Interest Rate Liberalization, Financial Development and Economic Growth in sub-Saharan African Economies

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Abstract
This study considers a structural interaction of the interest rate liberalisation-growth nexus; through the inclusion of financial development variables, for sub-Saharan African economies spanning the periods 1980-2012. Coupled with the institutional theory of growth, this study relies on the McKinnon-Shaw framework and, given its merits over conventional tests, a battery of panel unit-root tests was used to purify our data off spurious regression estimates. Later, both panel cointegration and panel error correction models were employed for empirical investigations. From the results obtained, it was evident that other factors such as the openness on trade and price stability are much more significant for interest rate liberalisation and economic growth in sub-Saharan African countries. More so, the extent as well as degree of financial development relatively assisted in reducing interest rate; further facilitates investment and then engendered growth. Theoretically, this study aligns with the McKinnon-Shaw hypothesis of interest rate-growth nexus. Interestingly, the results show that public institutions have been found significantly detrimental at driving the growth process of the sub-Saharan African economies. From the foregoing, the level of financial development, price stability and institutional arrangement should be properly attended to for effective and far-reaching policy suggestions in sub-Saharan African economies.

Keywords: Interest rate, Financial development, Economic Growth, Liberalisation, Panel
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1.0 Introduction

Motivated by the seminal study of McKinnon-Shaw (1973), researchers such as Kapur (1976), Mathieson (1980) and Fry (1989; 1995); among others, have dissipated great research efforts at investigating the relationship between interest rate liberalisation and economic growth. Beginning with, McKinnon (1973) and Shaw (1973) hypothesized that restriction on financial instruments like interest rate ceiling, high reserve requirement and directed credit policies would hinder financial deepening and hence reduce economic growth. However, a small but growing empirical literature such as the studies of Van Wijnbergen (1983) and Stiglitz (1994) are of the view that financial markets imperfections like asymmetric information and imperfect competition mean that financial liberalisation can have a negative effect on economic growth and development.

Most studies completed on this work are majorly from the Latin America and Asia. However, there is now increasing interest in this topic on its effect on Africa. For example, Fowowe (2002), Oshikoya (1992), Odhiambo (2009), Obamuyi (2009), Charlier and Oguie (2002) and Seck and El Nil (1993) have all tested the effect of this topic on some African countries. Previous empirical studies on this subject suffer from some limitations. First, the majority of the previous studies on this subject have attempted to examine the direct relationship between interest rate reforms and economic growth. Yet, it is argued that the relationship between interest rate reforms and economic growth is an indirect one (see Odhiambo, 2011). Interest rate liberalisation impacts on economic growth among other things, through its influence on financial deepening and savings.

Another limitation is that majority of the previous studies have concentrated mainly on the use of a bivariate causality test to examine the causal relationship between financial development and economic growth. Aside that granger causality test is not a technique but a test of analysis, reaching conclusion and making policy suggestions based on this bivariate causality test is a defective approach to empirical investigation as these studies are bound to suffer from variable omission bias (Asteriou & Stephen, 2007). Concerning the theories of economic growth, four major strands remain prominent in the theoretical literature. The first is the traditional theories of growth, the second is the neoclassical as well as exogenous theories of growth, the third is the endogenous growth theories and the fourth is the institutional growth theory.

Interestingly, most studies that have investigated the relationship between interest rate liberalisation and economic growth have focused on the exogenous or neoclassical growth theory, this study considered the institutional growth theory; given the perceptible roles played by institutions in the economic performance of emerging and developing nations (see Acemoglu & Robinson, 2001); the sub-Saharan African countries inclusive. Also, while the inclusion of financial development components has remained grossly latent in the empirical investigations between interest rate liberalisation and the growth nexus, this study seeks to explicitly trace the role played by financial development; especially for the case of sub-Saharan African economies. More so, the result of this study will help to inform policy makers and assists in producing more far-reaching policy decisions on the nature of the relationship in Sub-Saharan Africa. This study is further considered under four other sections. Section 2.0 reviews available theoretical and empirical literature while section 3.0 provides the methodological framework. Section 4.0 focuses on the estimations and discussion of findings and section 5.0, being the last, concludes and provides policy suggestions.

2.0 Literature Review

This paper considers the hypothesis of the Mckinnon-Shaw against that of the Keynesians and some other schools of thought in the debate of interest rate liberalisation – financial development – economic growth nexus. The Mckinnon-Shaw school of thought which can be taken to be a subset of the classical school of thought are led by Mckinnon (1973), Shaw (1973), Kapur (1976), Mathieson (1980), Galbis (1977), Jao (1985) and some few others while Van Wijnbergen (1983) and Taylor (1983) led the debate for Keynesians school. The neo-structuralist, post-keynesians and Stiglitz and Weiss (1981) are also among the major critics of the Mckinnon-Shaw hypothesis.

Foremost, the role of financial intermediation had been put in alignment with financial development and economic growth (Schumpeter, 1911). This notion had made economists debate the impact of financial sector on economic growth; most of them contend that financial deepening and savings increase investment and impact positively on economic growth. Contrast to this is the work of Robinson (1952), where he argues that financial intermediation does not cause economic development but rather it is a consequence of industrialization. According to Mckinnon-shaw (1973), interest rate liberalisation hypothesis focuses on financial repression which is define as the measures put in place by government to channel funds to itself as a form of debt reduction. For McKinnon (1989), an economy is financially repressed when tax and other factors distort the domestic capital market. These taxes and distortions, he argued, take two general forms: interest rate controls and direct credit allocation programmes. According to Eschenbach (2004), financial repression can also be the combination of indiscriminate nominal interest rate ceilings; high and accelerating inflation. The hypothesis of interest rate liberalisation asserts that repression is harmful for long-term economic growth because it reduces the amount of funds or savings available for investments and hence hinders economic growth (McKinnon, 1973). Mckinnon-Shaw opined that unrestrained interest rate regime will motivates savers to convert some of their savings from unproductive real assets to financial assets and by so doing will lead to increase in supply of credit in the economy. The contention is that this will affect financial deepening and savings, increase investment and thereby impact positively on economic growth. Ndebbio (2004) and Abiad, Oomes and Ueda (2004) in their work supports this view. Also, Feyzioğlu, Porter, and Takáts (2009) argued that interest rate liberalization raises the cost of capital, increase the return on savings, and allow smaller, more efficient banks to increase their role in intermediation. Thus efficiency of investment is increased.

The debate against the Mckinnon-Shaw hypothesis was led by Van Wijnbergen (1983) and Taylor (1983). They were regarded to be part of the Keynesians following their adoption of the Tobin's portfolio framework for household. They argued that in response to increase in interest rate on deposits, household will substitute their savings for gold or cash and loans in the informal sector. In essence, the major distinction between the Keynesian and the Mckinnon-Shaw hypothesis is that the Keynesians believe in "investment policy" while the Mckinnon-Shaw believes in "savings policy". This means that for the McKinnon-Shaw school, high interest rates promote savings, investment, and income while for the Keynesian school; a high interest rates policy discourages savings through its negative influence on investment and income (Khatkhate 1988; 1972).

Other schools of thought also have interesting contention of the Mckinnon-Shaw hypothesis. For instance, the post-Keynesians sees the need for effective demand and therefore contend that income distribution influences effective demand which contrast the Mckinnon-Shaw hypothesis; as an investment and savings function. This implies that interest rate liberalisation could lead to a fall in output and growth thereby financial instability in the economy (see Owusu, 2012). Also, the neo-structuralist places their argument on the presence of the informal financial sector of the economy and so argues that due to the increase in interest rates, funds would be channeled away from the informal sector to the formal sector. This may leads to reduction of the total supply of credits to the private sector (Gibson and Tsakalotos, 1994; Fry, 1997).

Another major critic of the Mckinnon-Shaw hypothesis is Stiglitz and Weiss (1981), they contend that financial market is liable to market failures, and believe that there should be some form of government intervention to correct the failures of the market. They pointed out that government should keep interest rate below their market clearing levels. The reason for this is that while a moderate increase in lending rates leads to a higher volume of lending, an additional increase in rates beyond a certain level would prompt a lower level of lending activity by adversely changing the quality of borrowers in favour of those in the high risk category (see also Stiglitz, 1994).

On the empirical front, evidence of interest rate liberalisation hypothesis seems to suggest a significant improvement in the quality of investment but not in the quantity of investment and the volume of savings. One thing which seems to be clear from the available evidence is that in addition to macroeconomic stabilisation, sound and proven regulation of the financial sector seems to play an important role for the successful implementation of the interest rate liberalisation policy. Roubini and Sala-i-Martin (1992) using a cross-section data from 98 countries for the period of 1960-1985, showed that various measures of financial repression affect growth negatively. Other writers have also used panel data (for example, Seck and El Nil, 1993; Charlier and Oguie, 2002; Allen and Ndikumana, 2000) to investigate the relationship between interest rate liberalisation and economic growth in Africa (Fowowe, 2002). Seck and El Nil (1993) and Charlier and Oguie (2002), for instance, find a significant positive relationship between economic growth and the real interest rate liberalisation.

Also, Obamuyi (2009) examined the relationship between interest rates liberalisation and economic growth in Nigeria. Using time series analysis and annual data from 1970 to 2006, he applied a co-integration and error correction model to capture both the long-run and short-run dynamics of the variables in the model. He showed that in Nigeria, the real lending rates have significant effects on economic growth. He also showed that a long-run relationship exists between economic growth and interest rate liberalisation and he concluded that the behaviour of interest rate in a liberalised economy is important for economic growth. Importantly, the study confirmed a positive relationship between interest rates and investment, on the one hand, and investment and economic growth, on the other hand, and concluded that the formulation and implementation of financial policies that enhance investment-friendly rates of interest are necessary for promoting economic growth in Nigeria.

Moreso, Owusu (2011), in his empirical findings show that in the long run interest rate liberalisation will lead to economic growth in Nigeria, thereby, supports the Mckinnon-Shaw hypothesis. Also, the studies of Chipote, Mgxekwa & Godza (2014), who examined financial liberalisation on economic growth in South Africa, employed the VECM technique and found long-run equilibrium condition among the variables included in the model with a short-run condition that inflation, lending rate and financial deepening have positive influence on economic growth as the exchange rate negatively impacted on it. Adofu, Abula & Audu

(2010) assessed the effects of interest rate deregulation in enhancing agricultural productivity in Nigeria. With the use of Ordinary Least Square (OLS) technique, the results obtained showed that interest rate deregulation has significant and positive impact on agricultural productivity and enhance economic activities in Nigeria for the period reviewed. Udo & Ogbuagu (2012), having established stationarity and long-run equilibrium condition among the variables, found that deposit rate of interest has a positive effect on financial depth while the causality test revealed one-way causality; flowing from financial depth to economic growth and that interest rate liberalisation tends to granger cause both financial depth and economic growth.

However, some empirical studies have findings that contrast with the hypothesis of interest rate liberalisation. For instance, Goldsmith (1969) using sample data from 35 countries over a period from 1860-1963, reports a rough or inconclusive correlation between interest rate liberalisation and economic growth. Additionally, King and Levine (1993) contended that about one third of the difference between very fast and very slow growing economies can be removed by increasing the depth of the financial intermediation sector. Bhatia and Khatkhate (1975) using correlation graphs to examine the relationship between economic growth and interest rate liberalisation in eleven African countries find no definite relationship between economic growth and financial liberalisation for the studied countries either individually, or for the whole group. Also, Ogun (1986) using cross sectional analysis on data for 20 countries in Africa from 1969 – 1983 estimated the correlation between interest rate liberalisation and economic growth and finds no support to the economic growth enhancing capabilities of financial liberalisation. Obute, Adyorough & Itodo (2012) employed the Adofu et. al., (2010) framework to assess the impact of interest rate deregulation on economic growth in Nigeria consequent upon the financial sector reforms beginning in 1986. The authors found that interest rate deregulation do not have significant influence on economic growth in Nigeria and thus recommend an effective deregulation of interest rate to foster resilience growth. Owusu and Odhiambo (2013) investigated financial liberalisation and economic growth in Ivory Coast with the use of the Autoregressive Distributed Lag (ARDL) framework. Their findings show that the effect of financial liberalisation policies on economic growth are negligible; both in the short-run and long-run situations.

The study of Gehringer (2013) summarized it best as the author found a mix result in the finance-led proposition but obtained a clear positively significant effect of the growth-led hypothesis. The findings align with the results obtained in the study of Baliamoune-Lutz (2003). Concerning the theories of economic growth, four major strands remain prominent in the theoretical literature. The first is the traditional theories of growth, the second is the neoclassical as well as exogenous theories of growth, the third is the endogenous growth theories and the fourth is the institutional growth theory. The traditional growth theories, which laid the foundation for many growth theories, largely centers around the classical propositions which posited that an increase in real GDP per person (which was brought forth by advances in technology and the accumulation of capital) will be temporary because posterity will induce a population explosion and the population explosion will decrease real GDP per person. The neoclassical growth model, which emphasizes the role of capital accumulation, was first constructed by Solow (1956) and Swan (1956). This model shows how economic policy can raise an economy's growth rate by inducing people to save more. But the model also predicts that such an increase in growth cannot last indefinitely. In the long run, the country's growth rate will revert to the rate of technological progress, which neoclassical theory takes as being independent of economic forces, or exogenous.

Growth theories that take this endogeneity of technology into account - especially since the rate of technological progress is what determines the long-run growth rate - is known as the endogenous growth theories. Incorporating endogenous technology into growth theory forces us to deal with the difficult phenomenon of increasing returns to scale. An alternative, institutional approach for explaining long-term sustained economic growth has been proposed in the form of social infrastructure. The quality of a state's legal, political and educational institutions can vary greatly depending on its history and geography, and can prove to be a significant cause of a country's development (or lack thereof). It can be argued that a stable rule of law and a healthy investing climate in which property rights are strongly enforced can contribute greatly to economic performance (Acemoglu & Robinson, 2001).

Interestingly, most studies that have investigated the relationship between interest rate liberalisation and economic growth have focused on the exogenous or neoclassical growth theory, this study considered the institutional growth theory; given the perceptible roles played by institutions in the economic performance of emerging and developing nations (see Acemoglu & Robinson, 2001); the sub-Saharan African countries inclusive. Again, it was clear that most empirical studies have been conducted on the premise of a reduced-form model where the relationship between interest rate liberalisation; as a form of financial liberalisation, and economic growth have been investigated directly; and not structurally. The problem with reduced-form models is that it treats the intermediate variables as a 'black box' which should be kept low and left uninvestigated (see Mishkin, 2012). Also, some of these studies subsumed financial development, taking it as a component of interest rate liberalisation (see Baliamoune-Lutz, 2003). More so, studies in this area have been grossly country-specific and none have been directed to provide policy direction on regional and/or continental basis. These are the gaps in empirical investigations that this study seeks to cover. As such, this study structurally and indirectly examines the interaction between the liberalisation of interest rate and economic growth in sub-Saharan Africa; by examining the intermediate roles of financial development.

3.0 Methodology

3.1 Theoretical Framework and Models Specification

Going by the submission that the precursor to interest rate liberalisation leading to economic growth rests on the depth of financial development in an economy (see Odhiambo, 2011), the theoretical framework for this study is largely anchored on McKinnon-Shaw (M-S) hypothesis and the institutional theory of growth. In line with the M-S proposition, the higher rate of interest can only stimulates growth in economies with sound financial development but endangered growth in economies with non-functional financial system; such as sub-Saharan African economies. The M-S hypothesis was refined by the model proposed by Edwards and Khan (1985) where they opined that liberalized as well as non-autarky factors affect the domestic interest rate of an economy with restricted capital account transactions. Edward and Khan (1985) began with specifying the standard Fisherian equation of nominal interest rates;

$$i_t = rr_t + \Pi_t^e \tag{1}$$

Where; i = nominal interest rate; rr = real interest rate; Π^e = expected rate of interest. In contrast to the temporary short-run disequilibrium of the Fisher's equation, the model assumed non-mean-reverting nature of the real interest rate; even in the short-run. As such, we have;

$$rr_t = \xi - eM_t^s + \varepsilon_t \tag{2}$$

Where; eM_t^s = excess money supply at a given period; ξ = positive parameter value and ε = random error term. Substituting for the real interest rates into equation (1), gives;

$$i_t = \xi - eM_t^s + \Pi_t^e + \varepsilon_t \tag{3}$$

It should be noted that the excess money supply is the excess of the actual stock of real money supply over the desired equilibrium stock of real money balance.

$$eM_t^s = \log M_t^s - \log M_t^d \tag{4}$$

Incorporating equation (4) into (3), and expanding out;

$$i_t = \xi - \log M_t^s + \log M_t^d + \Pi_t^e + \varepsilon_t \tag{5}$$

Given that the expected rate of inflation is not directly observable and that it has no direct effect on the real interest rate, then, equation (5) yields;

$$i_t = \xi - \log M_t^s + \log M_t^d + \varepsilon_t \tag{6}$$

When financial development is evident, money substitutes for goods and other financial assets also exchange for money. As such, the demand for money is determined by two opportunity cost variables which are the expected rate of inflation and interest rate and the real income as a scale variable,

$$\log M_t^d = f(rr_t, y_t, \Pi_t^e) \tag{7}$$

Substituting for money demand in equation (6) gives;

$$i_t = \xi - \log M_t^s + rr_t + y_t + \Pi_t^e + \varepsilon_t \tag{8}$$

Taking positive parameter as constant and given perfect foresight condition that expected inflation equals actual inflation and coupled with the exogenously determined nature of money supply, equation (8) gives the reduced form equation for nominal interest rates as:

$$i_t = \lambda_0 + \lambda_1 rr_t + \lambda_2 y_t + \lambda_3 \inf r_t + \varepsilon_t \tag{9}$$

Equation (9) is the closed economy model of interest rate enunciated within the McKinnon & Shaw (1973) framework. However, Edward and Khan (1985) refined this M-S framework by introducing liberalizing as well as non-autarky factors. To introduce the open market factors, Edward and Khan (1985) assumed an uncovered interest arbitrage relation assuming no impediments to capital flows. Domestic and foreign interest rates are closely linked, especially in a world with no transaction costs and risk-neutral agents.

$$i_t = I_t^* + e_t \tag{10}$$

Where; I_t^* is the world interest rate and e_t is the expected rate of change. Modeling a partial adjustment framework and combining closed and open economy extremes using the linear combination method; then, the following nominal interest rate model is specified, assuming a lag in response to domestic interest rate:

$$i_t = (1-\psi)(rr_t + \Pi_t^e) + \psi(I_t^* + e_t) + (1-\psi)i_{t-1} \tag{11}$$

Where; Ψ is the index measuring the degree of openness. After series of iterative procedures, the closed economy components yield;

$$i_t = rr_t + \Pi_t^e = \lambda_o + \lambda_1 rr_t + \lambda_2 y_t + \varepsilon_t \text{ (see equations 1 – 9)}$$

Equating equations (10) and (11);

$$i_t = (1-\psi)\lambda_0 + \lambda_1 rr_t + \lambda_2 y_t + \psi(I_t^* + e_t) + (1-\psi)i_{t-1} + \varepsilon_t \tag{12}$$

On the condition that SSA economies are still less liberalized, ψ; being the degree of openness is closer to zero and $(1-\psi)$ is closer to 1. As such, equation (12) yields;

$$i_t = \lambda_o + \lambda_1 i_{t-1} + \lambda_2 rr_t + \lambda_3 y_t + \lambda_4 \psi(I_t^* + e_t) + \varepsilon_t \tag{13}$$

The index of openness; ψ, introduces trade liberalisation (TRO) and capital account liberalisation (FDI ratio of GDP) into our model where the world interest rate, I_t^*, is rightly reflected. Equation (13), then, yields the behavioural equation for a small open economy such as Nigeria;

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2 rr_t + \beta_3 y_t + \beta_4 fdi_t + \beta_4 tro_t + \varepsilon_t \tag{14}$$

Tracing a structural interaction of the interest rate liberalisation-growth nexus through financial development, introduces domestic credit to the banking public, DCB, equation (14) becomes;

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2 rr_t + \beta_3 y_t + \beta_4 fdi_t + \beta_4 tro_t + \beta_5 dcb + \varepsilon_t \tag{15}$$

The presence of nominal and real interest rates suggests the introduction of inflation rate into the model and yields;

$$i_t = \beta_0 + \beta_1 i_{t-1} + \beta_2 rr_t + \beta_3 y_t + \beta_4 fdi_t + \beta_4 tro_t + \beta_5 dcb + \beta_6 \inf r + \varepsilon_t \tag{16}$$

In order to capture the feedback mechanism between interest rate liberalisation and economic growth; the contemporaneous equation to equation (16) in recourse to the institutional growth theory gives;

$$gdp_t = \beta_0 + \beta_1 gdp_{t-1} + \beta_2 rr_t + \beta_3 gef_t + \beta_4 fdi_t + \beta_4 tro_t + \beta_5 dcb + \beta_6 \inf r + \varepsilon_t \quad (17)$$

Where; gdp is the real gross domestic product per capital; i is interest rate liberalisation; dcb proxied domestic credit to banks deflated by the GDP; $\inf r$ is inflation rate; fdi is foreign direct investment as a ratio of gross domestic product; tro is trade openness. Both fdi and tro are indicators of openness; the former is a capital account liberalisation component which captures financial openness while the latter is an indicator for trade openness. Also, we include government effectiveness (proxied as gef), which is deflated by the GDP, to capture institutional factors as important growth factors for developing economies (Acemoglu and Robinson, 2001).

To investigate models (16) and (17) above, we ensure that the data employed for our analyses are purified to avoid spurious regression estimates (see Granger and Newbold, 1974) through the use of panel unit-root test as against the conventional unit-root test since the former is considered more efficient than the latter. Usually, conventional unit-root tests have lower power when the process is near integrated. Also, the presence of structural breaks might lead to errorneously accepting the hypothesis of unit-root and the power of the conventional tests could be low due to the small sample bias. To ameliorate the identified shortcomings in conventional unit-root test, the use of time-series and cross-section virtues of panel data and to test simultaneously for the nulls of the unit-root and stationarity and structural stability has been proposed (see Baltagi, 2010; Medrik, Rodriguez and Ruprah (2008). Moreover, we employ a battery of panel unit-root tests for robustness and reliability checks. The panel unit-root tests include those of Lin, Levin and Chin (LLC), Im-Pesaran-Shin (IPS), Augmented Dickey Fuller-Fisher Chi-square (ADF-Fisher Chi-Square) and the Phillip-Perron-Fisher (PP-Fisher) Chi-Square. Thereafter, the Cointegration tests were performed for the long-run equilibrium conditions and the short-run dynamics was also undertaken.

The technique upon which this empirical model is anchored and investigated revolves around the vector error correction modeling technique. However, we conduct tests of analyses around the unit-root and cointegration long-run equilibrium conditions for our series as pre-estimation tests. Also, some post-estimation as well as diagnostics tests were conducted for the robustness of estimates obtained.

3.2 Techniques of Analyses

Since the cointegration and error correction methods are a fairly common place in empirical estimations and is well documented elsewhere (Banerjee, et. al 1993; Engle and Granger 1987, Johansen 1988; Johansen and Juselius, 1990), only a brief overview here is provided in this study. Johansen (1988) multivariate cointegration model is based on the error correction representation given by:

$$\Delta X_t = \mu + \sum_{i=1}^{\rho-1} \tau_i \Delta X_{t-i} + \pi X_{t-i} + \varepsilon_t \quad (18)$$

Where Xt is an (nx1) column vector of ρ variables, μ is an (nx1) vector of constant terms, Γ and Π represent coefficient matrices, Δ is a difference operator, and εt˜ N (0, Σ). The coefficient matrix Π is known as the impact matrix, and it contains information about the long-run relationships. Johansen's methodology requires the estimation of the VAR equation 1 and the residuals are then used to compute two likelihood ratio (LR) test statistics that can be used in the determination of the unique cointegrating vectors of Xt. The cointegrating rank can be tested with two statistics: the trace test and the maximal eigenvalue test. The existence of long-run equilibrium condition is a precondition for short-run dynamics of empirical investigations (Johansen-Juselius, 1990) and the significant of the properly-signed error correction estimates is a confirmation of the long-run equilibrium condition (Johansen-Juselius, 1990).

The error correction version pertaining to the four variables incorporated in our study is stated below:

$$\Delta Y_t = \delta_0 + \sum_{i=0}^{n} \delta_{1i} \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta F_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta \mathrm{K}_{t-i} + \sum_{i=0}^{n} \delta_{4i} \Delta R_{t-i} + \lambda ECM_{t-i} + \varepsilon_t \qquad (19)$$

Where ECM_{t-1} is the error correction term and εt is the mutually uncorrelated white noise residual. The coefficient of the ECM variable contains information about whether the past values of variables affect the current values of the variables under study. The size and statistical significance of the coefficient of the error correction term in each ECM model measures the tendency of each variable to return to the equilibrium. A significant coefficient implies that past equilibrium errors play a role in determining the current outcomes. The short run dynamics are captured through the individual coefficients of the difference terms (Akinlo and Egbetunde, 2010).

3.3 Scope of Study and Data Sources

The study is carried out for sub-Saharan African countries for the period 1980-2012. Our choice of 1980 as the beginning period for this study is predicated on the presumption that this period 'midwife' the period for financial liberalisation across the countries in the African continent. Since financial liberalisation cuts across barely all independent African countries in the 1980s, the surrogate sub-Saharan African countries considered for this study was largely informed by this consideration. Those countries left out of this choice were duly informed by unavailability of data and/or its paucity. As such, the sub-Saharan African countries covered in the study are Botswana, Burundi, Cameroon, Central African Republic, Chad, Congo, Gabon, Gambia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Nigeria, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Togo and Zambia. For the data points, the measure per capita real output as the ratio of real Gross Domestic Product (GDP) to total population (denoted as Y) is taking as the dependent variable. Financial development (DCB) is measured as a domestic credit of banks; which serves as the credit to the general public. Real interest rate is denoted as (R), trade openness (TRO) is captured as the ratio of total trade to GDP, capital account openness is indicated as the ratio of foreign direct investment to the gross domestic product (proxied as FDI) while government effectiveness (GEF) is an indicator for institution. These data were sourced from the World Development Indicators – WDI – (2012); the Central Bank of Nigeria Statistical Bulletin (2012) and the Annual Statement of the National Bureau of Statistics (NBS) for various issues.

4.0 Estimations and Discussion of findings

Table 1: Result of Panel Unit Root Tests

Series	Levin, Lin & chut*		Im, Pesaran & Shin W-Stat		ADF-Fisher chi-square		PP-Fisher chi-square		Order of integra-tion
	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.	
Gdp	-7.48*	-13.79*	-10.44*	-22.08*	189.77*	425.8*	338.3*	560.5*	I(0)
Fdi	-2.74*	-8.25*	-3.89*	-16.77*	97.02*	323.6*	166.5*	471.8*	I(0)
Gef	3.59	-7.28*	4.85	-17.64*	14.29	331.6*	124.0*	438.7*	I(1)
Dcb	-1.56**	-8.89*	-0.74	-11.11*	48.54	203.6*	40.04	352.7*	I(1)
Tro	-1.22	-12.02*	-1.4***	-14.15*	50.36	265.0*	66.59*	491.4*	I(1)
Inf	-6.13*	-12.25*	-7.26*	-17.14*	137.2*	333.6*	164.7*	497.3*	I(0)
Int	-4.92*	-14.19*	-5.48*	-17.91*	105.1*	334.2*	200.8*	486.0*	I(0)

*, **, *** indicate 10%, 5% and 1% level of significance.
Sources: Authors' Computations

The test statistics of panel unit-root tests detailed in Table 1 above show that the series of analyses for this study are mixed unit root and stationarity but more of the latter as three (3) of the seven (7) series have to be integrated at an order 1 before becoming stationary at the 5 percent level of significance while four (4) of the seven (7) series can be directly employed for empirical analyses without running into spurious as well as nonsensical regression (see Green, 2009). Specifically, the variables of government effectiveness (proxied as GEF) is an institutional factor, the domestic credit from banks (proxied as DCB) is the credit to the general public; which serves as an indicator of financial development. The index of trade openness (proxied as TRO) are unit-root and have to differenced at order 1 before it could be stationary while the rate of inflation (proxied as INF), the rate of interest (proxied as INT), the ratio of foreign direct investment to gross domestic product (proxied as FDI) and the growth rate of GDP (proxied as GDP).

These estimates of stationarity cum unit-root lend credence to the findings that some economic series are unit-root in nature and could not be directly employed for empirical investigations without differencing (Granger and Newbold, 1974). Without prejudice to the Autoregressive Distributed Lag Bound test of Pesaran, Smith and Shin (2011); a Johansen cointegration test can be conducted on a model with mixed I(0) and I(1) stationary series provided the residuals are stationary at levels (see Gujarati, 2011). Consequent upon the stationarity of the series coupled with stationary residuals at levels, further analysis into ascertaining the long-run equilibrium conditions of the series where a retinue of multivariate cointegration tests such as the Kao Residual test, Pedroni Residual test and the Johansen-Fisher panel cointegration test would be considered.

Table 2: Kao Residual Cointegration Test

	Model 1	**Model 2**
ADF t-statistics	-1.8581*	-4.2049*

***denotes significance at the 5 percent level**

The tau statistics for cointegration indicate that the variables included in our models of interest rate liberalisation and growth have equilibrium conditions that keep them together to co-move in the long-run situations. The implication is that the variables of interest rate (proxied as INT), domestic credit to bank (proxied as DCB), the foreign direct investment (proxied as FDI), the growth process of the economy (proxied as GDP), the rate of inflation (proxied as INF) and the index of trade openness (proxied as TRO) for Model 1 and those of GDP, INT, INF, DCB, FDI, TRO and government effectiveness (proxied as GEF) for Model 2; all have equilibrium conditions for co-movement in the long-run (see Appendix). For further test for cointegration, we invoke the Pedroni Residual Cointegration and the Johansen-Fisher tests.

Table 3: Pedroni Residual Cointegration Test

Test Statistics+	**Model 1**	**Model 2**	**Test Statistics**	**Model 1**	**Model 2**
Panel v-statistic	-1.6176	-1.4181	Group rho-statistics	-0.4585	1.7390
Panel rho-statistics	-1.8779*	-0.3029	Group PP-Statistics	-11.4527*	-11.8181*
Panel PP-statistics	-10.6243*	-9.0334*	Group ADF-statistics	-0.4563	-2.2461*
Panel ADF Statistics	-2.3348*	-2.8188			
Test Statistics++					
Panel v-statistic	-2.8948	-3.9487			
Panel rho-statistics	-2.2622	1.0430			
Panel PP-statistics	-9.1288*	-7.3057*			
Panel ADF Statistics	-1.1446	-2.1824*			

*denotes significance at the 5 percent level; + denotes ordinary test statistics; ++ denotes weighted test statistics.

Interestingly too, the Pedroni Residual Cointegration test also confirms the presence of long-run equilibrium conditions among the variables included in the models. The main or ordinary residual test coupled with the weighted residual test together with the group residual test converge to the conclusion that cointegration exist. In fact, the Panel rho statistics, the Panel PP statistics and the Panel ADF statistics support this long-run equilibrium relationship among the series included in model 1 while only the Panel PP statistics supports for cointegration of the variables included in Model 2. However, when weighted and grouped respectively, the Panel PP-statistics and Panel ADF statistics support for cointegration of the variables in Model 2 while only the Panel PP-statistics confirms for the long-run equilibrium condition in Model 1 respectively (see Table 3). Again, we corroborate these estimates with the Johansen-Fisher Panel Cointegration test as detailed in Tables 4 and 5 respectively.

Table 4: Johansen-Fisher Panel Cointegration Test – Model 1

S/N	Trace Test Statistic				Maximum Eigenvalue Test			
	H_o:r	**H_i:r**	**Statistics**	**5% Level**	**H_o:r**	**H_i:r**	**Statistics**	**5% Level**
1	r = 0	r = 1	407.5*	0.0000	r = 0	r = 1	264.5*	0.0000
2	r ≤ 1	r = 2	189.2*	0.0000	r ≤ 1	r = 2	121.1*	0.0000
3	r ≤ 2	r = 3	94.62*	0.0000	r ≤ 2	r = 3	76.87*	0.0004
4	r ≤ 3	r = 4	44.98	0.2712	r ≤ 3	r = 4	33.80	0.7444
5	r ≤ 4	r = 5	35.85	0.6574	r ≤ 4	r = 5	23.12	0.9850
6	r ≤ 5	r = 6	66.94*	0.0048	r ≤ 5	r = 6	66.94*	0.0048

Trace test indicates 3 Cointegration equation(s) at 5% significant level.
*denotes rejection of the hypothesis at the 5% level

The Johansen-Fisher Panel test statistics for Model 1 detailed in Table 4 suggests that there exist at least three (3) cointegrating equations for Models 1 and 2 respectively. This implies that the variables included in our model could co-move together into the long-run.

Table 5: Johansen-Fisher Panel Cointegration Test – Model 2

S/N	Trace Test Statistic				Maximum Eigenvalue Test			
	H_o:r	**H_i:r**	**Statistics**	**5% Level**	**H_o:r**	**H_i:r**	**Statistics**	**5% Level**
1	r = 0	r = 1	626.2*	0.000	r = 0	r = 1	380.5*	0.0000
2	r ≤ 1	r = 2	336.2*	0.000	r ≤ 1	r = 2	173.0*	0.0000
3	r ≤ 2	r = 3	186.2*	0.000	r ≤ 2	r = 3	100.3*	0.0000
4	r ≤ 3	r = 4	107.0	0.000	r ≤ 3	r = 4	63.00*	0.0066
5	r ≤ 4	r = 5	65.78	0.0034	r ≤ 4	r = 5	48.75	0.1135
6	r ≤ 5	r = 6	44.12	0.2284	r ≤ 4	r = 6	32.02	0.7416
7	r ≤ 6	r = 7	65.68*	0.000	r ≤ 5	r = 7	65.68*	0.0035

Trace test indicates 4 Cointegration equation(s) at 5% significant level.
*denotes rejection of the hypothesis at the 5% level

4.3.6 Estimations of Short-run Coefficients

Table 6: Panel ECM Estimates for Model 1 - Interest Rate Liberalisation Model

Model 1: Interest Rate Liberalisation Model			
Variable	**Coefficient**	**T-Stat**	**Prob.**
C	0.571	1.394	0.164
D(INT(-1))	-0.398*⁺	-6.679*	0.000
D(GDP(-3))	0.1239	1.417	0.157
D(DCB(-2))	-0.0596	-1.501	0.134
D(INFR(-2)	-0.0623	-1.921***	0.055
D(FDI(-4))	-0.1186	-1.108	0.268
D(TRO(-4))	0.155	2.016**	0.044
ECM(-1)	-0.281	-5.315*	0.000
R^2	0.42		
Adj. R^2	0.38		
F-statistics ratio	12.14		
Prob. F-statistics ratio	(0.000)		
DW Statistics	1.99		

Source: E-Views Output; Note: Interest Rate (INT) is the Dependent Variable; * 1%; **5% and ***10%

The estimates of the lagged error correction for Models 1 and 2 (proxied as ECT_1) respectively are properly signed and highly significant; even at the 1 percent level. For model 1, the ECT has a coefficient of -0.281 with absolute T-statistics value of 5.32 while that of Model 2 is -0.712 with 9.73 absolute T-statistics value. The implication is that the recovery of both the interest rate and economic growth back to equilibrium respectively when affected by shock is significant with 28.1 percent of the errors in interest rate corrected for annually to a spate of about four (4) years before equilibrium is re-attained while for the case of economic growth; recovery rate is high at 71.2 percent and in less than two (2) years; recovery would have been attained. These estimates further show that the relationship of long-run equilibrium conditions; evident through the use of the various cointegration approaches, were justified.

The previous effects of interest rate (proxied as INT (-1)) on the current rate is negative with -0.398 coefficients and 6.679 absolute T-statistics value. This indicates that a higher level of interest rate in the past will command a lower rate for the current period and vice-versa. This suggests that the perfect foresight assumption that expected inflation equates current inflation could not be validated for the case of sub-Saharan African countries. However, the effect of inflation (proxied as INFR (-2)) on the rate of interest; in line with the Fisherian proposition, is valid with a negative relationship of -0.0623 coefficient and 1.921 T-statistics value barely at the 5 percent level. The effect of banks' domestic credit (proxied as DCB (-2)); as an indicator of financial development; on the rate of interest also impacts negatively on the economies of sub-Saharan Africa countries with -0.0596 coefficients but insignificant with absolute T-statistics value of 1.50. This suggests that the more developed the financial markets as well as financial institutions is, the lesser the rate of interest in the intermediation process. The ratio of foreign direct investment to gross domestic product (proxied as FDI) is also negatively related to interest rate of sub-Saharan African economies. This indicates that foreign capital inflows increase the money in the circulation and, thus, pressurized the rate of interest to reduce. The implication is that foreign direct investment has better assisted the interest liberalisation conditions of the sub-Saharan African economies. However, openness on trade as well as its liberalisation (proxied as TRO) is positively related to the rate of interest with 0.155 coefficients and 2.016 T-statistics values. Therefore, the degree of trade openness in the sub-Saharan African economy tends to increase the rate of interest in the financial intermediation process.

Table 7: Panel ECM Estimates for Model II – Economic Growth Model

Model 1: Economic Growth Model			
Variable	**Coefficient**	**T-Stat**	**Prob.**
C	-0.0625	-0.2795	0.780
D(INT(-4))	-0.0793	-3.673*	0.0003
D(GDP(-1))	-0.112	-1.671***	0.0953
D(DCB(-2))	0.03761	1.8512***	0.0647
D(INFR(-3)	-0.0261	-1.646***	0.1004
D(FDI(-3))	0.202	3.728*	0.0002
D(TRO(-1))	0.081	2.079**	0.0381
D(GEF(-2))	-1.436	-1.252	0.211
ECM(-1)	-0.712	-9.730*	0.000
R^2	0.48		
Adj. R^2	0.45		
F-statistics ratio	13.75		
Prob. F-statistics ratio	0.000		
DW Statistics	1.99		

Source: E-Views Output; Note: Economic Growth (GDP) is the Dependent Variable; * 1%; **5% and ***10%

Nonetheless, the previous effect of the growth process (proxied as GDP) on the current level is negative with -0.112 coefficient and 1.671 T-statistics values which is significant at the 10 percent level. The rate of interest (proxied as INT), inflation rate (proxied as INF) and government effectiveness (proxied as GEF) are negatively related to the growth process with -0.0793, -0.026 and -1.44 coefficients and absolute T-statistics values of 3.67, 1.65 and 1.25. Of the three, only the negative effect of interest rate that is significant at the 5 percent level; the inflation significant at the 10 percent level while the level of government effectiveness is insignificant. An important implication of these estimates is that the extent with which financial development has assisted in reducing the rate of interest (as obtained in Model 1) would make interest rate – in Model 2 – investment-enhancing and then engendered growth. This finding aligns with the Keynesian propositions. In line with theoretical expectation, also, the price levels of the sub-Saharan African economies are negatively related to growths while the level of government effectiveness is detrimental to the growth process of these economies. However, the degree of openness on trade (proxied as TRO), the level of financial development (proxied as DCB) – which is indicated as the deposit credit of banks – and foreign direct investment are positively related to growth in sub-Saharan Africa countries with 0.0805, 0.0376 and 0.202 coefficients and absolute T-statistics values of 2.079, 1.85 and 3.73 respectively. This indicates that openness on trade and foreign direct investment are positively and significantly related to economic growth in sub-Saharan Africa countries at the 5 percent level while the level of financial development is significant at the 10 percent level.

On the whole, the coefficient of determination (R^2) and Adjusted R^2 are 0.42 and 0.38 respectively for Model 1. Therefore, the explanatory variables accounted for the movement in the dependent variable to a spate of 42 percent and 38 percent respectively. For Model 2, the contemporaneous values are 0.48 and 0.45 respectively; which connotes that there is 48 percent and 45 percent accounts for the explanatory variable(s) respectively. The F-statistics ratios are 12.14 and 13.75 for Models 1 and 2 respectively. These are highly significant in that the probability values for these statistics are 0.000 while the Models are free of autocorrelation problems as the Durbin Watson (DW) statistics are 1.99 for each of Models 1 and 2 respectively.

Table 8: Diagnostic Results

S/N	Test Statistics	Model 1: Interest Rate Liberalisation Model	Model 2: Growth Model
1	**Wald Test**	**Model 1**	**Model 2**
	F-statistics	3.257 (0.039)	3.934 (0.020)
	Chi-Square	6.514 (0.039)	7.868 (0.020)
2	**Omitted Variable Test**	**Model 1**	**Model 2**
	T-test	1.748 (0.081)	67.215 (0.000)
	F-test	3.057 (0.081)	4517.82 (0.000)
	Likelihood ratio	3.239 (0.072)	1242.78 (0.000)

Source: E-Views Output. Note: Figures in parentheses are the probabilities of significance

The test statistics for both the Wald statistics and Omitted variables tests rejects their respective hypothesis at the 5 percent level of significance. The omitted variable test shows that the model is fit as it indicates that the observed difference between the less restrictive model (an otherwise model with more variables) and the specified model for this work are insignificant, thus, lending credence to the fitness of the model employed. More so, the Wald statistics is also significant at the 5 percent level and the null hypothesis that the inclusion of the variable does not affect the fitness of the model is rejected for both the interest rate and economic growth models respectively.

5.0 Conclusion and Recommendation

Conclusively, it is evident that other factors such as the openness on trade and price stability are much more significant for interest rate liberalisation and economic growth for sub-Saharan African economies. Considerably, the extent of financial development has assisted in reducing interest rate which further facilitates investment and then engendered growth. Theoretically, this study aligns with the McKinnon-Shaw hypothesis of interest rate-growth nexus. Interestingly, public institutions have been found significantly detrimental at driving the growth process of the sub-Saharan African economies; thereby, lending credence to the

Acemoglu and Robinson (2001) propositions on the importance of effective institution in the growth process of developing economies. From the foregoing, for interest-rate-enhancing growth in sub-Saharan African countries; the level of financial development, price stability and institutional arrangement should be properly attended to with adequate policy decisions.

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