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Empirical Analysis of the Nexus between Saving and Economic Growth in Selected African Countries (1981–2014)

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Abstract

This empirical study investigates the direction of causality between gross domestic saving and economic growth among the six sub-Saharan African fastest growing economies as reported by African Development Bank between 1981 and 2014 using the recently developed methodologies of autoregressive distributed lag (ARDL) and the Toda and Yamamoto causality test. The result shows the existence of unidirectional causality running from economic growth to gross domestic saving for Ghana and Burkina Faso, while gross domestic saving Granger causes economic growth in Liberia, Niger and Sierra Leone, indicating a unidirectional causality. However, no causality is recorded for Nigeria. The empirical study, therefore, concludes that the direction of causality is mixed and country-specific among the sub-Saharan African fastest growing economies.

Keywords

Saving, Growth, Toda-Yamamoto Causality, Sub-Saharan African countries

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Introduction

One of the most controversial areas in macroeconomics is the saving–growth nexus. This is because of divergent opinions in theories and mixed empirical results among researchers. In the theories, for example, the neoclassical school believes that higher savings lead to higher growth rates. This is plausible because increase in saving can stimulate economic growth through the mechanism of investment. Neoclassical works like Harrod (1939), Domar (1946), Solow (1956), King and Levine (1994), Lewis (1955) and Romer (1986) are based on this theoretical viewpoint. These works are grounded on the conventional viewpoint that higher savings lead to higher investment and consequently imply higher economic growth in the economy; thus, these works suggest the formulation of macroeconomic policies that stimulate aggregate saving to achieve economic growth. So, from the neoclassical principle, causality runs from saving to economic growth. On the other hand, the Keynesian schools conflict with the classical opinion and postulate that economic growth leads to savings in the economy. The Keynesian opinion is based on the standpoint that saving is a leakage which depends on income or growth in income (Tang & Tan, 2014). Therefore, saving is an outcome of income and not its determinant (Keynes, 1936). On this the Keynesian opinion, several macroeconomic works have been rooted (Carroll & Weil, 1994; Godley & Cripps, 1985; Sodokin, 2004; Tang & Tan, 2014). So, from Keynesian perspective, it is expected that causality runs from economic growth to saving. However, due to divergence of opinions in theories, the issue is left for empirical investigations for settlement.

In the empirical literature, the issue of saving–growth nexus has attracted a lot of academic interest from different parts of the world (AbuAl-Foul, 2010; Gjergji & Turan, 2004; Masih & Peters, 2010; Odhiambo, 2009; Palley, 1996; Sinha & Sinha, 1998; Tang & Tan, 2014) and central to this nexus is the issue of causation. While some studies have reported causality running from saving to growth (Alguacil et al., 2004; Anoruo & Ahmad, 2001; Olajide, 2010; World Bank, 1993); some others have reported causation running from economic growth to saving (Agarwal, 2001; Mohan, 2006; Sajid & Sarfraz, 2008; Sinha & Sinha, 1998; Verma, 2007). At the same time, we have studies that report bidirectional relationship (AbuAl-Foul, 2010; Tang & Chua, 2009; Zeren & Ekrem, 2013). Meanwhile, the existing studies continue to yield conflicts and inconclusiveness depending on the methodology, measure of variables and environments.

The policy implications of saving–growth causation are momentous for the stakeholders and government on policy formulations (Abu, 2010; Gjergji & Turan, 2014; Masih & Peters, 2010; Tang & Tan, 2014) For example, if econometric results show that saving Granger causes growth in an economy, this agrees with the principle of classical school, then the government and stakeholders can confidently concentrate on policies that influence and mobilise saving and automatically economic growth will be achieved and sustained in the economy. On the other hand, if empirical econometric result indicates that economic growth Granger causes saving in an economy, then the policymakers should concentrate on the

policies that induce economic growth, and consequently saving will voluntarily increase in such an economy. This is the opinion of the Keynesian school of thought. If bidirectional, then either of the variables will promote the other.

The issue of saving–growth nexus is revisited due to the impressive savings and economic growth rates recorded among the most sub-Saharan African countries in the last one decade. In fact, African countries have been described as potential giants and hope for the world due to this recent macroeconomic performance (World Bank, 2015). Specifically, six sub-Saharan West African countries have been described as the fastest growing economies in West Africa (African Development Bank, 2015; Department of Economic and Social Affairs, United Nations, 2015); hence, their choice for this study. These countries include: Niger, Burkina Faso, Nigeria, Ghana, Liberia and Sierra Leone. Simultaneously, as these countries record impressive economic growth, most of them also record increase in savings. Therefore, it is imperative to find out whether the impressive economic growth recorded among these countries is partly a result of increase in savings or not. Hence, this empirical investigation is conducted. Aggregately, the average economic growth ranges between 5 per cent and 8.5 per cent among these countries within 2006 and 2014 (African Development Bank Financial Statistical Bulletin, 2014). Individually, they have these economic growth rates during the period: Niger (5.6 per cent), Burkina Faso (6.1 per cent), Nigeria (6.3 per cent), Ghana (7.0 per cent), Liberia (7.4 per cent) and Sierra Leone (8.1 per cent).

On the other hand, using gross domestic saving divided by gross domestic product (GDP) to capture saving among these countries. Aggregately, saving rate varies between 0.37 per cent and 33.40 per cent during 2006 and 2014 among these countries. Individually, these countries have recorded these saving rates during the period: Nigeria (22.6 per cent), Burkina Faso (14.5 per cent), Niger (14.2 per cent), Ghana (10.5 per cent), Liberia (–85.37 per cent) and Sierra Leone (1.69 per cent) (World Bank, 2016). Considering the impressive performance of saving and growth rates among these countries and their strategic importance as the fastest growing countries in Sub-Saharan Africa, it is, therefore, expedient to empirically investigate whether savings in these countries have contributed significantly to the impressive economic growth recorded in these countries or not. The empirical result will help in formulating appropriate policies that will sustain and increase saving and growth among these countries. Furthermore, it will also help to settle the conflict in empirical literature on the direction of causality between saving and economic growth.

Unlike the existing studies on Nigeria and other sub-Saharan African countries (Abu, 2010; AbuAl-Foul, 2010; Adeleke, 2014; Masih & Peters, 2010; Mohan, 2006; Odhiambo, 2014; Verhoef, Greyling & Mwamba, 2014), this article employs the recently developed causality test by Toda and Yamamoto (1995) and Pesaran, Shin and Smith's (2001) autoregressive distributed lag (ARDL) cointegration test to confirm the causality and long-run relationship between the saving and economic growth among the fastest growing sub-Saharan African countries between 2006 and 2014. This method is superior to the ordinary Granger causality test as it circumvents potential bias problems associated with stationarity and cointegration tests encountered during causality test by researchers, thereby yielding consistent and

unbiased estimates. Both tests can be used regardless of the order of integration—either $I(0)$, $I(1)$, $I(2)$, non-cointegrated series or cointegrated of arbitrary order. The Toda and Yamamoto (1995) causality approach works efficiently within an augmented vector autoregressive (VAR) on levels of the variables and as a result makes adjustment for long-run information that are often lost in the model that requires first differencing and pre-whitening (Clark & Mirza, 2006; Menyah & Wolde-Rufael, 2009; Rambaldi & Doran, 1996; Toda & Yamamoto, 1995; Zapata & Rambaldi, 1997). Also, Pesaran et al. (2001) cointegration test is suitable for a small sample like this and at the same time, it does not require the pre-knowledge of the order of integration of variables or integration ranks, and thus avoids the limitations of unit root test attached to other cointegration tests. Furthermore, Pesaran et al. (2001) does not require the knowledge of the order of integration, either $I(0)$, $I(1)$, $I(2)$ or of arbitrary order, before it can be undertaken.

This article fills three gaps in the literature. One, while the existing studies employ ordinary Granger test, this article employs a more robust Toda and Yamamoto (1995) causality test to study the causality between saving and economic growth within the dynamic VAR framework, thereby filling a methodological gap. To our knowledge, no study has employed this technique among the studies on African countries on the subject matter. Two, the article settles the long-standing conflict on saving–investment causality with empirical evidence from the sub-Saharan African fastest growing economies between 2006 and 2014 since the empirical result will inform us whether gross domestic saving among the sub-Saharan African fastest growing countries has contributed to the present economic growth or not. Lastly, the study re-investigates the long-run relationship between saving and economic growth among these countries using the recently developed ARDL method. No study has employed this methodology for the selected countries. The rest of the article is structured as follows: The next section deals with the literature review while the section three addresses the issues relating to data requirement, sources and methodology. The section four handles empirical results. The paper ends with policy recommendations.

Literature Review

Theoretical Review

Theoretical postulations on the relationship between saving and economic growth started during the time of Adam Smith (Tang & Tan, 2014). Adam Smith says the economy needs industrialisation to achieve economic growth. Not recognising other sources of finance such as foreign direct investment (FDI) during the period, Smith submitted that industrialisation can only be achieved through adequate capital accumulation. According to him, capital accumulation is strongly and positively related to the rate of saving. This means society can only accumulate capital through the increased saving. We, therefore, expect higher saving rate that will lead to an increase in capital accumulation and, consequently, higher economic growth following the thought of Adam Smith.

The classical model of Harrod (1939) and Domar (1946) of economic growth is another theory that relates the two variables. The model submitted that in an economy with a particular level of technological advancement, the rate of economic growth is directly related to the rate of capital accumulation. Like Smith's proposition, this capital accumulation is determined by the rate of saving in an economy. As a result, higher saving rate implies higher capital accumulation and, consequently, higher economic growth. Also, from the perspective of neoclassical school, Solow and Swan (1956) expanded the Harrod and Domar model. They clearly state that saving is a determinant of economic growth. Other determinants are population growth rate and technical progress. To them, saving affects investment and investment in an economy is directly proportional to economic growth. So at the equilibrium level, saving is equal to investment. However, unlike the Harrod and Domar model, the influence of saving on economic growth is temporary in the short run due to the law of variable proportions employed in their theory. What actually determines economic growth is technological advancement, which is not determined within the confinement of economic theories. The neoclassical school of thought, therefore, fails to provide an answer to the question of the determinants of economic growth in the long run, and to them what determines economic growth in the short run is technological advancement, which is not explained within the framework of economic theories. This is what gave birth to the endogenous growth theory led by Lucas (1988) and Romer (1986). So, from the classical school of thought, we expect that saving Granger causes economic growth.

From the Keynesian school of thought, saving is seen as a function of income, since income can either be spent on the consumption of goods and services or saved. At the same time, a rational consumer might decide to share his income between the two. The school, therefore, concludes that income determines gross domestic saving in the economy. So, if national income grows, then per capita income will increase, and consequently the share of per capita income on saving and consumption will increase depending on the rate of increase and the magnitude of previous income. For developed countries where the existing level of per capita income is high, it is expected that the higher proportion of increase in income will be channelled to saving and this will increase the level of investment in the economy, thereby leading to economic growth. However, for developing countries, where the existing level of per capita income is low, higher proportion of increase in per capita income is expected to be channelled to consumption and, thereby increasing firms' profits. As a result, firms will hire more labour and capital, and the economy will grow. So, from the Keynesian point of view, economic growth is expected to Granger cause saving in sub-Saharan African economies.

Review of Empirical Literature

The nexus between saving and economic growth has significant policy implications, as previously noted. As a result, several empirical studies have been carried out on the subject. However, empirical evidences are mixed depending on the measurement of variables, environment and techniques adopted. This section presents a succinct summary of studies related to the relationship between saving and investment.

Earlier studies on the nexus between saving and economic growth by Gavin et al. (1997) and Sinha and Sinha (1998) revealed that causality runs from growth to saving for Mexico and not otherwise, as suggested by the classical school. Using the technique of vector error correction model (VECM) and times series data of real GDP, private saving and public saving between 1960 and 1996, the multivariate study shows that economic growth Granger causes saving in Mexico. Other studies that support this result are: Saltz (1999), Agrawal (2001), Anoruo and Ahmad (2001) and Narayan and Narayan (2006). However, study by Masih and Peters (2010) that employed Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) within the bivariate framework on the same, Mexico, revealed a contrary result. The study shows that causality runs from saving to economic growth, indicating the acceptance of the classical viewpoint in the same country.

Investigating the relationship in Pakistan, Looney (1996) reported that saving granger caused economic growth from 1973 to 1991. This result was later revalidated by Agrawal (2000). Sinha (1999) later re-investigated the causality again in Pakistan and reported bidirectional relationship unlike the previous studies by Looney (1996) and Agrawal (2000). The study further established a long-run relationship between saving and economic growth in the country using Johansen and Juselius' cointegration method. The empirical studies were extended to Asian continent by Agrawal et al. (2008), using a set of Asian countries and annual time series data; the study revealed that most Asian countries accept the Keynesian viewpoint that economic growth Granger causes saving. Another study by Baharumshah et al. (2003) on the same Asian countries of Thailand, South Korea, Malaysia and the Philippines using a time series data spanning between 1960 and 1997 within a VEC model also supports Agrawal (2008) in stating that economic growth Granger causes saving among the selected Asian countries except for Singapore. This is the Keynesian viewpoint.

The direction of causality was also investigated in India. Using time series data spanning from 1950 to 2007 and multivariate causality within VAR/VEC models, Jangili (2011) found that saving and investment led to economic growth but the opposite relationship was not found. This suggests that the classical viewpoint was prevailing in India. It also implies that higher saving leads to higher investment and, consequently, higher economic growth. The study also reported long-run relationship among saving, investment and economic growth in India. This position does not agree with other studies on India like those by Mühleisen (1997), Verma (2007) and Sinha and Sinha (1998) that reported causality running from economic growth to saving on the same country and, therefore, necessitates the acceptance of the Keynesian viewpoint.

The relationship has also been investigated in small economies. Katircioglu and Naraliyeva (2006) investigated the relationship in Kazakhstan. The distinct feature of this study is the continuous increase of interest rate and integration of the country with the world economy. Using the time series data of real GDP and domestic saving, the study reported a long-run relationship and unidirectional causality running from saving to real GDP in the country. Albania was another small, open economy where empirical investigation on saving and economic growth has been carried out. Turan and Gjergji (2014) employed time series data between 1992 and 2002 using Johansen cointegration test and ordinary least squares (OLS); the study

reported long-run relationship between saving, investment and FDI. The study further reported saving had significant effect on economic growth, but the opposite effect was not reported. AbuAl-Foul (2010) also provided evidence from the MENA countries of Tunisia and Morocco on the direction of causality; the study employs annual time series data between 1965–2007 for Morocco and 1961–2007 for Tunisia. Bidirectional causality for Morocco and unidirectional causality running from growth of saving to economic growth were reported by the study.

Studies on the nexus between saving and economic growth in sub-Saharan Africa is scarce. Abu (2010) investigated the relationship in Nigeria between 1970 and 2007 using cointegration and causality tests for gross national saving and GDP; the study reported the existence of long-run relationship and unidirectional relationship running from economic growth to saving. Adelakun (2011) also supports this direction on Nigeria. This implies the rejection of the classical viewpoint and the acceptance of the Keynesian opinion on the argument. Olajide (2010) studied the causal relationship in Nigeria, and reported a long-run relationship between saving and economic growth and a unidirectional causality running from saving to economic growth leading to the rejection of the Keynesian theoretical opinion unlike Abu (2010). Other studies also support this opinion on Nigeria (Bankole & Fatai, 2013; Olajide, 2010). Adeleke (2014) also studied the relationship in Nigeria within the period of 1970 and 2013 using the ARDL technique and causality test; the study reports that bidirectional causality exists between saving and economic growth in Nigeria. Unlike Abu (2010) and Olajide (2010), this study agrees with both the classical and Keynesian theoretical viewpoints on the direction of causality. Therefore, we can conclude that empirical result on Nigeria is mixed.

Hundie (2014) investigated the causality in Ethiopia using time series data between 1970 and 2010 within a multivariate framework of Toda and Yamamoto and Dolado Lutkepohl; the study reported a unidirectional causality running from economic growth to gross domestic saving, and not in the opposite direction. The study agrees with the Keynesian theoretical viewpoint.

Motivated by slow economic growth and declining saving rate in South Africa in the 1990s Odhiambo (2009) investigated the causal relationship using time series data spanning between 1950 and 2005 within a multivariate model of saving, economic growth and foreign capital inflow, and techniques of error correction model (ECM) and cointegration. Having reported long-run relationship between the variables, the study also reported bidirectional causality between saving and economic growth in the short run and unidirectional causality running from economic growth to saving in South Africa. The study recommended that the government should pursue economic growth in the long run and then the saving rate will automatically increase in South Africa.

Some cross-countries studies have also been conducted on developing and developed countries on the subject matter. On African countries, for example, Anoruo and Ahmad (2001) studied the relationship among seven African countries of Nigeria, Congo, Ghana, Kenya, Cote d'Ivoire, South Africa and Zambia; the study found out that economic growth Granger causes saving in Nigeria, Ghana, Zambia and Kenya supporting the Keynesian viewpoint, while the opposite of saving Granger causing economic growth was reported in Congo upholding the classical submission on the argument. The study also reported bidirectional

causality in South Africa and Cote d'Ivoire. This accepts the views of both schools of thought on the argument.

Mohan (2006) investigated the relationship among countries of different income levels. Using time series annual data and Granger causality method, the study segregates the countries into low-income, low-middle-income, upper-middle-income and high-income countries cumulating into 35 countries. The study reported that income level does not state the direction of causality. Among the low-income countries, the empirical results are mixed, while in most low-middle income countries, the causality was reported to be running from economic growth to growth rate of saving. Furthermore, the findings show that in all the high-income countries except Singapore, causality runs from economic growth to growth rate of saving. Lastly, bidirectional causality was reported among high-income countries.

Lastly, Andersson (2000) investigated the causality relationship among the developed countries of the USA (1950–1997), the UK (1952–1996) and Sweden (1950–1996) with special attention paid to the short- and long-run dynamism and individual country heterogeneity, unlike the previous studies. The study employs time series data for real GDP and saving within a bivariate system, and VAR/VEC techniques. Like Mohan (2006), the report of the findings show that causality is different among countries. In the UK where long-run relationship was reported, there was also bidirectional causality; however, unidirectional causality of gross saving to economic growth was reported in Sweden. Lastly, there was no long-run relationship between the variables in the USA. In the short run, bidirectional causality was reported in the USA, while unidirectional causality running from gross saving to economic growth was reported in the UK. However, there was no short-run chain recorded on Sweden.

The general observation from the review of empirical literature on saving and economic growth nexus is that the results are mixed depending on the econometric method and measurement of variables and environments where the studies are undertaken. The most recent studies on the subject employed ARDL method and Toda–Yamamoto causality test to revalidate the existing results. Furthermore, the following are observed on studies on African countries. One, empirical studies on the subject is scarce. Most countries like Niger, Burkina Faso, Liberia and Sierra Leone have not been empirically investigated. Two, apart from Hundie (2014) that was conducted on Ethiopia, there is no study that has employed ARDL methodology and Toda–Yamamoto causality test to revalidate the scanty existing results. Three, there is no recent study on African countries that provide empirical evidence from the sub-Saharan African fastest growing economies considering their recent impressive economic growth and saving performance. This study intends to fill these gaps in the literature.

Methodology

Existing literature shows that most time series data employed in studying the nexus between saving and economic growth encounter two problems. One, both the variables of saving and economic growth must be integrated of order $I(1)$.

If they are not or if they are having different order, then the estimation of the long-run relationship will be lost. Also, given the fact that both unit root and cointegration tests have low power against the alternative hypothesis, these series can experience pre-testing bias and size distortions, thereby leading to inaccurate non-causality result (Menyah & Wolde-Rufael, 2010; Pesaran et al., 2001; Toda & Yamamoto, 1995; Wolde-Rufael, 2005). Two, literature has also shown that using F-statistic for investigating causality may lead to invalid result when the variables are integrated or cointegrated because of its lack of standard distributions (Giles & Mizra, 1998; Giles & Williams, 1999; Menyah & Wolde-Rufael, 2010; Toda & Yamamoto, 1995; Wolde-Rufael, 2009). The study, therefore, fills the methodology gap by employing ARDL (2001) cointegration and Toda and Yamamoto (1995) causality tests to investigate the long run and causality between saving and economic growth among the sub-Saharan African fastest growing economies between 2006 and 2014. Since most studies have issues investigating the long-run relationship, and as noted earlier, the ordinary non-Granger causality employed for the existing studies might have yielded spurious results.

Bounds Cointegration Test

Given the above limitations, this work employs bounds approach to cointegration in investigating the nexus between saving and economic growth among sub-Saharan African fastest growing economies because it addresses the weaknesses earlier identified with other cointegration methodologies. The technique can be applied whether the series are I(0), I(1), I(2) or of arbitrary order (Clark & Mirza, 2006; Pesaran et al., 2001; Rambaldi & Doran, 1996; Zapata & Rambaldi, 1997). The method is also suitable for empirical studies of small sample like this as it yields unbiased estimates and at the same time the endogeneity issue is better addressed than in Johansen and Juselius cointegration methodology. The ARDL method is built on the estimation of the dynamic error correction representation of the individual variables in the model. It, therefore, tests the model to ascertain the statistical significance of the lagged levels of its variables. The unrestricted ECM of the nexus between saving and economic growth is specified as follows considering the variables one after the other:

$$\begin{aligned} \Delta ECG_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta ECG_{t-i} + \sum_{i=1}^n \beta_{1i} \Delta LGDS_{t-i} + \delta_1 ECG_{t-1} \\ & + \delta_2 LGDS_{t-1} + \varepsilon_{1t} \end{aligned} \quad (1)$$

Where Δ is the first difference operator, ECG_t is the dependent variable and $LGDS_t$ is the independent variable, δ_1 and δ_2 are the long-run parameters and ε_{1t} is the white noise error term. ECG is the economic growth rate and $LGDS$ is the log of gross domestic saving.

The first step in estimating ARDL is the examination of the order of integration and unit root test of ECG and gross domestic saving among the variables of investigation. The next is the selection of the appropriate lag length for the study.

This study employs Akaike information criterion (AIC) for this purpose in order to estimate Equation (1). The study employs F-test or Wald statistics to check our null and alternative hypotheses specified as $H_0: \delta_1 = \delta_2 = 0$ and $H_1: \delta_1 \neq \delta_2$, respectively. The F-statistic or Wald statistic is compared with Pesaran et al. (2001) critical values to make the decision.

Toda and Yamamoto Approach to Granger Causality Test

In order to avoid inherent problems associated with ordinary Granger causality test, this study adopts the Toda and Yamamoto (1995) causality test to investigate the causality between saving and economic growth among the selected African countries. The test is superior to the ordinary Granger causality test in a number of ways. One, the test disregards the stationarity and cointegration tests among the series before testing for causality as pre-testing bias and size distortions are inherent when undertaking these tests. Two, the method produces a more robust result in VAR model because the variables are in levels instead of the differenced variables as required by the ordinary Granger causality. It, therefore, avoids the risk associated with incorrect identification of the order of integration of the series (Mavrotas & Kelly, 2001; Wolde-Rufael, 2005). Three, the test also employs modified Wald statistic which is superior to the normal F-test as noted earlier (Giles & Mizra, 1998; Giles & Williams, 1999; Menyah & Wolde-Rufael, 2010; Toda & Yamamoto, 1995; Wolde-Rufael, 2009). The Toda and Yamamoto (1995) approach to causality is conducted by augmenting the right VAR order, say m , with the maximum order of integration, say d_{\max} . Once this is achieved, we estimate $(m + d_{\max})$ th order of VAR instead of the m th order (Caporale & Pittis, 1999; Rambaldi, 1997; Rambaldi & Doran, 1996; Wolde-Rufael, 2009). The Toda and Yamamoto (1995) produced a normal test statistic with standard asymptotic property that guaranteed valid inference for Granger causality. The study, therefore, specifies the saving–economic growth relationship within VAR system as shown below:

$$\begin{aligned}
 ECG_t = & a_0 + \sum_{i=1}^m a_{1i} ECG_{t-i} + \sum_{j=m+1}^{d_{\max}} a_{2j} ECG_{t-j} + \sum_{i=1}^m \beta_{1i} LGDS_{t-i} \\
 & + \sum_{j=m+1}^{d_{\max}} \beta_{2j} LGDS_{t-j} + \mu_{1t}
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 LGDS_t = & \varphi_0 + \sum_{i=1}^m \varphi_{1i} LGDS_{t-i} + \sum_{j=m+1}^{d_{\max}} \varphi_{2j} LGDS_{t-j} + \sum_{i=1}^m \theta_{1i} ECG_{t-i} \\
 & + \sum_{j=m+1}^{d_{\max}} \theta_{2j} ECG_{t-j} + \mu_{2t}
 \end{aligned} \tag{3}$$

The series are as defined in Equation (1). From Equation (2), we accept the alternative hypothesis that Granger causality runs from log of gross domestic

saving (LGDS) to economic growth (ECG) if $\beta_{li} \neq 0 \forall_i$. Also, in Equation (3), we conclude and accept the alternative hypothesis that economic growth (ECG) Granger cause gross domestic saving (LGDS), if $\theta_{li} \neq 0 \forall_i$. This test is performed individually for the six countries employed in the study.

Data and Data Sources

The study employs the saving and economic growth data of the six fastest growing sub-Saharan African countries (Nigeria, Burkina Faso, Ghana, Niger, Liberia and Sierra Leone) between 1994 and 2014. All data are sourced from World Bank financial indicators online. Economic growth is captured with annual growth of gross domestic saving, while saving is represented by gross domestic saving. The variables are measured in local currency units in current terms of individual countries. Furthermore, gross domestic saving is transformed with natural logarithm to address the problem of heteroscedasticity that might occur in the model as a result of large values.

Empirical Evidences and Interpretations

Unit Root Tests

Before starting the empirical interpretations of the model, it is important to test for stationarity of the variables employed in the study to determine their order of integration. This study employs Augmented Dickey–Fuller (ADF) and Phillip–Perron (PP) unit root tests to determine the stationarity properties. The summary results are presented in Tables 1 and 2. While Table 1 presents the stationarity results for the six countries when the model incorporates only constant, Table 2 presents the stationarity results when the model incorporates both constant and trend. The appropriate lag lengths are automatically selected using AIC for appropriate lag selection. The empirical results are presented below:

Table 1. Unit Root Tests (Constant Only)

Countries	Variables	ADF			
		ADF (at levels)	(at first difference)	PP (at levels)	PP (at first difference)
Nigeria	ECG	-4.7159***		-4.7096***	
	LGDS		-5.8769***		-18.2651***
Ghana	ECG	-3.35701**		-3.2451**	
	LGDS				
Burkina F.	ECG	6.2554***		-6.2663***	

(Table 1 Continued)

(Table 1 Continued)

Countries	Variables	ADF			
		ADF (at levels)	(at first difference)	PP (at levels)	PP (at first difference)
Liberia	LGDS	-2.6670***			-9.5736***
	ECG	-3.2235**		-3.22913**	
Niger	LGDS		-4.7262***		-4.7262***
	ECG	-5.4361***		-5.4409***	
Serria Leone	LGDS		-3.0219**		-8.3727***
	ECG	-4.71503***		-4.8455***	
	LGDS				-7.1892***

Source: Author's Calculations.

Notes: ***, ** and * denote 1 per cent, 5 per cent and 10 per cent, respectively.

The integration test for the model that incorporates constant only for both ADF and PP tests shows that economic growth attains stationarity at levels without being differenced for all the countries in the study. Nigeria, Burkina Faso, Niger and Sierra Leone all attain stationarity at 1 per cent level of significance, while Ghana and Liberia attains stationarity at 5 per cent level of significance for ADF and PP stationarity tests, respectively. This shows that economic growth of all the countries are integrated of order one, that is, $I(0)$. However, log of gross domestic saving attains stationarity at levels with 1 per cent level of significance for Burkina Faso only; log of gross domestic saving of other countries attain stationarity at the first difference with 1 per cent level of significance for Nigeria and Liberia and 5 per cent level of significance for Niger under ADF test. The PP test shows that the log of gross domestic saving of all the countries in the study attain stationarity at the first difference with 1 per cent level of significance except for Ghana that attains stationarity at level, $I(0)$, with 5 per cent level of significance. In summary, the result shows that the model of the stationarity test with constant only shows a mixture of both $I(0)$ and $I(1)$.

The result of the stationarity test for the model with constant and trend is presented in Table 2. Test of stationarity using ADF for economic growth on Nigeria, Ghana, Niger and Sierra Leone shows that the countries attain stationarity at levels, $I(0)$ with 1 per cent level of significance. However, Ghana and Liberia attain stationarity at the first difference with 5 per cent and 1 per cent level of significance, respectively. For the log of gross domestic saving, four countries of Nigeria, Ghana, Burkina Faso and Niger attain stationarity at levels with 1 per cent level of significance for most countries. The other two countries of Liberia and Sierra Leone attain stationarity at the first difference. When PP test of stationarity is employed, the log of gross domestic saving attains stationarity at the first difference, $I(1)$, for four countries of Ghana, Burkina Faso, Liberia and Niger with 1 per cent level of significance, while Nigeria and Ghana attain stationarity at levels, $I(0)$, with 1 per cent level of significance. For economic growth under the PP test, two countries of Nigeria and Niger attain stationarity at

level with 1 per cent level of significance, while the other four countries attain stationarity at the first difference with 1 per cent level of significance for these countries. In conclusion, the model with constant and trend on the test of stationarity, depicts a mixture of both $I(0)$ and $I(1)$.

Table 2. Unit Root Tests (Constant and Trend)

Countries	Variables	ADF			
		ADF (at levels)	ADF (at first difference)	PP (at levels)	PP (at first difference)
Nigeria	ECG	-5.3245***		-5.324***	
	LGDS	-5.5374***		-10.9985***	
Ghana	ECG		-3.7902**		-7.0382***
	LGDS	-4.3333***		-4.3333***	
Burkina F.	ECG	-6.7894***		-6.9945***	
	LGDS	3.3812*			-9.8131***
Liberia	ECG		-7.4951***		-7.5386***
	LGDS		-4.5207**		-4.5207**
Niger	ECG	-6.811***		-10.4551***	
	LGDS	-5.8353***			-15.3326***
Serria Leone	ECG	-5.9353***			-15.3326***
	LGDS				-6.7614***

Source: Author's Calculations.

Notes: ***, ** and * denote 1 per cent, 5 per cent and 10 per cent, respectively.

The Bounds Test for Long-run Relationship

The result of the cointegration test using Pesaran et al. (2001) is presented in Table 3. The empirical result rejects the null hypothesis of no long-run relationship between log of gross domestic saving and economic growth for all the countries. Using $LGDS_t$ as a dependent variable, the results show that there is a long-run relationship from the log of gross domestic saving to economic growth for all the countries. However, when ECG_t is employed as the dependent variable, only four countries of Nigeria, Ghana, Niger and Liberia report a long-run relationship from economic growth to the log of gross domestic saving among the countries, while there was no long-run relationship reported from the log of gross domestic saving to economic growth in Burkina Faso and Sierra Leone. This agrees with the neoclassical theory that saving only has temporal effect on economic growth in the short run.

Table 3. The Bounds Test for Long Run Relationship

Countries	Dependent Variable	F-Statistic		Long run Coefficient	Error Correction term
		without Trend	with Trend		
Nigeria	ΔECG	14.30827***	13.742***	1.282628**	-0.931***
Ghana	ΔECG	23.9095***	26.20635***	-1.678832	-0.993873***
Burkina F.	$\Delta LGDS$	0.854418	7.9104**	-0.557983**	-0.591293***
Liberia	ΔECG	10.92184**	-	0	-0.753064**
Niger	ΔECG	5.838891**	33.13835***	-1.023274*	-1.53715***
Serria Leo.	$\Delta LGDS$	5.90245**	-	-0.136623	-0.730702

Source: Athor's Calculations.

Notes: ***, ** and * represent 1 per cent, 5 per cent and 10 per cent, respectively.

The F-test is as tabulated in Perasan (2001). The appropriate lag of four is automatically selected using AIC for these tests. The bounds test shows that economic growth is positively and significantly related to the log of gross domestic saving in Nigeria, Burkina Faso and Niger with 5 per cent, 5 per cent and 10 per cent levels of significance respectively. However, the coefficient for Ghana is not statistically significant and this reports negative long-run relationship between log of gross domestic saving and economic growth. Also, the long-run relationship is not reported for Liberia. This might occur because gross domestic saving was not logged; it was used in its original form due to much negative values recorded in the series, which could not be logged. In the same vein, the empirical results show that log of gross domestic saving is negatively related to economic growth in the long run for Burkina Faso and Sierra Leone. While this relationship is statistically significant at 5 per cent level of significance for Burkina Faso, it is not statistically significant for Sierra Leone. The error correction term is negative for all the models ranging from 59 per cent to 153 per cent with 1 per cent level of significance for four out of the six models. This shows that there is quick and high speed of adjustment to equilibrium in case of disequilibrium from the long-run path in a year.

Toda and Yamamoto Granger Causality Test

Lastly, this study reports the result of the Toda and Yamamoto version of Granger causality test between gross domestic saving and economic growth among the six sub-Saharan African fastest growing countries in 2014 as compiled by African Development Bank. The result is presented in Table 4. Before conducting the test for the causality, the study employed Akaike information criterion (AIC) for the selection of the optimal lag lengths that are used in the study except on occasions where the recommended lag length suffers from serial correlation. In such instances, we choose the next appropriate lag length free from serial correlation. All the lag lengths used in the models are free from serial correlation; this is confirmed by serial correlation Lagrange Multiplier (LM) test. The next step is to

augment the optimal lag length of our VAR with the maximum order of integration of the series before running our tests.

Table 4. Toda and Yamamoto Granger Causality Test

Countries	LGDS to ECG		ECG to LGDS		Direction of Causality
	p-Value	χ^2 Value	p-Value	χ^2 Value	
Nigeria	0.911	0.012486	0.2628	0.2628	No
Ghana	0.8873	0.239221	0.0307**	6.964426	ECG→LGDS
Burkina Faso	0.9863	0.027579	0.0386**	6.506674	ECG→LGDS
Liberia	0.000***	95.8139	0.9813	0.176236	LGDS→ECG
Sierra Leone	0.0157**	8.308093	0.3681	1.998687	LGDS→ECG
Niger	0.000***	30.95532	0.5043	4.320022	LGDS→ECG

Source: Author's Calculation.

Notes: *** and ** indicate 1 per cent, and 5 per cent level of significance. P is the probability values while χ^2 is the Chi Square value.

As explained by the significance of the *p*-values of the modified Wald statistic, the study reports unidirectional causality for five countries of Niger, Burkina Faso, Ghana, Sierra Leone and Liberia, while there was no causality reported for Nigeria. The unidirectional causality runs from economic growth to gross domestic saving for Ghana and Burkina Faso, meaning that past values of economic growth have predictive power in determining the present values of gross domestic saving in these countries. The result on Ghana is confirmed by the existing work of Anoruo and Ahmad (2001). However, there is no existing work on Burkina Faso. This means that economic growth granger causes gross domestic saving in these countries.

On the other hand, unidirectional causality also runs from gross domestic saving to economic growth for Sierra Leone, Niger and Liberia. This shows that gross domestic saving granger cause economic growth among these countries, meaning that gross domestic saving has predictive power in determining present values of economic growth in these countries. This is the viewpoint of the classical school which believes that saving leads to economic growth. It should be noted that there are no existing studies on these countries in the literature; this work is the first.

The result on Nigeria does not record any causality between gross domestic saving and economic growth in either direction. This means that past gross domestic saving in Nigeria does not have predictive power to determine the present economic growth in Nigeria or otherwise. This contrasts with the studies like Anoruo and Ahmad (2001), Mohan, (2006), Olajide (2010) and Abu (2010) that reported unidirectional causality running from economic growth to gross domestic saving which employ ordinary Granger causality technique for the same country. However, the existence of the long-run relationship reported by ARDL technique employed in the study confirms the findings of the above-existing studies that employ Johansen cointegration method to test for the long-run relationship.

Policy Implications and Conclusion

Policy Implications and Recommendations

Since unidirectional causality runs from economic growth to gross domestic saving in Ghana and Burkina Faso, the stakeholders and governments of these countries should, pursue macroeconomic policies that will lead to economic growth, and gross domestic saving will increase. This result also supports the view of the Keynesian school of thought which postulates that increase in saving is a result of economic growth. To this school, to increase gross domestic saving, the government must achieve economic growth. We, therefore, recommend that the government of these countries should pursue policies that bring about economic growth, such as increase in government spending on education, health, infrastructural facilities, research and development, among others. This will automatically increase gross domestic saving in these countries. And consequently, increase in gross domestic saving will also lead to increase in capital formation and investment. This will finally improve the general welfare of the people.

For Sierra Leone, Niger and Liberia, unidirectional causality also runs from gross domestic saving to economic growth. One of the policies that is needed to achieve economic growth among these countries is the policy that is aimed at increasing gross domestic saving. The stakeholders and governments of these countries should, therefore, target policies that will increase GDP and automatically economic growth. These policies include increase in the rate of interest to encourage savers. The governments should also increase the number of financial institutions, especially microfinance banks, since a large proportion of the sub-Saharan African population is poor. Furthermore, policies for financial inclusion among these countries should be encouraged since this has the tendency to increase gross domestic saving.

The policy implications of the empirical result on Nigeria are momentous. It shows that policies that aim at increasing economic growth do not influence gross domestic saving in Nigeria or otherwise. Therefore, the government should design policies aimed at achieving economic growth and gross domestic saving separately as they do not cause each other. Furthermore, the result does not agree with either of the theoretical underpinnings of the Keynesian or classical schools of thought in the debate. This is surprising, but plausible, when we look at the present situation in Nigerian economy. Economic growth recorded so far is a result of increase in the supply and price of crude oil in the international market and not necessarily because the general public is saving. In fact, the present happening in Nigerian economy is that of simultaneous increase in economic growth and poverty levels. This is plausible because economic growth, so far in Nigeria, is a jobless growth; mostly a result of development of the downstream oil industry that has low capacity for job creation. The productive sector of the economy is not contributing to the present economic growth. Saving is an outcome of increase in per capita income and people will only save when they have income (Keynes, 1936). The empirical result portrays the present unemployment problem in Nigeria. In fact, the present unemployment problem in Nigeria is alarming and

this is having a great consequence on gross domestic saving of the people. Lastly, the result on Nigeria shows the productive sector of the economy is not contributing to the present economic growth. The economic growth recorded in Nigeria is derived from the revenue from crude oil over the years and this is not having any impact on the per capita income of Nigerians.

Conclusion

The study examines the nexus between saving and economic growth among the sub-Saharan African fastest growing African countries of Nigeria, Ghana, Sierra Leone, Burkina Faso, Liberia and Niger as reported by African Development Bank and the Department of Economic and Social Affairs, United Nations using the recently developed methodologies of ARDL, and Toda and Yamamoto cointegration and Granger causality tests. The objective of the study is to find out whether gross domestic saving among these countries has contributed significantly to the present outstanding economic growth performance and to know whether there is a long-run relationship between saving and economic growth among these countries during 1981–2014. Generally speaking, the empirical results are mixed and surprising but plausible like the existing studies on the debate in the literature. The Granger causality does not report any causal relationship for Nigeria, while other five countries show unidirectional relationship. The unidirectional relationship runs from economic growth to gross domestic saving for Ghana and Burkina Faso, while unidirectional relationship also runs from gross domestic saving to economic growth for countries of Niger, Liberia and Sierra Leone. This shows that past values of economic growth have predictive power in determining the present values of gross domestic saving in Burkina Faso and Ghana. Also, past values of gross domestic saving have predictive power in determining the present values of economic growth in Niger, Liberia and Sierra Leone. The present study like the existing studies on the debate, therefore, suggests that the nexus between saving and economic growth is country-specific even among the fastest growing economies in Africa. Each country should, therefore, set up policies individually to achieve either of the macroeconomic variables. However, the existence of a long-run relationship between the variables is general among the countries.

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