to rely on foreign saving, foreign aid as well as debt management in financing its capital formation. Such reliance on foreign saving is not sustainable

because of the possibility of withdrawal or decline in concessionary capital inflow caused by donour fatique and increase competition for these resources. The need to internalize the process of capital formation is therefore obvious. To achieve these through domestic saving, the causal relations among savings, investment and growth need to be clearly defined and understood. This paper explores the causality relationships among these variables in Nigeria.

The causality tests will help us to improve our understanding of the saving – growths nexus, to the extent that saving translates into physical capital accumulation. This, according to Schmidt – Hebbel and Serven (1996) is a central ingredient for growth.

The data for this work is taken over a period of 29 years (1979 – 1999) and the paper is organised in five sections. Section one covers the above introduction while section two reviews related literature. Section three dwells on methodology while section four discusses the empirical results. Section five summaries, explores policy implications and concludes the paper.

Theoretical Framework and Literature Review

Theoretical Framework

Savings is defined by Keynes (1936 as the excess of income over expenditure on consumption. He views saving as that part of income of a given time period which has not passed into consumption. Given that income is equal to the value of current output; that current investment is equal to the value of that part of current output which is not consumed; and that savings is equal to the excess of income over consumption, thus making saving equal to investment.

The classical economists, however, regard the rate of interest as the factor which brings the demand for investment and the willingness to save into equilibrium with one another. They also maintain the equality of aggregate saving and aggregate investment. They held that every act of increased saving necessarily brings into existence a corresponding act of increased investment.

Literature Review

Macroeconomic instability has been acute in LDCs than in the advanced countries. Such higher instability in poorer regions may be explained by their larger exposure to adverse foreign shocks, higher incidence of various domestic shocks (wars, droughts, famines, ethnic conflicts etc) and their lower capability to cope with them.

Saving, investment and growth are observed to suffer world-wide as a result of the first (1973) and second (1980) oil shocks. However, East Asia suffered less and showed more rapid recovery from these adverse shocks than most other oil - importing developing countries.

Schmidt-Habbel , Serven and Solimano (1994) draw four conclusions from the above discussed issues. First, they maintain that all world regions – including OECD countries but except East Asia showed a disturbing downward trend in their saving, investment and growth performance during the last three decades. Second, they observed that the regional diversity within LDCs is growing: the poorest countries and regions (Africa) are getting even poorer while middle – income countries and regions (East Asia in particular) grow richer. Third, the poorer regions are not only affected by bad performance but also by much higher degrees of instability. Finally, the available facts suggest the existence of vicious circles of low saving and investment and

deteriorating growth along with virtuous circles of vigorous saving and investment and rapid growth in Africa and East Asia, respectively.

Attanasio, Picci and Scorcu (1998) have also estimated a structural model linking growth, savings and investment rates. Intuitively, it may be suggested that sustained growth process should require capital accumulation, and therefore an adequate flow of saving. Growth itself might also influence saving in various ways.

The works of Carroll and Weil (1994), Schmidt-Hebbel, Serven and Solimano (1994), Atanasio, Picci and Scorcu (1998) among others give very informative results concerning the saving, investment and growth link.

Investment– Growth Link

A strong association has been established between investment ratio and long-term growth performance (Kuznets, 1973, Romer 1987, Levine and Renelt, 1992, Delong and Summers, 1991, 1993, Easterly and Rebelo, 1993; de Gregorio 1992; Corbo and Rojas, 1993; Lefort and Solimano, 1993; Serven and Solimano 1993). Conversely, some other studies have found negative long-run effect of investment on growth. Attanasio, Picci and Scorcu (1998) rather found that growth rates strongly and positively Granger cause investment. They, however, did not find any evidence of causation going from investment to growth.

Solow (1955) neo-classical model maintains that capital accumulation affects growth only during the transition to the steady state. By contrast, therefore, long-run growth is determined only by population growth and the rate of technical change, which was assumed exogenous (see Solow 1957, Denison 1962, 1967). This view, however, attracted criticism from authors who felt that the separation between investment and innovation (technical

changes) was artificial as most technical innovation tend to be embodied in new machinery and equipment (Kaldor 1957, Robinson 1962, Schumpeter, 1934).

Others maintain that the identification and design of profitable and innovative investment objects requires also the existence of an entrepreneurial class with innovative skills, and awareness of business opportunities. They, therefore, extend the Solow model to include human capital and, assuming that its accumulation is guided by that of physical capital, find that investment can account both directly and indirectly for most of the variation in growth across countries (Mankiw, Romer and Weil 1992).

Saving and Growth

Carroll and Weil (1994) used the Summers-Heston data set to analyse the correlation between saving and growth rates. The result shows that growth (positively) causes saving while saving does not cause growth in the larger data set. However, in the OECD data set, they found that growth does not cause saving, while with the inclusion of time dummies, saving causes growth with a negative sign. In their analysis of saving and growth. Attanasio, Picci and Scorcu (1998) found that growth Granger-cause saving positively. Schmidt-Hebbel, Serven and Solimano (1994) maintain that saving is the chief force driving growth and submit further that it is necessary for countries to ensure adequate levels of saving in order to provide sufficient financing for investment and to avoid balance-of-payments equilibria. Even if saving is not the driving force behind growth, ensuring adequate saving level would still be necessary in order to guarantee sufficient financing for capital accumulation and avoid an excess of investment over saving which can create inflationary pressures.

Saving and Investment

According to Schmidt-Hennel, Serven and Solimano (1994), the understanding of the saving – investment link is desirable for two important reasons. First of all it helps to explain the positive correlation between saving and growth. Second, if capital accumulation is regarded as the core or the engine of growth, then the interaction between saving and investment is crucial for an assessment of the validity of the traditional posture that raising saving is the surest means of increasing growth. This, however, works with the underlying assumption that each country's extra saving is necessarily translated into higher domestic investment.

The empirical evidence first reported by Feldstein and Horioka (1980) and more recently by Feldstein and Bacchetta (1991) show that in the long-run, saving and investment rates show strong positive correlation. On a sample of industrial countries, Feldstein and Horioka found a correlation coefficient close to 0.9 (virtually the same found by Feldstein and Bacchetta). Other studies with the same line of findings include Dooley, Frankel and Mathieson (1987), Summers (1988), as well as Attanasio, Picci and Scorcu (1998) who found that in the long-run and short – run, saving causes investment.

Methodology

Granger-Causality Model

A sustained growth should require capital accumulation, and, therefore, the availability of an adequate flow of saving. In turn, growth might influence saving in a variety of ways. The transmission mechanism between saving and growth would be better understood by conducting the causality tests in such a way

that it explores fully the relationships among saving, investment and growth. Therefore, in addition to the estimation of the causal relationship between savings and growth, we also intend to estimate the causal relationships between saving and investment as well as investment and economic growth.

In furtherance of the above, the Granger causality tests shall employ the following basic dynamic models:

(a) Saving and Growth

$$S_t = \alpha^S + \beta^S S_{t-1} + \pi_1 g_{t-1} + \pi_2 g_{t-2} + \pi_3 g_{t-3} + \pi 4 g_{1-4} + \mu_t^s \ldots\ldots\ldots\ldots\beta.1)$$

Where:

$g_{t-1}, g_{t-2}, g_{t-3}$, are the four lags of growth while π_1, π_2, π_3 and π_4 are their respective coefficients

S_t represents real gross national savings during the current period, S_{t-1} = real gross national savings in the previous year while $\square^s$ represents autonomous savings.

(b) Saving and Investment

$$I_t = \alpha^1 + \beta_1^1 S_{t-1} + \beta_2^1 S_{t-2} + \beta_3^1 S_{t-3} + \beta_4^1 S_{t-4} + \mu_t^1 \ldots\ldots\ldots\ldots(3.2)$$

Where S_{t-1}, S_{t-2}, S_{t-3}, and S_{t-4} are four lagged values of gross national saving while $\square_1$, $\square_2$, $\square_3$ and $\square_4$ are their respective coefficients. I_t represent real investment in the current year and $\square^1$ represents autonomous investment

(c) *Growth and Investment*

$$g_t = \alpha^g + \theta_1^g I_{t-1} + \theta_2^g I_{t-2} + \theta_3^g I_{t-3} + \theta_4^g I_{1-4} + \mu_t^g \ldots\ldots\ldots\ldots(3.3)$$

where I_{t-1}, I_{t-2}, I_{t-3} and I_{t-4} are four lagged values of investment while $\square_1$, $\square_2$, $\square_3$, and $\square_4$ are their respective coefficients. g_t represents the growth rate of GDP during the current period.

The dynamics of taking more lags (See Attanasio, Picci and Scoru. 1998) will help us distinguished between short-run and long-run effects.

Causality Analysis

To determine the correct model specification for the causality analysis, we also test for co-integration. A prerequisite for co-integration is that all the variables must be integrated of the same order. Thus, unit root tests based on the Augmented Dickey-Fuller (ADF) test will be carried out.

The basic statistical approach in the study, therefore, has four stages:

(i) testing the data for non-stationarity/stationarity.
(ii) testing for the existence of long run or co-integrated relationships between the variables of interest. The estimation process begins with running OLS regression to provide an initial indication of the nature of the relationships between the variables and their dynamic structure:
(iii) fitting error correction models (ECM) to allow inferences about both the short run dynamics and long run equilibrium relationships, and
(iv) assessment of resulting models against both economic and statistic criteria.

Empirical Results

Causality Tests

The summary of the F-tests and other causality test results are presented in tables 1, 2 and 3

Growth to Savings ($G \Rightarrow S$)

In table 1 we consider the dynamic relationship between Saving and growth. Given the lag structure, the degrees of freedom and the f-statistic our empirical results show that growth does not Granger-cause saving. The coefficients on lagged growth are insignificant. There is, therefore, no significant evidence of causal relationships running from growth to saving. These results are contrary to those obtained by Attanasio, Picci and Scorcu (1998) whose results showed that growth Granger-causes saving. The difference in results may be due to choice of samples as well as estimation techniques.

Again our results differ from those obtained by Cawoll and Weil (1994) in which growth (positively) causes saving in the larger data set. However, in the OECD data set, they found that growth does not Granger cause saving. We believe that these results, to some extent, depend on the data used, the econometric technique employed and on the frequency chosen for analysis.

Table 1 Summary of Causality Test Result. Growth to Saving (G ⇒S)

Lag Structure	F – Statistic	df
1,1	0.30611	(2,22)
1,2	0.37177	(3,20)
1,3	0.4213	(4,18)
1,4	0.39376	(5,16)
1,5	0.38035	(6,14)
1,6	0.29174	(7,12)
1,7	0.56688	(8,10)
1,8	0.51403	(9,8)
2,1	0.59396	(2,20)
2,2	0.68386	(3,19)
2,3	0.64922	(4,17)
2,4	0.38178	(5,15)
2,5	0.38829	(6,13)
2,6	0.28944	(7,11)
2,7	0.5209	(8,9)
2,8	0.37537	(9,7)

- G & □S = Growth & First difference of saving.

Table 2 Summary of Causality test Result. Saving to Investment (S ⇒ I)

Lag Structure	F – Statistic	df
1,1	0.03673	(2,22)
1,2	0.23327	(3,20)
1,3	0.31723	(4,18)
1,4	0.33463	(5,16)
1,5	0.2551	(6,14)
1,6	0.11600	(7,12)
1,7	1.7813	(8,10)
1,8	0.8892	(9,8)
2,1	0.06153	(2,20)
2,2	0.22065	(3,19)
2,3	0.28978	(4,17)
2,4	0.3014	(5,15)
2,5	0.2256	(6,13)
2,6	0.1066	(7,11)
2,7	1.6853	(8,9)
2,8	0.82723	(9,7)

- S & □I= Saving and first difference of investment

Table 3 Summary of Causality test Result. Investment to Growth (I ⇒ G)

Lag Structure	F – Statistic	d f
1,1	0.7792	(2,22)
1,2	0.5116	(3,20)
1,3	0.5836	(4,18)
1,4	2.6922	(5,16)
1,5	2.2511	(6,14)
1,6	7.3288**	(7,12)
1,7	7.4703**	(8,10)
1,8	7.3562**	(9,8)
2,1	1.2815	(2,20)
2,2	0.8359	(3,19)
2,3	1.0943	(4,17)
2,4	3.5785*	(5,15)
2,5	2.9092	(6,13)
2,6	8.4942**	(7,11)
2,7	7.7240**	(8,9)
2,8	6.9731**	(9,7)

- G & □I = Growth & first difference of investment
- * 5% - ** 1%

Saving to Investment (S ⇒ I)

Table 2 presents a summary of causality test result for saving to investment. Our result does not, however, indicate any causal relationship running from saving to investment. Saving does not, therefore, Granger cause investment. Though the coefficients are positive, they are all insignificant. These results are again incompatible with earlier results by Carroll and Weil (1994) as well as Attanasio, Picci and Scorcu (1998), perhaps due to methods of evaluation and samples used. Furthermore

contrasting economic forces are likely determinants of the relationships which we have studied.

Investment to Growth (I ⇒ G)

Finally we turn to the relationship between investment and growth. The causality test results are reported in table 3. In this case we find, at the given lag structure, that investment strongly and positively Granger cause growth. The implication of this result is that capital accumulation constitute a necessary (but not sufficient) prerequisite for economic growth. Recent literature emphasizes other complementary inputs which includes human capital and technical knowledge as also being paramount for growth. The quality of investment is also a key determinant of its ultimate reward in terms of growth. This is a lesson which Nigeria must learn if our efforts at rekindling investment must yield the desired reward.

Conclusion

This paper has attempted a causality analysis of saving, investment and growth in Nigeria using time series data for 29 years. (1970 1999). Due to the dearth of savings data for Nigeria on all other savings variants (private saving, public saving, household saving), our savings measure is the gross national savings.The Granger causality tests revealed that investment Granger causes growth in Nigeria. Moreover, the test also reveals no significant relationship between savings and investment. Furthermore, there is no significant evidence of causal relationship running from growth to saving.The causality results which indicate that investment causes growth is informative. It confirms the notion that the accumulation of physical capital is the engine of growth. Therefore raising the rate of investment is the key to increasing long-term growth. Practically, therefore, investible funds must be channelled into productive sectors of the

economy for it to boost economic growth.

Our causality result on saving to investment is worrisome, for two reasons. The correlation between saving and growth would be better appreciated if the saving – investment link is clear. Moreover, if capital accumulation is indeed the engine of growth, then the interrelation between saving and investment is crucial for assessing the validity of the traditional belief that raising savings is the surest way to increase growth via capital accumulation (Schmidt – Hebbel, Serven and solimanos, 1994). This is, however, based on the assumption that the nation's extra saving is necessarily translated into higher domestic investment.

The absence of a causal relationship between saving, and investment in Nigeria may be explained by the Keynesian postulation that the determinants of saving are different from those of investment. While saving depends mainly on income and wealth, investment depends on stability and risk. Therefore, the saving-investment relations in Nigeria may be due to the result of those two independent decisions. The fact that investment Granger causes growth expresses the need for the public and private sectors to take the issue of rekindling investment seriously. The issue of capital accumulation should go beyond technological transfer. It should encompass innovation as well as investment in human capital. Furthermore, the public sector must be able to overcome the limitations imposed by administrative and institutional bottlenecks. Thereby, government would possess the capacities to target the right investment options and avoid rent-seeking. The government must also create institutional environment that instills confidence in Savers. One way of ensuring this, is the maintenance of socio-economic and political stability in the polity.

To achieve saving mobilization there is need for increased productivity from all sectors of the economy. This is possible if

productive resources are put into near full employment. Such is likely to result in an increase in GDP, and since variations in GDP exert significant influence on aggregate saving, more saving could be converted into investment to enhance economic growth and development.

Although savings is not the major drawing force behind growth in Nigeria, it would be worthwhile to ensure adequate savings level as a matter of policy. This would guarantee sufficient financing for capital accumulation and the avoidance of an excess investment over savings, which is capable of creating inflationary pressure and /or balance of payments disequilibria.

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