# DOES INFRASTRUCTURE ALTER THE NEXUS BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH? INSIGHTS FROM SUB-SAHARAN AFRICA

**SALIHU OTUNBA ALABI**
Department of Economics, Kwara State College of Education, Ilorin, Nigeria
**HAMMED AGBOOLA YUSUF**
Department of Economics, University of Ilorin, Ilorin, Nigeria
**WALIU OLAWALE SHITTU**
Department of Economics, KolaDaisi University, Ibadan, Nigeria. E-mail: walesh.economist@gmail.com
**LUQMAN OLANREWAJU AFOLABI**
School of Business & Economics, University of Kigali, Kigali, Rwanda
**KAFILAT LOLA GOLD**
Department of Economics, Kwara State College of Education, Ilorin, Nigeria

**Abstract**

This research investigates the role of infrastructure in the nexus between financial development and economic growth in 20 SSA countries. Our study is among the few to have observed an asymmetric connection between financial development and growth, while also measuring the interactive role of infrastructure on growth in SSA, which is considered the most vulnerable region in the world. While employing the pooled mean group (PMG) estimation technique on the data (spanning 1985 – 2018) obtained through secondary sources, our empirical findings suggest a non-linear linkage between financial development and economic growth, such that the positive impact outweighs the negative one in both the short-run and the long-run. The non-linear estimate, however, provides that financial development has a mixed impact on economic growth as it indicates a positive effect to a certain level after which it hurts growth. Moreover, a negative long-run coefficient is observed on infrastructure, wherein it reduces the growth rate of the SSA economy by an average of 0.27%. On the final note, the interaction effect of infrastructure and financial development reveal a positive linkage with economic growth, wherein infrastructure enhances the long-run positive effect of financial development on the growth of the SSA countries by 0.23%. These results have important policy implications on the economies of the West African countries considered, as the study reveals inefficiency of infrastructure investment in the region.

**Keywords**: Financial Development, Infrastructure, Economic Growth, Pooled Mean Group, SSA

**JEL Classification**: 04; G2; C1

## 1. BACKGROUND OF THE STUDY

The relationship between financial development and economic growth has received a great deal of attention during recent decades. However, there are conflicting views concerning the role that financial system play in economic growth, for example, while Levine (1997) believes that financial intermediaries enhance economic efficiency and, ultimately, growth by helping allocate capital optimally, Lucas (1988) asserts that the role of the financial sector in economic growth is 'over-stressed'. Notwithstanding the controversy among the scholars, modern theoretical literature (Romer 1986; Lucas 1988; Rebelo 1991; Grossman and Helpman 1991; Pagano, 1993; Khan, 2001, among others) on finance-growth nexus combines endogenous growth theory and microeconomics of financial systems. In addition, finance affects the real economy in several ways, hence understanding the possible mechanisms through which it may impact on economic growth is essential to derive sound policy recommendations (Levine, 2005). Numerous works emphasize that there may be a non-linear (Deidda and Fattouha, 2002), and ultimately non-monotonic (Allen et al., 2014; Law and Singh, 2014), relationship between the degree of financial development and economic performance (i.e., long-run economic growth).

The level of financial development in sub-Saharan Africa (SSA) remains low, even though the sector continues to grow in recent times. Financial sector development in SSA remain relatively underdeveloped and shallow in the CFA franc zone (David et al., 2014). The relative backwardness of the region's financial sector has been attributed to lack of institutional quality (Singh et al., 2009), informality, weak governance, political and economic instability (Beck and Honohan, 2007) and sparse population density (Allen et al., 2012). More so, David et al., (2014) suggest financial integration as an important conduit to financial development especially in countries with better institutional quality. However, the role of infrastructural development on economic growth is well documented by several policy (e.g. Arvis et al., 2012; Le and Ozturk, 2020) and scientific (e.g. Limao and Venables, 2001) papers. Several scholars (e.g. Vickerman, 1995; Camagni and Capello, 2013; Yinusa, Aworinde and Odusanya, 2020; Ahmed, Long, Dauda and Mensah, 2020; Olaniyi and Oladeji, 2020) and international institutions (e.g. World Bank [e.g. Arvis et al., 2012], European Union [e.g. Purwanto, 2010], OECD [e.g. Merk, 2012]) have discussed the potential benefits of an improved infrastructural development and its capability of fostering both regional competitiveness and economic development in developing economies. Consequently, Infrastructural development aim at enhancing surge in productivity and efficiency through acting as a bridge between resources

and factories, individuals, and jobs and finally products and markets. Hence, investment and growth can be contributed via infrastructural development.

In the same vein, a well-functioning system of infrastructure assets and services is a prerequisite for long-term economic growth. It lowers transaction costs, facilitates the exchange of goods, services, and ideas, fosters competition, and makes regional specialization and the realization of economies of scale possible. Several studies have documented the fact that institutional improvements are essential not only in promoting economic development but also in delivering the benefits of financial development by enhancing the rule of law, securing property rights, addressing corruption, reducing uncertainty, and subsequently increasing the confidence of investors (Law and Habibullah, 2006; Khan, Kong, Xiang and Zhang, 2019; Olaniyi and Oladeji, 2020; Aluko and Ibrahim, 2020; Le and Ozturk, 2020).

It has been argued extensively that England experiences a higher growth than Spain due to its better institutions. On the other hand, an understanding of the relationship between institutions and financial development is offered in the seminal paper by La Porta, Lopez-de- Silanes, Shleifer, and Vishny (1998) as cited by Aluko and Ibrahim (2020) argued that countries with better institutions are more likely to enjoy higher levels of financial development. Surprisingly, none of the studies, to the best knowledge of the researchers, examined in the course of this research work was able to interrogate the likely contribution of infrastructure on the relationship between financial development and economic growth in the Sub-Saharan Africa. Most studies delved into either the relationship between infrastructure and economic growth or financial development and economic growth without assessing those variables holistically. It, therefore, becomes expedient to rigorously and assiduously examine whether infrastructural development has the potentialities of altering the assumed relationship between financial development and economic growth in the SSA countries, given its importance in turning around the economy.

## 2. LITERATURE REVIEW

Fedderke and Garlick (2008) conducted a study on infrastructural development and economic growth in South Africa. Theoretical approach was rigorously adopted and identified five specific channels through which infrastructure may affect growth: as a factor of production, a complement to other factors of production, a stimulus to factor accumulation, a stimulus to aggregate demand and a tool of industrial policy. The connection between infrastructural development and economic growth in China was examined by Sahoo, Dash and Nataraj (2010) using time series data ranging from 1975 to 2007. Autoregressive Distributive Lag model (ARDL) econometric technique was used. The result reveal that infrastructure stock, labour force, public and private investments played a vital role in economic growth in China. Importantly, infrastructure development in China has a significant positive contribution to growth both private and public investment. Also, there is unidirectional causality from infrastructure development to output growth justifying

China's high spending on infrastructure. Likewise, financial development and economic growth was examined in Ghana by Adu, Marbuah and Mensah (2013) using principal component analysis established that the growth effect of financial development is sensitive to the choice of proxy. Both the credit to the private sector as ratios to GDP and total domestic credit are conducive for growth, while broad money stock to GDP ratio is not growth-inducing. The indexes created from principal component analysis confirmed the sensitivity of the effect to the choice of proxy. Hence, understanding whether financial development is good or bad for growth depends on the indicator used to proxy for financial development.

In a study that set out to examine financial sector development and economic growth in Nigeria, Balago (2014) employed Ordinary Least Square (OLS) and Vector Error Correction model (VECM) on a time series data ranging from 1990 to 2009. The result of the study indicates that development in financial sector variables viz: banking sector credits, total market capitalization and foreign direct investment positively affect economic growth variables – real gross domestic product. Also, Younis (2014) examined the significance of infrastructure investment for economic growth in Pakistan. Principle Component Analysis and VECM was employed in estimating the model. The study found that that long-run impact of private investment and social infrastructure investment on economic growth is positive and significant while economic infrastructure investment affects economic growth negatively. In short run, on the other hand, infrastructure investment does not have any significant impact on economic growth. But national savings rate and private investment rate show negative impact on growth, whereas, price of capital and direct tax have positive impact on economic growth.

In another major study, Afonso and Blanco-Arana (2018) conducted a research work on financial development and economic growth in OECD countries from 1990 to 2016. The study employed Random effect model and found that an increase in domestic credit provided by the financial sector, in market capitalization and in the turnover ratio of domestic shares entails a significant positive effect on per capita GDP. Similarly, it was revealed that the crisis on local credit as suggested by the market capitalization and financial sector varies across the period. different effects during the period. The result evinced that results there is a weak causal relationship between economic growth and financial development support the neutrality hypothesis in emerging countries, except for Turkey.

Bist (2018) conducted a study on financial development and economic growth in 16 African and non-African low-income countries from 1995 to 2014. Fully modified and Dynamic OLS was employed and the result established that there exists a cross-sectional dependence across the countries. The Pedroni's panel cointegration analysis provides clear support for the hypothesis that there exists a long-run cointegrating relationship between financial development and economic growth. Also, the long-run panel estimates indicate that financial development has a positive and significant impact on economic growth. Examining the nexus between

financial development and economic growth in European countries, Fuinhas, Filipe, Belucio and Marques (2019) using secondary data from 1990 to 2015 employed the Panel Vector Auto-Regressive model and ranger causality test. The outcome suggests the important of the introduction of euro and sub-prime crisis that the model, hence indicating the stability and endogeneity of the model. In the same vein, a two-way direction exists between development of the stock market and development of the banking sector, suggesting that the need by the government to put in place stable policies capable of attracting investors into the banking sector of the economy.

Moreover, Skare, Sinkovic and Rochon (2019) assessed financial development and economic growth in Poland from 1980 to 2018. The study employed VECM econometric techniques in estimating the model. Therefore, the result indicates both domestic shares and that of companies are significant and large. Similarly, total private credit share in the GDP retards the effect of financial development on economic growth. Furthermore, the study shows that financial series may possibly have long memory properties and that researching the financial development-growth nexus could require using fractional integration methods. In a cross-country study which investigates the impact of institutional quality on financial development on 15 emerging and growth-leading economies, Khan, Kong, Xiang and Zhang (2019) employed Two-Staged Least Square (2SLS) method on the model. The outcome shows that that openness, national culture, and economic growth significantly moderate financial development via their positive interaction with Institutional quality. Also, it was established that institutions play a significant role in driving emerging and growth-leading economies.

In the same vein, Aluko and Ibrahim (2020) examine the nexus between institutions with respect to financial development –economic growth relationship in 28 sub-Saharan Africa countries from 1996 to 2015. Generalized Method of Moments (GMM) estimation technique was used in estimating the model. The study found that when the International Country Risk Guide (ICRG)-based measure of institutions is used as the threshold variable, below the optimal level of institutional quality, financial development does not significantly promote economic growth. For countries with institutional quality above the threshold, higher finance is associated with growth. In another major study that investigates the effect of institutional quality on the finance–growth nexus: insights from West African countries, Olaniyi and Oladeji (2020) make use of dynamic generalized method of moments (GMM) technique to estimate the model. The result however suggest that financial development positively affected economic growth while its interaction with institutional quality hurt growth. Khan, Khan and Zuojun (2020) in their research work on institutional quality and financial development from 189 Developing and Emerging Economies. Employing dynamic models OLS, fixed effect, random effect, and generalized method of moments (GMM) estimators indicates that better institutions are important for financial development, specifically political stability, control of corruption and regulatory quality positively affect financial development.

Rule of law negatively affects financial development, which reveals that in most of the global countries, the rule of law is very weak.

Examining the impact of financial development, government expenditure, globalization and institutional quality on carbon dioxide emissions formed the central focus of Le and Ozturk (2020) in which the authors found that both the financial development, globalization and energy consumption worsen carbon dioxide emissions. The findings demonstrate that globalization, financial development, and energy consumption increase CO2 emissions. Besides, the environmental Kuznets Curve hypothesis is affirmed in emerging market and developing economies. The impact of institutional quality on economic growth and carbon emissions: Evidence from Indonesia, South Korea and Thailand from 1990 to 2016 was examined by Salman, Long Dauda and Mensah (2019). The study used Fully Modified Ordinary Least Squares and Dynamic Ordinary Least Squares methods to estimate the model. The result demonstrates the role of efficient and effective domestic institutions in simultaneously raising economic growth and reducing CO2 emissions. Also, institutional quality, energy use and trade openness stimulate economic growth. X-raying the nexus between infrastructure and growth in Nigeria using quarterly data from 1997: Q1 to 2017: Q4. Ebuh et al (2019) employed Vector Error Correction Model (VECM) and justify that infrastructure stock stimulates long-run real economy expansion in the country.

Ibrahim, Sare and Adam (2020) analyzed the application of frequency domain approach to the causal nexus between information, communication and technology infrastructure and financial development in selected countries in Africa using Granger Causality test. The result demonstrates that confirm the neutrality assumption giving the independency of both the financial development and ICT infrastructure in numerous nations. Also, in another major study that seeks to examine the significance of financial development, innovation and transportation infrastructure in attaining sustainability in China, Umar, Ji, Kirikkaleli and Xu (2020) found that a mutual relationship among the concerned variables. From a country specific study, Yinusa, Aworinde and Odusanya (2020) conducted a research study on institutional quality, financial development and inclusive growth in Nigeria from 1984 to 2017. The study employed asymmetric cointegration approach and established there is a long-run relationship between institutional quality, financial development and inclusive growth in Nigeria. Also, that adjustments process to equilibrium for institutional quality, financial development and inclusive growth were asymmetric in Nigeria. In a similar study which set out to examine Financial Development, Institutional Quality, and Environmental Degradation Nexus in Pakistan from 1996 to 2018, Ahmed, Kousar, Pervaiz and Ramos-Requena (2020) used Asymmetric ARDL approach to estimate the model. The result show that the significant long-run symmetric and asymmetric association of institutional quality (IQ) and financial development (FD) with environmental degradation (ED) and environmental sustainability. However, IQ- has an insignificant association with environmental sustainability.

## 3. RESEARCH METHODOLOGY

### 3.1. MODEL SPECIFICATION

In line with the progress so far recorded on the nexus between financial development, infrastructure and economic growth in the empirical literature, equations [3.1] and [3.2] are constructed to achieve the objectives of this study. While the equation [3.1] measures the non-linear effect of financial development on the growth of 20 SSA countries, equation [3.2] observes the interaction effect of financial development and infrastructure on the growth of the region.

[3.1] $$GDPPCGR_{it} = \beta_0 + \beta_1 FinDev_{it} + \beta_2 FinDevSQ_{it} + \beta_3 GCF_{it} + \beta_4 SchEnr_{it} + \beta_5 Infra_{it} + \beta_6 FDI_{it} + \epsilon_{it}$$

[3.2] $$GDPPCGR_{it} = \beta_0 + \beta_1 FinDev_{it} + \beta_2 FinDevSQ_{it} + \beta_3 GCF_{it} + \beta_4 SchEnr_{it} + \beta_5 Infra_{it} + \beta_6 FDI_{it} + \beta_6 FinDev\_Infra_{it} + \epsilon_{it}$$

Our model dependent variable is economic growth (GDPPCGR), measured by the per capita growth rate of GDP. The set of explanatory variables[1] are financial development (FinDev); its square (FinDevSQ); capital stock, measured by gross capital formation (GCF); human capital, measured by school enrollment rate (schenr); infrastructure (infra), measured by fixed telephone subscription (per 100 people) and foreign direct investment (FDI). $\beta_i$ ($i$ = 0,1,2,...,20) are the representative parameters for the intercept and slope coefficients; $\epsilon_{it}$ is the stochastic term, which captures the impacts of other variables that are not included in the model; *i* represents the cross-section (countries); *t* is the time-series (in years). More so, the data for this research, spanning 1985 – 2018, are drawn from the World Bank's World Development Indicators (WDI).

We expect a positive relationship between financial development and economic growth. This is in respect of Patrick's (1966) supply-leading hypothesis – where the financial system leads growth at the early stage of development – and demand-following hypothesis – with a supposition that the growth causes financial sector development as an economy approaches advanced degrees of development. Also, a positive coefficient is anticipated for infrastructure, as evident from several empirical studies (e.g. Sahoo et al., 2010; Younis, 2014). Our control variables (human capital, foreign direct investment, and capital stock) are equally expected to exert positive influences on economic growth, as postulated by several economists and various empirical studies (e.g. Zallé, 2019; Cobb & Douglas, 1928; Shittu et al., 2020).

[1] GCF, SchEnr, and FDI are chosen as control variables in line with their connections to the dependent variable.

### 3.2. THE TEST OF STATIONARITY

To address any possible cross-sectional dependence in the panel, this study also employs the technique developed by Pesaran (2007) in order to examine the existence (or otherwise) of unit root, as well as the order of the integration of the variables. This technique has the advantage of examining the unit root in the presence of cross-sectional dependence.

Suppose $Y_{it}$ is the observation on the i*th* cross-section and time *t* which are generated in line with a simple dynamic linear heterogenous model of the form:

[3.3] $$Y_{it} = (1 - \emptyset_i)\varepsilon_i + \emptyset_i Y_{i,\ t-i} + \varepsilon_{it},\ i=1,2,3,\ldots,N;\ t=1,2,3,\ldots,T$$

where *Y* represents each of GDPPCGR, FinDev, FDI, Infra, GCF, and SchEnr; the initial value $Y_{i0}$ has a density function with a finite mean and variance; while the stochastic term $(\varepsilon_{it})$ has the single-factor structure where $f_t$ is an unobserved common effect, and $Y_{it}$ is individual-specific error term.

[3.4] $$\varepsilon_{it} = \mathfrak{X} i f_t + Y_{it}$$

The stationarity hypothesis, $\emptyset_i$, may be expressed by combining equations [3.3] and [3.4] into [3.5]:

[3.5] $$\Delta Y_{it} = \alpha_i + \beta_i Y_{i,\ t-1} + \mathfrak{X}_i f_t + v_{it}$$

Hence, the null hypothesis (Ho: $\beta_i = 0$ for all *i*) may be tested against the alternative hypothesis (Ho: $\beta_i < 0$ for all $i = 1, 2, \ldots, N_1$) and $I = N_1+1, N_1+2, \ldots, N$.

Suppose $N_1/N$, the fraction of the individual stationary processes is non-zero and tends to the fixed value '$\delta$', such that $0 < \delta \leq 1$ as $N \rightarrow \infty$. This condition is necessary for the consistency of the panel unit root test.

### 3.3. PANEL AUTOREGRESSIVE DISTRIBUTED LAG (PARDL)

Given a dynamic panel *ARDL* of the form:

[3.5] $$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}^{'} X_{i,t-j} + \mu_i + \varepsilon_{it}$$

Such that: $i = 1, 2, 3, \ldots, 54$; $t = 1, 2, 3, \ldots, ;$ *Xit* is the set of independent variables and $y_{it}$ denotes the dependent variable; $\delta it$ are *k* x 1 vectors of the coefficients; $\lambda ij$ are the scalars; and $\mu i$ is the group-specific effect. *T* is assumed to be large enough to enhance model fitness for each of the separate groups; while the time-trend, as well as other fixed regressors, may equally be included. Again, one characteristic of the cointegrated variables is that they are responsive to any deviation from the path of convergence. This implies an error correction model for which the short-run system variable dynamics are being influenced by the level of divergence from equilibrium. Hence, the re-parametrization of the above equation into the error correction equation becomes necessary.

[3.6] $$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_i^{'} X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}^{'} * \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} ;$$

where:

[3.7] $$\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij}),\ \theta_i = \sum_{j=0}^{q} \delta_{ij} / (1 - \sum_{k} \lambda_{ik}),\ \lambda_{ij}^{*} = -\sum_{m=j+1}^{p} \lambda_{im}$$
$$j = 1,2,..., p-1, and\ \delta_{ij}^{*} = -\sum_{m=j+1}^{q} \delta_{im} \quad j = 1,2,..., q-1$$

From the equations, $\phi i$ is the error correction term (*ECT*), which indicates the speed of convergence to equilibrium, such that there would be no evidence of stable, long-run relationship if $\phi i$ is zero. This dynamic approach is superior to the static method in that the short-run feature of our model is easily distinguishable from that of the long-run, while the rate of the region's economy's returns to long-run equilibrium is easily established (Olawale & Hassan, 2016).

## 4. DISCUSSION OF FINDINGS

### 4.1. STATIONARITY ANALYSIS

To examine the unit root property, and the order of integration of the variables, the results of the stationarity tests are presented in Table 1.

**Table 1:** *Stationarity Analysis*

| Variables | Level | First Difference |
|---|---|---|
| FinDev | 1.640 | -10.053*** |
| Infra | 1.0315 | -5.5839*** |
| FDI | -4.060*** | 16.4714*** |
| Schenrol | 0.5386 | -3.829*** |
| GCF | 2.549 | -11.052*** |
| FinDevsq | 2.3649 | -14.651*** |
| Finhumacap | 0.0299 | -9.826*** |
| Infrafin | 1.329 | -3.804*** |

The unit root test is conducted at 'intercept & trend' condition; *** denotes significance at 1% level

*Source: Authors' computation*

From the figures presented in Table 1, FDI is found to be statistically significant at 1% critical value in the level form; this suggests that the null hypothesis (Ho: unit root) may be rejected at 1% level of significance. All other variables are, however, observed to be stationary only after the first difference, given that the probability value in each case is less than 1%. Therefore, based on the Pesaran (2007) CIPS and CADF stationarity methodology, our variables are confirmed to be integrated of orders zero and one, I(0) & I(1).

### 4.2. ESTIMATION OF THE SHORT-RUN AND LONG-RUN COEFFICIENTS

The estimates from the Pooled Mean Group (PMG) technique is presented in Table 2. The error-correction terms show significant and negative estimates such that the average convergence rate is 0.871. This implies that about 87% of the short-run disequilibrium is being corrected every year, so that the equilibrium condition is attained in the long-run.

***Table 2:*** *Short and Long-run Estimation Coefficients*

| | (i) | (ii) | (iii) |
|---|---|---|---|
| finadev | -0.0260*** | 0.0632*** | -0.0312*** |
| | (-3.88) | (3.65) | (-4.42) |
| fdi | 0.571*** | 0.562*** | 0.575*** |
| | (16.93) | (16.96) | (17.07) |
| gcf | 0.0104 | 0.00989 | 0.0101 |
| | (0.92) | (0.82) | (0.90) |
| schoolenrol | 0.0271* | 0.0294** | 0.0284** |
| | (2.52) | (2.84) | (2.65) |
| infra | -0.108* | -0.103* | -0.599* |
| | (-1.66) | (-1.64) | (-2.08) |
| finadevsq | | -1.350*** | |
| | | (-4.61) | |
| fininfra | | 0.231* | |
| | | (1.73) | |
| SR | | | |
| ec | -0.861*** | -0.891*** | -0.861*** |
| | (-36.98) | (-37.50) | (-37.06) |
| D.finadev | -0.0806*** | 0.195*** | -0.0964*** |
| | (-4.33) | (3.80) | (-4.79) |
| D.fdi | -0.494*** | -0.501*** | -0.498*** |
| | (-19.12) | (-19.15) | (-19.27) |
| D.gcf | 0.106** | 0.144*** | 0.111** |
| | (2.78) | (3.61) | (2.90) |
| D.schoolen~l | 0.107** | 0.0954* | 0.105** |
| | (2.77) | (2.48) | (2.71) |
| D.infra | 0.455* | 0.478* | -0.469 |
| | (1.89) | (2.00) | (-0.79) |
| D.finadevsq | | -3.627*** | |
| | | (-5.52) | |
| D.fininfra | | 0.492 | |
| | | (1.79) | |
| _cons | 0.800 | 4.401*** | -4.088 |
| | (0.93) | (3.49) | (-1.38) |

t - statistics in parentheses; * p<0.1, ** p<0.05, *** p<0.01

In the table above, a non-linear relationship is observed between financial development and economic growth in SSA region. Even though both the short-run and the long-run estimates provide for a negative linear relationship between the two variables, the positive effect dominates the negative one in both the short-run and the long-run estimate. This provides that financial development spurs economic growth by 0.002% in the long-run, as found in several previous studies (Balago, 2014; Bist, 2018; Yusuf et al., 2020; Afonso & Blanco-Arana, 2018). This confirms Patrick's (1966) supply-leading hypothesis, as well as King and Levine (1993b) proposition that financial system enhances risk diversification, stimulates productivity, and mobilizes foreign finance options for entrepreneurs. The converse is, however, the case in the non-linear estimates, as the square of financial development is largely found to be negative in both the short-run and the long-run. This submits that the positive influence of financial development on economic growth is to a certain extent after which it hurts growth. This may not be unconnected with the argument that a high level of financial openness reduces the aggregate real credit to local firms, thus lowering investment and slowing down the growth process (Samargandi et al., 2014 citing Van Wijnbergen, 1983 & Buffie, 1984).

Furthermore, our model control variables are found with the long-run expected signs; each of human capital and foreign direct investment is found to be significant and positive. The coefficient of capital stock is, however, found to be positive but not significant. Our empirical estimates also reveal an important linkage between economic growth and infrastructure, such that infrastructure is positive and negative in the short-run and the long-run, respectively. These short-run and long-run findings align with some researchers' (Canning & Pedroni, 2004; Hulten & Schwab, 1997) assertion that over time, an optimal level of infrastructure exists where growth is maximized, while anything beyond this level would reduce economic growth by dissuading investment from more productive resources. Hence, this negative long-run coefficient suggests that infrastructure reduces the growth rate of the SSA economy by an average of 0.27%. This is possible because of some challenges encountered in the process of infrastructural development, such as destruction of environment, abuse of public fund and wasteful investment, which ultimately hamper growth (see Sahoo et al., 2010). Finally, the interaction effect of infrastructure and financial development reveal a positive linkage with economic growth. This suggests that infrastructure enhances the long-run positive effect of financial development on the growth of SSA region by 0.23%.

## 5. CONCLUSION

The debate on the role of financial development on economic growth remains polarized in the economic literature. This is because some writers are of the opinion that the former scales up the latter, while some others hold the opposite view. In view of this, our research contributes to this important debate in the empirical context of SSA countries. Again, in arguing this relationship, some studies have examined the role of institutions, while some other have considered other moderating

variables, including human capital. This research deviates from this path by examining the interactive impact of infrastructure; this is important in view of the inefficiencies in infrastructural investments in SSA. Using the PMG estimation technique, our empirical findings suggest a non-linear linkage between financial development and economic growth, such that the positive impact outweighs the negative one in both the short-run and the long-run. The non-linear estimate, however, suggests that the positive influence of financial development on economic growth is to certain extent after which it hurts growth. Moreover, a negative long-run coefficient is observed on infrastructure, wherein it reduces the growth rate of the SSA economy by an average of 0.27%. On the final note, the interaction effect of infrastructure and financial development reveals a positive linkage with economic growth, wherein infrastructure enhances the long-run positive effect of financial development on the growth of the SSA countries by 0.23%. Furthermore, our model control variables are found with the long-run expected signs; each of human capital and foreign direct investment is found to be significant and positive. The coefficient of capital stock is, however, found to be positive but not significant.

The applicable policies are those that promote growth through infrastructural improvement and financial development. Precisely, the governments of these SSA countries are enjoined to promote policies that develop the financial services sector for the attainment of a sustainable economy; this may be achieved via increased credit to the private sector of the economy. In addition, the governments of SSA countries are encouraged to enhance both physical and human infrastructures in order to moderate the role of financial development on economic growth.

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