Savings-Growth Nexus in Nigeria: An Asymmetric ARDL Approach

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Abstract

This study investigates the asymmetric relationship between savings and growth in Nigeria between 1970 and 2020. The study employs Asymmetric ARDL method in tracing the non-linear relationship between the variables. The study discovered using non-linear ARDL (NARDL) causality that there was a unidirectional causal relationship running from the positive component of savings to real GDP in the short-run, long-run and very long-run (strong causality). This implies that the positive component of savings is a determinant of real GDP in Nigeria. The result further showed that there was significant positive relationship between positive component of savings and real GDP in the short and long-run but the negative component of savings was not a significant determinant of real GDP both in the short-run and long-run, more importantly, the study discovered an asymmetric relationship between savings and growth for the period under studied. The study, therefore, recommended that savings must be encouraged in the country to have more investment base as a sound fiscal policy that could propel growth, because the negative effect of dis-savings on growth is more pronounced than the positive effect of savings on growth.

Keywords: Savings, GDP. Non-linear, Asymmetric ARDL, Nigeria

1 Introduction

Saving has been identified as a variable that plays an indispensable role in economic growth and development process of any country. Saving as defined by Keynes (1936) is the excess income after consumption. Literally, savings means the unspent income, which has the capacity of defining the growth process of an economy when invested. Economic growth is also necessary for increased saving, it is believed that saving is the centre piece to growth. Saving has been instrumental to growth in many countries. In year 2000, the savings rate in Nigeria was 32.7 percent, it increased to 48.8 percent in 2006, in 2012, it reduced to 30.2 percent, a further reduction to the tune of 29.3 percent and 18.65 percent was witnessed in 2013 and 2014 respectively, in 2019, and the savings rate was 13.9 percent in the country. While in other developing countries like China, Tanzania and Togo, the savings rate were 45 percent, 24.8 percent and 21.2 percent respectively. In 2020, the savings rate increased to 21.6 percent amidst the COVID pandemic. The GDP growth rates in 2016 was -1.62 percent, in 2017, it increased to 0.81 percent, in 2018, 1.92 percent was recorded, while in 2020, it reduced to -1.79 percent. It is expected that an increase in savings rate will translate to an equivalent increase in GDP. Savings and GDP rates have been fluctuating, while the direction of the cause of this fluctuation cannot be really ascertained. The relationship between savings and economic growth is a crucial one; this direction of causality between the variables has continued to generate series of debate among scholars (Sajid and Sarfraz 2008). Given the importance of the relationship between these two variables, a lot of researches has been carried out to ascertain the direction of causality between these variables. Baro (1990) provided support to the notion that capital accumulation and savings are central to understanding growth differentials across countries. Studies by David, Goncalves & Werner (2023), Olayiwola, Okunade, and Fatai, (2021), Olajide (2009) Lucas (1988), Cullison (1993), Jappeli and Pagano (1994), Alguacil, Guadros and Orts (2002), Lorie (2007) and revealed that savings preceded economic growth while Gavinel al (1997), Sinhaad Sanha (1998), Saltz (1999), Agrawal (2001) discovered the reverse causality.

Most of the researches on savings-growth nexus have dwelt on the linear relationship between savings and growth and this has restricted researchers only to the techniques of analysis which

could capture the linear relationship between the variables. Without any emphasis on the asymmetric relationship which may occur between savings and growth in the periods of boom and depression in a country. This situation necessitates the need to raise a question on whether change in savings can result in the same level of GDP growth in a boom and depression. Also, another issue that has engaged the attention of development economists and policy makers is whether growth responds asymmetrically to changes in the level of savings. Uncovering the asymmetries in the adjustment process to long run equilibrium constitutes further valuable information that may be usable accordingly by investors, policy makers as well as firms to formulate policies that would encourage more savings for productive investments which in turn lead to increased economic growth.

This study shall bridge the gap in literature by tracing the asymmetric relationship between savings and growth using asymmetric ARDL which have been omitted in literature. (*See* Olayiwola, Okunade, and Fatai, 2021; Odionye, Emerole and Ugwuebe, 2016; Adeleke, 2014; Adelakun, 2011). For instance, Olayiwola, Okunade, and Fatai, 2021 worked on savings-growth nexus in Nigeria, with special emphasis on pre and post effect of savings on growth, VECM causality was employed as the estimating technique.

Odionye, Emerole and Ugwuebe (2016) worked on the savings -growth Nexus in Nigeria using co-integrations technique. Also, Adeleke (2014) investigated saving growth nexus in an oil-rich exporting country using Nigeria as a case study, applied ARDL on the variable. Najarzadeh, Reed and Tasan (2014) used ARDL and revealed a bi-directional relationship between savings and economic growth for Iran, in a similar vein,

Adelakun (2011) used the error-correction modelling procedure to explain the determinants of private savings in Nigeria during the period covering 1970-2007. Abu (2010) also employed the Co integration techniques to analysis the relationship between savings and economic growth in Nigeria during the period covering 1970-2007. Olajide (2010) employed Co integration test to trace the direction of causality between saving and economic growth in Nigeria between 1970 and 2006. Adebiyi (2005) also investigated the relationship between savings and economic growth by employing Granger causality test and impulse response analysis of vector auto regressive models on a quarterly data spanning between1970-1998. None of these studies have

attempted the need to consider the effect of savings on growth at two different economic periods characterised as boom and recession.

The objective of this study is to investigate the relationship between savings and growth using an asymmetric Autoregressive distributed lag, that is, if the effect of a change in savings on gross domestic product will be the same in both boom and recession periods. This paper is organized as follows; following the introduction is the literature review. Section three addresses the methodology, while section four consists of discussion of results. Section five contains the summary, conclusion and policy recommendations.

2. Literature review

2.1 Theoretical Framework

Theoretically, the study relied on the ground provided by the Solow-growth model. The model posits that closed and small open economy models provide a static view of the economy at a given point in time. Although, the neoclassical model of Harrod-Domar emphasized potential dysfunctional aspects of growth that is how increase in unemployment could trigger growth, but Solow growth model permits a dynamic view of how savings affect the economy over time. The production function model was applied to the study of growth problems by Robert Solow. Solow stated a Cobb-Douglas production function that;

$Q = AK^{a}L^{b}$

Where A is multifactor productivity, a and b are less than one indicating diminishing returns to a single factor.

Solow noted that there could be an increase in Q if there is increase in L, K and A. L represents labour, K stands for capital and A is the effective labour apart from the production function Solow also identified three important variables as determinants of growth. They are discussed below;

1) Savings Rate: Solow predicted that an increase in savings rate could have a positive effect on growth.
2) Population Growth; it was predicted that a rise in population will decrease the income per capita.

3) Productivity growth; Solow was of the opinion that growth in production can be achieved through advancement in technology. That is, advancement in technology will cause the production function and saving function to shift upward. It means more output will be created with same amount of inputs.

2.2 Empirical Literature.

The relationship between savings and growth has attracted several debates both from the classical and Keynesian economists. The classical economists are of the view that increased savings will stimulate economic growth through increased investment (Bebezuk, 2000). Authors like Harrod (1939), Domar (1946) Lewis (1955), Solow (1956), Kaldo (1956), Alguacil, Cuadros and Orts (2004), Singh (2009), Misztal (2011), gave credence to this fact. While, the Keynesians, on the other hand, are of the opinion that economic growth stimulates increased savings. Keynes (1936), Sinh and Sinh (1998), Saltz (1999), Agrawal (2001), Anoruo and Ahmad (2001), Narayan and Narayan (2006), Lorie (2007) and Abu (2010), confirmed this assertion.

The researchers all over the world have also used different models to ascertain the direction of relationship between savings and economic growth. Olayiwola, Okunade and Fatai (2021) revisited the savings - growth nexus in Nigeria via VECM method. The result of the study shows that no significant relationship exists between saving and economic growth in the pre-democracy period, while in the post democracy period a uni-directional relationship was observed between savings and economic growth. Both periods revealed a bi-directional relationship between savings and economic growth. Sinha (1996) conducted an empirical study on savings and economic growth in India for the period of 1960-1995 using co integration test and discovered a neutral result between savings and economic growth. To confirm the findings, Marrotas and Kelly (2001) used a more recent causality test, identified as modified Wald Test (MWALD) developed by Toda and Yamamoto (1995) to examine the causal relationship between savings and economic growth for India and Sri lanka. They also discover a non-related relationship for India, while an evidence of bilateral causality was discovered between economic growth and private savings in the case of Sri lanka. Tang and Chua (2007) conducted their findings on Malaysia by employing the non-parameter analysis of co integration techniques and

discovered that saving is an engine to economic growth; the positive related result indicates that when saving is increasing, economic growth will also be increased.

Misztal (2011) conducted a research on causality with different level of economic development using co integration result and discovered a one-way causal relationship between gross domestic saving and gross domestic product in the case of developed countries, developing and transition countries. This result confirmed the findings on Malaysia that saving is an engine of growth. Mohan (2006), in the research conducted on four groups of countries with various levels of economic development from1960-2001 discovered a mixed result, out of the countries considered 13 revealed that economic growth was the cause of increased savings, 2 countries also revealed the reverse direction while 2 countries showed a neutral relationship between savings and economic growth. A two-way relationship between economic growth and savings was discovered in 5 countries.

Bassam AbuAl-Foul (2010) also used co integration to examine the relationship between real gross domestic products and real gross domestic savings for Morocco and Tunisia between 1965 and 2007 and 1961 and 2007, respectively. The result revealed a long run two-way causal relationship between gross domestic product and gross domestic saving in Morocco but in Tunisia, a unidirectional, gross domestic saving was discovered, gross domestic saving was responsible for growth in domestic product in the country for that period.

Anoruo and Ahmad (2001), examined the savings growth nexus for seven African economies, the empirical study indicated that savings and economic growth are co integrated for all the selected countries except Nigeria. The Granger causality test indicated a bilateral causality between savings and economic growth in Cote d' Ivoire and South African economics. In Congo, a unidirectional causal relationship was discovered from savings to economic growth. While in Kenya, Ghana, Nigeria and Zambia causality runs from economic growth to savings, Rashid (2003), examined the relation between economic growth and savings in five Asian countries (Singapore, South Korea, Malaysia, Thailand, Philippines), from 1960 to 1997. VECM model was employed to analyse the data, for the period studied, economic growth was not as a result of savings for countries like South Korea, Malaysia, Thailand and Philippines, and savings was responsible for growth only in Singapore. Abu (2010) conducted a research on the direction of causality between saving and economic growth in Nigeria using co integration technique. The

result of the findings confirmed that economic growth is necessary for increased savings Olajide (2010) employed a modified co integration method known as modified Wald Statistics, to ascertain the direction of relationship between savings and economic growth from 1970-2006. The result discovered a long run unidirectional causality relation between saving and economic growth.

Adebiyi (2005) investigated the relationship between savings and growth using a quarterly data spanning between 1970 and 1998. The data were analysed with Granger causality test and Impulse Response Analysis of Vector Auto regressive Model. The result showed per capita income as a proxy of growth has been sensitive to savings in Nigeria. It means savings was instrumental to growth in Nigeria for the period considered. The different methods of analysis considered in the period between 1960 to2007 in the analysis above yielded mixed results. Odionye et al (2016) examined the casual relationship between domestic private savings and economic growth for the period of 1980 to 2013. The study employed the Augmented Granger Causality Test and discovered a unidirectional causality from domestic private savings to growth in Nigeria. Romm(2003) used VECM estimation technique to examine the directions of relationship between savings and economic growth in South Africa, and discovered a bi-directional relationship. Bolarinwa and Obembe (2017) investigated the direction of causality between economic growth and savings among six Sub-Saharan African fastest growing economies. ARDL was employed, the result revealed the existence of uni-directional causality running from economic growth to savings for Ghana and Burkina-Faso. While savings granger caused economic growth in Liberia, Niger and Sierra- Leone. No causality was recoded for Nigeria. Pickson, Enning and Siaw (2017) revealed a uni-directional relationship running from savings to economic growth for Ghana. Tang and Chua (2009) used dynamic OLS in Malaysia, the result revealed that savings and economic growth are positively related. The gap of a nonlinear relationship confirmed the basis for this updated research work.

3. Methodology

3.1 Estimation Technique

The Autoregressive Distributed Lag (ARDL) was used in establishing long-run relationship. The I(o) term are not important asymptotically but they assume importance in small samples. Never the less, ARDL co-integration techniques cannot be applied to 1(2) variables. The ARDL model

can be reparametrized to yield an error correction model but the ECM may not be easily interpreted when the co-integrating vectors are unknown. The ADRL model is best suited for bivariate relationship. Shin et al (2011) developed an asymmetric ARDL co integration methodology, which permits positive and negative partial sum decompositions. This gives room for the detection of non-linearity both in the short and long run. Asymmetric ARDL is known for its ability to analyse issues of non-linearity and non-stationarity in the domain of an unrestricted error correction model.

3.2 Model Specification

The general form of the ARDL model is defined as;

$$\phi(L)y_t = \alpha_0 + \alpha_1 w_1 + \beta(L)x_{1t} + u_t \qquad \text{(equ 1)}$$

Where $\phi(L) = 1 - \alpha\sum_{t-1}^{\infty}\phi_1 L^i$ and $\beta(L)\sum_{j=1}^{\infty}\beta_j L^j$ with L being the lag operator and (w_t) being a vector of deterministic variables such as the intercept, seasonal dummies, time trends and the other exogeneous variables.

This work used the asymmetric ARDL model to detect the non-linearity among economic variables both in the long run and short run. Given the work of, Katrakilidis and Trachanas (2012), Shin, Yu and Greenwood (2014) Fousekis, Katrakilidis and Trachanas (2015), the non-linear asymmetric co integrating regression will be stated as this;

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \qquad \text{(equ2)}$$

where β^+ and β^- are the long run parameters and x_t is a K x 1 vector of regressors decomposed

$$X_t = X_o + X_t^+ + X_t^-$$

(equ 3)

Where, X_t^+ and X_t^- are partial sum processes of positive and negative changes in X_t;

$$X_t^+ = \sum_{j=1}^{t}\Delta x_j^+ = \sum_{j=1}^{t} Max(\Delta x_j, o) and X_t^- = \sum_{j=1}^{t}\Delta x_j^- + \sum_{j=1}^{t} Min(\Delta x_j, o) \qquad \text{(equ 4)}$$

To obtain the asymmetric error correction model (AECM) as shown below, the equ 2 is associated with (p,q) ARDL;

$$\Delta y_t = Py_{t-1} + \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^- + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \sum_{j=0}^{q} (\pi_j^+ \Delta X_{t-j}^+ + \pi_j^- \Delta X_{t-j}^-) + \varepsilon_t \qquad \text{(equ 5)}$$

For $j = 1-q$, where $\theta^+ = -P\beta^+ = \theta^- = P\beta^-$

This entire empirical analysis can be made to follow three procedures, the procedure I

captures the standard OLS estimation and the confirmation of the long run relationship between the levels of the variables Y_t , X_t^+ and X_t^- by using F -test, Pesaran, Shin and Smith (2001) and Shin et al (2001) bounds –testing method will be used. The second procedure shows how the wald test can be used in examining long-run asymmetry, where $\Theta = \Theta^+ = \Theta^-$ and short-run symmetry which can follow this from; $_i^+ = _i^-$ for all $_i = 1$

In the third procedure equation (5) can be used to get the asymmetric cumulative dynamic multiplier effects of a unit change in X^+_t respectively on y_t;

$$M_i^+ = \sum_{j=0}^{i} \frac{\partial y_{t+j}}{\partial X_t^+},\ M_i^- = \sum_{j=0}^{i} \frac{\partial y_{t+j}}{\partial X_t^-},\ i = 0,1,2,3,...$$

It should be noted that i ---∞, then m^+_i ---β^+ and M^-_i ---β^-, where β^+ β^- are the asymmetric long run coefficients calculated as $\beta^+ = -\Theta^+/p$ and $\beta^- = -\Theta^-/p$ respectively.

Given the objectives of the study, the model is specified as follows;

$$\ln GDP_t = f(\ln SAV_t^+, \ln SAV_t^-) \qquad \text{(equ 6)}$$

Where $\ln SAV_t^+$, $\ln SAV_t^-$ are partial sums of positive and negative changes in lnSAV.

3.3 Type and Source of Data

This study used annual data for the period 1970-2020 with emphasis on the Nigerian economy. Growth was measured as Gross Domestic Product (GDP_t). We measured savings as total savings (SAV_t). Both variables were transformed into their natural logarithm GDP_t and SAV_t

were dis-aggregated into their positive and negative components, namely as GDP_t^+ SAV_t^+. Data were obtained from the Central Bank of Nigeria Statistical bulletin (CBN), 2022.

4. Discussion of Result

This section focuses on presentation and discussion of result. Table 1 reports the result of ADF and PP unit root test which shows that all variables are non-stationary at level whereas after first difference they are stationary at 1% and 5% levels of significance. These two tests ensures that none of the variables is integrated of upper order than one and approve that all variables are integrated of order one I(1).

Table 1: Unit Root Test Result

Variables	**ADF**		**PP**	
	Critical-value	**Prob-value**	**Critical-value**	**Prob-value**
Level				
LRGDP	-0.1914	0.9319	-0.1444	0.9378
LSAV	0.0114	0.9545	0.0303	0.9562
First-Difference				
LRGDP	-3.1612	0.0294	-3.0233	0.0406
LSAV	-4.9178	0.0002	-4.6947	0.0004

Table 2 shows the asymmetric ARDL Bounds Test. From the result, F-statistic is 7.837385 while the lower and upper bound statistics are 2.86 and 4.01 respectively. Since the F-Statistics of 7.8373 is greater than the upper bound value of 4.01, then the study concluded that there is asymmetric co-integration between the two variables. It means that the null hypothesis of no co-integration will be rejected and the alternate hypothesis of co-integration is accepted.

Table 2: Asymmetric ARDL Bound Test

Test Statistic	**Value**	**k**
F-statistic	7.837385	4

Critical Value Bounds

Significance	Lower Bound I(0)	Upper Bound I(1)
5%	2.86	4.01

Table 3 reports the asymmetric ARDL result. The result shows that there is positive and significant relationship between the positive component of saving and real gross domestic product in the short-run. The result indicates that 1% increase in the positive variation of saving has 26.9% significance increase in real gross domestic product. The same result was found in the long-run for positive component of saving. It was found that the positive component of saving is statistically significant in determining real GDP in the long-run. For negative component of saving, the result shows an insignificant positive relationship between the negative component of saving and real GDP in both short and long-run. In addition, the lagged error correction term (ECT) is negative and statistically significant at the 5% level with a coefficient -0.32276. This indicates that 32.27percent of the disequilibrium of economic performance in previous period is corrected in the present period. Also, the R^2 which measures the degree at which the saving explained real GDP is high at 85% and the F-statistics (F=74.50) which measures overall significance of the model indicates that all the estimated regression coefficients are highly statistically significantly different from zero.

Lastly, in order to ensure that the NARDL model is robust, this study employs Breusch-Godfrey serial correlation test and Autoregressive Conditional (ARCH) Heteroscedasticity. Based on the diagnostic test result reported the lower part of Table 3, there is no evidence of serial correlation and heteroscedasticity in the model because the probability values of the Breusch-Pagan serial correlation test and ARCH Heteroscedasticity test is greater than 5% level of significance. Furthermore, the stability of the model is determined using the cumulative sum (CUSUM) techniques developed by Brown et al (1975). These tests are based on the recursive regression residuals and it incorporates the short-run dynamics to the long-run through residuals. Fig 1 which shows that estimated coefficients are well within the 5% critical bounds, meaning that they are stable. The Dynamic multiplier graph in Fig. 2 also shows that the model is stable.

Table 3: Asymmetric ARDL Result

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**

Long run Estimate				
LSAV_POS	0.8334	0.2320	3.5912	0.0009
LSAV_NEG	88.6290	58.2238	1.5222	0.1358
C	2.3986	0.7608	3.1524	0.0031
Short-Run Estimate				
D(LSAV_POS)	0.2690	0.1137	2.3648	0.023
D(LSAV_NEG)	28.6059	19.6340	1.4569	0.1529
ECT (-1)	-0.3227	0.1443	-2.2353	0.031
R-Squared	0.85			
F-Stat	74.50			0.0000

Diagnostic Test	Test Value	Prob
Serial LM Test	0.38	0.7696
Hetero Test	2.18	0.1056

Dynamic multiplier

Tables 4 and 5 show the non-linear ARDL causality for real GDP and savings. The result shows that there is unidirectional causal relationship between positive component of savings and real GDP in the short and long-run. The result supports the research carried out by Odionye et al (2016), Olajide (2010), Adebiyi (2005), on the Nigerian economy, Bassam AbuAl-Foul (2010) on Tunisia economy, Rashid (2003) on Singapore. The result also shows that there is strong causal relationship running from positive variation of saving to real GDP. However, for negative component of saving, the results indicate a unidirectional causal relationship running from the negative component of saving to real GDP only in the long-run. This implies that the positive component of saving is a determinant of real GDP in the short-run, long-run and very long-run but the component of saving can only determine the real GDP in the long-run. No evidence of causal relationship running from the component of real GDP to saving either in short-run, long-run and very long-run.

Table 4: NARDL Causality

Dependent variable: LRGDP						
LRGDP	**Short Run**	**Prob.**	**Long Run**	**Prob**	**Strong**	**Prob.**
LSAV_POS	5.5923	0.018	4.9968	0.0254	5.8405	0.0157
LSAV_NEG	2.1227	0.1451	4.9968	0.0254	2.1583	0.1418

Table 5: NARDL Causality

Dependent variable: LSAV						
LSAV	**Short Run**	**Prob**	**Long Run**	**Prob**	**Strong**	**Prob.**
LRGDP_POS	0.2990	0.5845	0.1049	0.746	0.0821	0.7744
LRGDP_NEG	1.4445	0.2294	0.1049	0.746	1.4411	0.23

5. Summary, Conclusion and Recommendation

5.1 Summary

This paper investigated the casual relationship between economic growth and savings in Nigeria between the periods 1970 to 2020. The Asymmetry ARDL approach was employed to analyse the data for this period. The study carried out a comprehensive literature reviews on savings and growth and discovered that most of the researchers worked only on the linear relationship

between savings and economic growth. In Nigeria, some authors believed savings stimulated economic growth through increased investment. While others subscribed to the Keynesian view that economic growth stimulated increased saving. It was detected that the statistical model used by these researchers played a big role in determining the direction of relationship between savings and economic growth and the speed of adjustment of savings to growth in the periods of boom and depression in Nigeria.

5.2 Conclusion

The result shows that there was positive and significant relationship between the positive component of saving and real gross domestic product in the short-run which suggests that 1% increase in the positive variation of saving has 26.9% significance increase in real gross domestic product. The same result was found in the long-run for positive component of saving. It was found that the positive component of saving was statistically significant in determining real GDP in the long-run. For negative component of saving, the result shows an insignificant positive relationship between the negative component of saving and real GDP in both the short and long-run. The lagged error correction term (ECT) is negative and is statistically significant at the 5% level with a coefficient -0.32276.

5.3 Recommendation

Based on the above findings, the study recommends that all efforts must be geared towards increasing savings in Nigeria so as to stimulate economic growth. Because, it is believed that any money saved will be converted to investment, increased investment will also boost economic activities. The increase in economic activities in a boom will result in increased GDP.

The importance of savings in an economy cannot be underestimated, given the outcome of this analysis. It is necessary for the Nigerian government and stakeholders to create enabling environment that could encourage and boost savings in the country. Government and stakeholders must create awareness on the need to embrace savings as a reliable tool for redirecting idle funds especially in a boom period. It is conventional to dis-save especially in the period of crisis, motivation must be provided to compel people to save more rather than dis- save in the period of recession.

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