check for updates

THE NEXUS BETWEEN ECONOMIC GROWTH, FINANCIAL DEVELOPMENT, FINANCIAL INCLUSION AND FINANCIAL INNOVATION IN AFRICA

Check for updates

Adegbola Olubukola Otekunrin[1+]
Tough Chinoda[2]
Kudzanai Matowanyika[3]

[1]Senior Lecturer (PhD), Department of Accounting, Landmark University, Nigeria.
Email: otekunrin.adegbola@lmu.edu.ng

[2]Senior Lecturer (PhD), Faculty of Management and Entrepreneurial Studies Women's University in Africa, Harare, Zimbabwe.
Email: toughchinoda@gmail.com

[3]Senior Lecturer (PhD), Graduate Business School Chinhoyi University of Technology, Chinhoyi, Zimbabwe.
Email: kudzaimatowanyika@gmail.com

(+ Corresponding author)

ABSTRACT

This research explores the connection between economic growth, financial development, financial inclusion and financial innovation in Africa by employing the panel structural vector autoregression using annual data from 2004 to 2018. The vector error correction model Granger causality test was applied to examine directional causality with financial inclusion, financial innovation and economic growth used as dependent variables, and error correction term (ECT) coefficients are negatively significant at one percent for the long-term causality. It shows that the causal association between financial inclusion and financial innovation is explained by the African economy feedback hypothesis. The short-run causality shows a causal connection between economic growth and financial inclusion as well as financial innovation. It means that additional development in any one of these variables (i.e., economic growth, financial innovation and financial inclusion) will have a vital impact on connected variables, which can be noticed in the short run. This is why policymakers and government should consider each of the facets of financial inclusion and financial innovation as they do not merely affect each other; they also affect economic activities, hence fiscal policy is capable of steering more financial inclusions, financial innovation and financial development.

Contribution/Originality: This study was carried out to examine the connection between financial inclusion, financial innovation, economic growth and financial development, in Africa to show how facets of financial inclusion and financial innovation affect not only each other but how they affect economic activities in Africa as these effects are not yet well known.

1. INTRODUCTION

Financial innovation and financial inclusion play a pivotal role in the financial arrangement through maximizing financial efficiency and effectiveness. Empirically, financial innovation improves bank performance (Chipeta & Muthinja, 2018) and also leads to efficient financial intermediation and financial efficacy. On the other hand, financial inclusion cuts costs of finance, enhances formal credit and savings availability, accelerates the development of capital and bank-based financial institutions as well as financial stability (Ashraf, Karlan, & Yin,

2010; Babajide, Adegboye, & Alexander, 2015; Sarma & Pais, 2011; Swamy, 2012). The nexus linking financial inclusion and innovation is implicit and not yet well empirically tested. Researchers have examined the influence of financial innovation on economic growth (Bara & Mudzingiri, 2016; Qamruzzaman & Jianguo, 2017; Qamruzzaman & Jianguo, 2018a), firms' performance (Carbó-Valverde, Rodríguez-Fernández, & Udell, 2016), money demand (Dunne & Kasekende, 2018; Kasekende, 2016) and growth of the banking sector (Kamau & Oluoch, 2016). According to Qamruzzaman and Jianguo (2019), "financial innovation accelerates financial development allowing investment diversifications and risk minimization and thus plays a decisive role in economic growth (Bhatt & Mundial, 1989). In addition, a financial innovation augment the capital accumulation process in the financial system by encouraging savings propensity among the population with improved financial assists and intensifies investment opportunities by offering innovative and less risky financial instruments. Most prominently, financial innovations open a gate for the undeserving population in society to come under the umbrella of the formal financial system and avail of the benefits of finance." Qamruzzaman and Jianguo (2019) asserted that "nonetheless, financial inclusion is the ultimate output with the adaption and diffusion of financial innovation. Therefore, the question can arise; do financial innovations promote the speed of financial inclusion in the financial system or in another way, and does financial inclusion demand innovative financial instruments and services?" Qamruzzaman and Jianguo (2019) claimed that their study is "novel in various aspects. First, with the study, for the first time, the financial innovation index was developed as a proxy of financial innovation, rather relying on a single indicator. Even though the existing empirical literature had shown that several proxy indicators were used to address financial innovation in the equation, no consensus indicators appear in this regard. Therefore, this study tried to mitigate this gap by considering the financial innovation index with three (03) proxies, which have been repetitively used in different studies. Second, though empirical literature has produced evidence regarding the financial inclusion index measuring the economic inclusion effects, no such study has yet been performed. Third, so far, to the best of the author's knowledge, this is the first ever empirical investigation focusing on the nexus between financial innovation and financial inclusion." In line with previous studies mentioned above, this study examined the nexus between financial inclusion, financial innovation, economic growth and financial development in Africa.

2. LITERATURE REVIEW

2.1. Economic Growth and Financial Innovation

Although financial innovation plays a pivotal function in the modern financial system, it has received negligible interest from development agencies, policymakers, financial experts and researchers. Four versions of the causal hypothesis explain the financial innovation–growth nexus. Bara and Mudzingiri (2016); Shittu (2012); Beck (2010) and Qamruzzaman and Jianguo (2019) opined that "first, the supply-leading hypothesis is that financial innovation promotes economic growth by allowing financing expansion, trade efficiency, easy access to financial services, and efficiency in financial institutions dealing with customers. Second, the demand-leading hypothesis is that economic growth expands economic activities at both macro and micro levels. Therefore, financial services availability is imperative to maintain the normal speed of aggregated economic progression. Third, the feedback hypothesis is that it is caused by both financial innovation and economic growth and is also known as bidirectional causality. The feedback hypothesis explained that the effect could be observed from each one, and empirical literature has produced ample evidence." Fourth, Sekhar and Gudimetla (2013), Lumpkin (2010) and Qamruzzaman and Jianguo (2019) opined that the unbiased hypothesis means that between financial innovation and economic growth no causality exists.

2.2. Financial Development and Financial Innovation

Qamruzzaman and Jianguo (2019), citing Bhatt and Mundial (1989), opined that "financial innovation reduces the risk and transaction costs in the financial system through effective and efficient payment mechanisms,

institutional efficiency and thus accelerates capital market development. Financial innovation plays both objective and subjective roles in financial development, such as increased savings propensity in society by offering innovative financial assets and the accumulation of capital for investment to increase output. Financial innovation in the financial system leads to financial diversity by introducing diversified financial instruments; each of them possesses unique attributes and features. These diversifications in financial assets and services encourage savings propensity in society in the form of financial assets and borrowing that ensure efficient allocation of economic resources in productive investment projects. Further, the efficient allocation of savings into productive investment augments financial activities and ensures financial integration in the financial market, and thus allows financial development, at large." Using Kenyan banks, Chipeta and Muthinja (2018) unveiled empirical evidence in support of the financial innovation-led financial performance. They established that financial innovation and operational performance are positively related and this finding is in line with Muthinja (2016) and Makini (2010), who also concluded a financial innovation-led financial performance using Kenyan banks.

2.3. Financial Inclusion and Economic Growth

The connection between financial inclusion and economic growth has been severally and empirically examined across countries and using varying methodologies (Babajide et al., 2015; Evans & Lawanson, 2017; Evans, 2015; Iqbal & Sami, 2017; Kim, Yu, & Hassan, 2018; Lenka & Sharma, 2017; Okoye, Erin, & Modebe, 2017; Sethi & Acharya, 2018; Sharma, 2016). The results from these researches are mixed as well as indecisive. Studies that concluded that financial inclusion and economic growth are positively and significantly related include Lenka & Sharma (2017); Okoye et al. (2017); Iqbal and Sami (2017); Lenka and Sharma (2017); Okoye et al. (2017) and Sharma (2016). Studies that concluded that economic growth and financial inclusion are negatively and significantly related include (Kim et al., 2018). Gourene and Mendy (2019) concluded that economic growth and financial inclusion have no causality relationship, while Sethi and Acharya (2018); Kim et al. (2018) and Evans and Lawanson (2017) concluded that financial inclusion and economic growth have a bi-directional relationship.

2.4. Financial Inclusion and Financial Development

Countries that execute financial inclusion proficiently and effectively witness sustainable financial development (Rasheed et al., 2016). They also concluded that financial development and financial inclusion are positively related. Their research was based on ninety-seven countries' financial inclusion influence on financial development from 2004 to 2012 using system GMM evaluation. Qamruzzaman and Jianguo (2019) citied Allen et al. (2014) and asserted that "in Africa, innovation in financial services, like mobile banking, has a positive effect on overcoming financial, infrastructural limitations and allows the population to access financial services. The inclusion of the deprived and geographically located population in the mainstream of the financial system accelerates financial activities and simultaneously reduces the market fraction." Adeola and Evans (2017) concluded that financial development and financial inclusion are positively related and also that financial development and economic diversification are positively related. Their study focused on financial development as it relates to economic diversification as well as financial inclusion in Nigeria; they also asserted that their conclusion is contrariwise.

3. METHODOLOGY

The connection and causality involving financial inclusion financial innovation and in Africa were examined in this study with the use of annual data from 2004 to 2017 obtained from the Global Development Indicators Database (GDID) of the World Bank. We used a panel of 30 African countries selected based on data availability from 2004 to 2017. We examined the interaction between financial inclusion and innovation. Economic growth proxied by GDP and financial development (FD) was integrated into a panel structural vector error correction model (PSVECM) used to evaluate the connection between financial inclusion proxied by financial inclusion index

674

(FII) and financial innovation. Critics of using single indicators as proxies for financial inclusion include Naceur, Adolfo, and Alexander (2015); Sharma (2016); Evans (2015) and Sarma and Pais (2011). Due to these critics, this study adopted a financial inclusion index that consists of four indicators extensively used for financial inclusion; these include credit to the private sector, ATMs per 100,000 adults, depositors with commercial banks and commercial bank branches per 100,000 adults. The financial inclusion index (FII) was calculated using the key element analysis by combining the Cámara and Tuesta (2014) and Sarma and Pais (2011) approaches to surmount the flaws of every method. This study employed three widely used indicators of innovation. This was built up by this study for the first time using key element analysis methods for constructing the financial innovation index. The study also considered two macroeconomic fundamentals – economic growth and financial development (FD) – as independent variables. These two variables were incorporated since they both play a pivotal ordinance function in the financial structure, hence recognizing their feasible influence on financial inclusion and innovation. Domestic credit to private sector divided by GDP was used to measure financial development. We followed the footsteps of Gourene and Mendy (2019) and Emara and El Said (2019) who used GDP as measure of economic growth.

3.1. Methodological Framework and Modeling

We followed the PSVECM approach of Kwenda (2018) to explore the interplay among financial inclusion, financial innovation, economic growth and financial development in Africa. The structural model given Equation 1, 2 below is the reduced form of the PSVECM:

$$X_{it} = Y_i + Z(B) X_{it} + it \dots\dots\dots\dots\dots\dots\dots\dots\text{Equation (1)}$$

$X_{it} = (n \times k)$ vector variable is specified as:

$$X_{it} = (\text{FII, IFI, FD, GDP}) \dots\dots\dots\dots\dots\dots\dots\text{Equation (2)}$$

Where, financial inclusion index is IFI, FII is the financial innovation index, FD is the financial development, and GDP is the economic growth estimate. Y_i is the vector of variables signifying a country's intercept terms, Z(B) is the polynomial matrix of the lag operator that indicates how endogenous variables, as well as their lags, are interrelated, and $\mu_{it} = \theta^{-1} \kappa \varepsilon_{it}$ and/or $\theta it = \kappa \varepsilon_{it}$ is a vector of arbitrary interruption.

We imposed precincts in the matrix θ to convalesce the information in the structural model, and K in the system as contained in Equation 3 below, in line with Kwenda (2018).

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ \pi_{21} & 1 & 0 & \pi_{24} \\ 0 & \pi_{32} & 1 & 0 \\ \pi_{41} & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{it}^w \\ \varepsilon_{it}^x \\ \varepsilon_{it}^y \\ \varepsilon_{it}^z \end{bmatrix} = \begin{bmatrix} \tau_1 & 0 & 0 & 0 \\ 0 & \tau_2 & 0 & 0 \\ 0 & 0 & \tau_3 & 0 \\ 0 & 0 & 0 & \tau_4 \end{bmatrix} \begin{bmatrix} \omega_{it}^w \\ \omega_{it}^x \\ \omega_{it}^y \\ \omega_{it}^z \end{bmatrix} \quad (3)$$

The notations w, x, y and z are used to represent each variable FII, IFI, FD and GDP. The terms ϵ_{it}^w, ϵ_{it}^x, ϵ_{it}^y and ϵ_{it}^z are residuals in reduced-form disturbances to both the endogenous (domestic) and the exogenous (foreign)

variables, which additionally symbolize the unpredicted shocks of each variable. The associated structural shocks

with the parallel equations are denoted by the subsequent residuals: $\omega_{it}^w, \omega_{it}^x, \omega_{it}^y$ and ω_{it}^z.

3.2. Research Questions and Proposed Hypotheses

Our study unveils a novel perception by examining the nexus between financial inclusion and financial innovation whilst integrating economic growth and financial development as two additional variables through the application of the PSVECM by following the proposed structure by Kwenda (2018). The proposed hypotheses and possible causality among the variables are summarized in Figure 1.

H1A, B: Financial innovation Granger-causes financial inclusion as well as contrariwise.

H2A, B: Financial inclusion Granger-causes financial development as well as contrariwise.

H3A, B: Financial development Granger-causes economic growth as well as contrariwise.

H4A, B: Financial innovation Granger-causes economic growth as well as contrariwise.

H5A, B: Financial inclusion Granger-causes economic growth as well as contrariwise.

H6A, B: Financial innovation Granger-causes financial development as well as contrariwise.
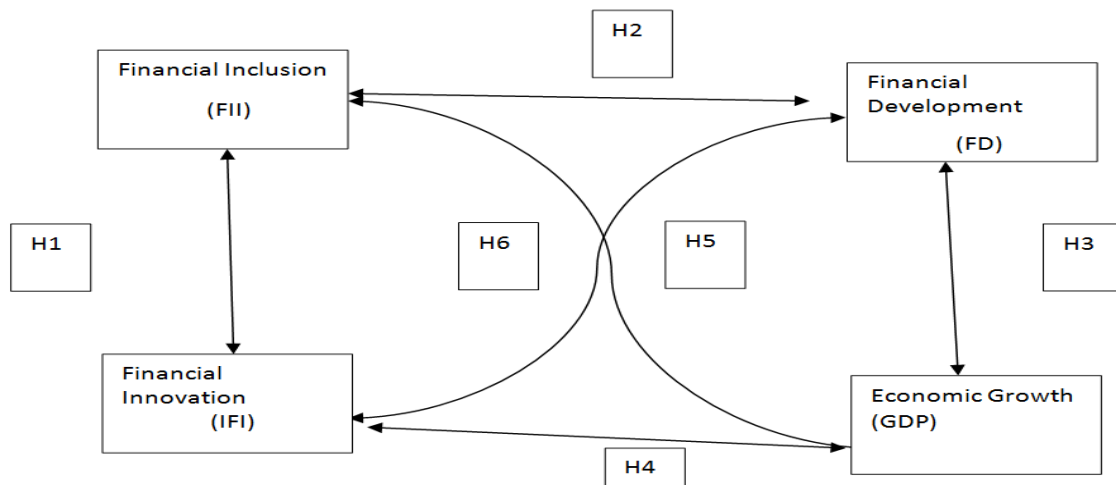

Figure-1. Feasible casualty and theoretical structure.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 1 presents the analysis of financial inclusion (FII), financial innovation (IFI), financial development (FD) and economic growth (GDP) using descriptive statistics. The minimum value and the maximum value are as shown in the table. Also shown are the mean standard deviation and the probability values.

Table-1. Descriptive Statistics Summary.

	Obs.	Mean	Std. Dev.	Max.	Min.	Prob.
Financial Inclusion (FII)	420	0.215	0.171	0.88	0.16	0.000
Financial Innovation (IFI)	420	0.181	0.042	0.76	0.12	0.000
Financial Development (FD)	420	10.02	6.91	62.08	2.36	0.000
Economic Growth (GDP)	420	2.58	4.82	30.65	-62.25	0.000

4.2. Panel Unit Root and Cointegration Test

Several unit root tests were performed to check stationarity in the data set, following existing empirical literature. These include the Phillips–Perron test proposed by Maddala and Wu (1999), chi-squared test proposed by Im, Pesaran, and Shin (2003) and the augmented Dickey–Fuller and Fisher tests proposed by Maddala and Wu

(1999) that assume the null hypothesis that all the panels have a unit root test. The results of this research confirm that variables were not integrated similarly, as indicated in Table 2 and Table 3. The variables FII and FD are stationary at level I (0), whereas GDP and IFI turn out to be stationary after the first difference I (1).

Table-2. IPS, ADF and PP Unit Root Tests @ I (0) Level.

	IPS		ADF		PP	
	Statistics	Calculated prob.	Statistics	Calculated prob.	Statistics	Calculated prob.
GDP	-0.82270	0.2053	49.2592	0.5030	71.3228	0.0255
IFI	1.36505	0.9139	40.2330	0.8367	45.6002	0.6504
FII	-4.91861	0.0000	74.9299	0.0045	107.756	0.0000
FD	-0.77402	0.2195	59.7416	0.0840	119.639	0.0000

Table-3. IPS, ADF and PP Unit Root Tests @ I (1) Level.

	IPS		ADF		PP	
	Statistics	Calculated prob.	Statistics	Calculated prob.	Statistics	Calculated prob.
ΔGDP	-1.99073	0.0233	68.0191	0.0458	89.8449	0.0005
ΔIFI	-3.0625	0.0011	86.1722	0.0011	85.8807	0.00 2
ΔFII	-7.34936	0.0000	125.812	0.0000	281.428	0.0000
ΔFD	-4.577 4	0.0000	100.588	0.0000	315.677	0.0000

After the stationarity between the variables has been determined, we then assessed the likely subsistence of cointegration among economic growth, financial inclusion, financial development and financial innovation using the Johansen maximum chance framework (Johansen, 1988; Johansen & Juselius, 1992). Table 4 shows the panel cointegration test. The trace test and the maximum eigenvalue test concluded that no cointegration null hypothesis is rejected, indicating the subsistence of three cointegrating associations. Consequently, this shows a positive and long-run connection between financial innovation, financial inclusion, financial development and economic growth in Africa. Since VAR models are consistently sensitive to lag, we used likelihood ratio (LR), final prediction error (FPE), Schwarz criterion (SC) and Akaike information criterion (AIC) selection criteria, all of which imply the use of a lag length of four. We also carried out misspecification tests for serial correlation, as well as stability tests for the model. The Lagrange multiplier (LM) test showed no serial correlation at the particular lag, and the model passed the stability test.

Table-4. Cointegration Test Results.

Model: (FII, IFI, FD, GDP) VAR lag = 4.

H_0	H_1	$\lambda TraceValue$	5% Critical value	λmax	5% Critical value
r = 0	r ≥ 1	59.21***	47.84	35.70***	27.57
r ≤ 1	r ≥ 2	23.50	20.57	13.6	21.12
r ≤ 2	r ≥ 3	9.902	15.48	8.07	14.25
r ≤ 3	r ≥ 4	1.836	3.84	1.36	3.84

Note: r indicates the number of the cointegrating vectors. (***) denotes statistical significance at 10%.

4.3. Panel SVECM Results

In line with Amisano and Giannini (1997) identification scheme, 22 or $2n^2 - n(n + 1)/2$ limitations were

imposed on the A and B matrices mix (n represents variables' digit) for the 4-variable PSVECM. Sixteen maximum limitations were imposed on the transverse matrix B and as a consequence the A matrix riveted the residual six limitations for the system to be precisely classified. Given that the non-recursive PSVECM applied 16 zero limitations on A, the system is over-classified, and ten free parameters in the A matrix with the six in the B matrix

677

were estimated, as per Equation 3. The PSVECM used in this study contains four variables, financial inclusion (FII), financial innovation (IFI), economic growth (GDP) and financial development (FD)

4.4. The VECM Granger Causality Test

The VECM Granger causality test was applied to examine directional causality connecting financial inclusion, financial innovation, economic growth and financial development, as shown in Table 5. Error correction term (ECT) coefficients were used to determine long-term causality presence in the model. With financial inclusion, financial innovation and economic growth used as the dependent variables, ECT coefficients are negatively significant (at one percent) for the long-term causality. The result shows bidirectional casualty between financial inclusion and financial innovation [IFI <==> FII]. This result is similar to the result of Qamruzzaman and Jianguo (2018a), Qamruzzaman and Jianguo (2018b), Qamruzzaman and Jianguo (2018c). It shows that the causal association between financial inclusion and financial innovation is explained by the African economy feedback hypothesis. The short-run causality shows the causal association between economic growth and financial inclusion [GDP <==> FII] as well as the causal connection between financial innovation and financial inclusion [IFI <==> FII], which is also explained by the African economy feedback hypothesis. It means that further development in economic growth, financial innovation and financial inclusion will have a decisive impact on related variables, which can be noticed in the short run. This result is similar to the results of Sethi and Acharya (2018), Evans and Lawanson (2017) and Kim et al. (2018).

Table-5. VECM Granger Causality Test Results.

Dependent Variables	Short-run Causality				Lagged Error Correction Coefficient	
	Independent Variables					
Model: VECM with (IFI, FII, GDP, FD)						
	IFI	FII	GDP	FD	ECT (-1)	Remarks
IFI	-	0.32 (0.003)**	0.016 (0.261)	0.22 (0.04)*	-0.168(0.002)*	Presence
FII	2.01 (0.012)**	-	0.008 (0.001)**	2.29 (0.12)	-0.024 (0.014)**	Presence
GDP	0.66 (0.021)	2.61 (0.002)**	-	0.35 (0.52)	-0.648 (0.002)**	Presence
FD	0.15 (0.013)**	5.56 (0.11)	0.57 (0.002)**	-	0.141 (0.282)	

Note: The short-run causality shows also a unidirectional connection between financial development to financial inclusion [FD ==> FII] and to economic growth [FD ==> GDP]. Also, the financial innovation and financial development follows a feedback hypothesis [IFI <==> FD].

5. CONCLUSIONS

The connection between financial inclusion and financial innovation in Africa was examined in this study with the use of annual data from 2004 to 2017. Economic growth and financial development were integrated into a panel SVECM to evaluate the connection involving financial inclusion and financial innovation. The study established three cointegrating relationships and the results disclosed bidirectional casualty between financial inclusion and financial innovation. It shows that the causal association between financial inclusion and financial innovation is explained by the African economy feedback hypothesis. The short-run causality shows a causal connection between economic growth and financial inclusion [GDP <==> FII] as well as a causal association between financial innovation and financial inclusion [IFI <==> FII]. This imply that further increase in one of the variables, has an imperative impact on associated variables i.e. economic growth, financial innovation and financial inclusion, which can be noticed in the short run. The short-run causality shows also unidirectional connection between financial development to financial inclusion [FD ==> FII] and to economic growth [FD ==> GDP]. Also, the financial innovation and financial development follows a feedback hypothesis [IFI <==> FD]. This indicates why

policymakers and government should consider each facet of financial inclusion and financial innovation to steer more development in these areas, as they do not merely affect each other but also affect wider economic activities.

REFERENCES

Adeola, O., & Evans, O. (2017). Financial inclusion, financial development, and economic diversification in Nigeria. *The Journal of Developing Areas, 51*(3), 1-15.Available at: https://doi.org/10.1353/jda.2017.0057.

Allen, F., Carletti, E., Cull, R., Qian, J. Q., Senbet, L., & Valenzuela, P. (2014). The African financial development and financial inclusion gaps. *Journal of African Economies, 23*(5), 614-642.Available at: https://doi.org/10.1093/jae/eju015.

Amisano, G., & Giannini, C. (1997). *Topics in structural VAR econometrics* (2nd ed.). Springer: Berlin.

Ashraf, N., Karlan, D., & Yin, W. (2010). Female empowerment: Impact of a commitment savings product in the Philippines. *World Development, 38*(3), 333-344.Available at: https://doi.org/10.1016/j.worlddev.2009.05.010.

Babajide, A. A., Adegboye, F. B., & Alexander, E. O. (2015). Financial inclusion andeconomic growth in Nigeria. *International Journal of Economics and Financial Issues, 5*(3), 629–637.

Bara, A., & Mudzingiri, C. (2016). Financial innovation and economic growth: Evidence from Zimbabwe. *Investment Management and Financial Innovations*(13, Iss. 2), 65-75.Available at: https://doi.org/10.21511/imfi.13(2).2016.07.

Beck, T. (2010). *Financial development and economic growth: Stock markets versus banks? In Africa'sFinancial Markets: A real development tool.* Tilburg: Tilburg University.

Bhatt, V. V., & Mundial, B. (1989). *Financial innovation and credit market development.* Washington, DC: World Bank.

Cámara, N., & Tuesta, D. A. (2014). Measuring financial inclusion: A muldimensional index (September 22, 2014). BBVA Research Paper No. 14/26.

Carbó-Valverde, S., Rodríguez-Fernández, F., & Udell, G. F. (2016). Trade credit, the financial crisis, and SME Access to Finance. *Journal of Money, Credit and Banking, Blackwell Publishing, 48*(1), 113-143.

Chipeta, C., & Muthinja, M. M. (2018). Financial innovations and bank performance in Kenya: Evidence from branchless banking models. *South African Journal of Economic and Management Sciences, 21*(1), 1-11.

Dunne, J. P., & Kasekende, E. (2018). Financial innovation and money demand: Evidence from Sub-Saharan Africa. *South African Journal of Economics, 86*(4), 428-448.

Emara, N., & El Said, A. (2019). Financial inclusion and economic growth: The role of governance in selected MENA countries, Munich Personal RePEc Archive, Rutgers University (pp. 1-42): City University London.

Evans, O., & Lawanson, O. (2017). A multi-sectoral study of financial inclusion and economic output in Nigeria. *Ovidius University Annals, Economic Sciences Series, 17*(1), 195-204.

Evans, O. (2015). The effects of economic and financial development on financial inclusion in Africa. *Reviewof Economics and Development Studies, 1*(1), 17–25.

Gourene, G. A. Z., & Mendy, P. (2019). Financial inclusionand economic growth in WAEMU: AMultiscale heterogeneity panel causality approach. *Theoretical Economics Letters, 9*, 477-488.Available at: https://doi.org/10.4236/tel.2019.93033.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), 53–74.

Iqbal, B. A., & Sami, S. (2017). Role of banks in financial inclusion in India. *Contaduría y Administración, 62*(2), 644-656.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control, 12*(2–3), 231–254.

Johansen, S., & Juselius, K. (1992). Testing structural hypotheses in a multivariate cointegration analysis of the PPP and the UIP for UK. *Journal of Econometrics, Elsevier, 53*(1-3), 211-244.Available at: https://doi.org/10.1016/0304-4076(92)90086-7.

Kamau, D. M., & Oluoch, J. (2016). Relationship between financial innovation and commercialbank performance in Kenya. *International Journal of Social Science and Information Technology, 2*(4), 1–19.

Kasekende, E. (2016). *Financial innovation and money demand in Sub-Saharan Africa.* PhD Thesis,University of Cape Town, Cape Town, South Africa.

Kim, D.-W., Yu, J.-S., & Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance, 43*, 1-14.

Kwenda, F. (2018). A panel VECM analysis of competition, access to finance and economic growth in BRICS, Acta Universitatis Danubius. *Œconomica, 14*(1), 138-154.

Lenka, S. K., & Sharma, R. (2017). Does financial inclusion spur economic growth in India? *The Journal of Developing Areas, 51*(3), 215-228.

Lumpkin, S. (2010). Regulatory issues related to financial innovation. *OECD Journal: Financial Market Trends, 2009*(2), 1–31.

Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics, 61*(S1), 631-652.

Makini, S. O. (2010). *The relationship between financial innovation and financial performance ofcommercial banks in Kenya.* Master's Thesis, University of Nairobi, Nairobi, Kenya.

Muthinja, M. M. (2016). *Financial innovations and bank performance in Kenya: Evidence from branchless banking models.* PhD Thesis, University of the Witwatersrand, Johannesburg, South Africa.

Naceur, S. B., Adolfo, B., & Alexander, M. (2015). *Can islamic banking increase financial Inclusion?* Washington, DC: International Monetary Fund.

Okoye, L. U., Erin, O., & Modebe, N. J. (2017). Financial inclusion as a strategy for enhanced economic growth and development. *The Journal of Internet Banking and Commerce, 6*(2), 1–14.

Qamruzzaman, M., & Jianguo, W. (2017). Financial innovation and economic growth in Bangladesh. *Financial Innovation, 3*(1), 1-24.

Qamruzzaman, M., & Jianguo, W. (2018a). Financial innovation, stock market development, and economic growth: An application of ARDL model. *International Journal of Financial Studies, 6*(3), 1-30.Available at: https://doi.org/10.3390/ijfs6030069.

Qamruzzaman, M., & Jianguo, W. (2018b). Nexus between financial innovation and economic growth in South Asia: Evidence from ARDL and nonlinear ARDL approaches. *FinanceInnov, 4*(20).Available at: https://doi.org/10.1186/s40854-018-0103-3.

Qamruzzaman, M., & Jianguo, W. (2018c). Does foreign direct investment, financial innovation, and tradeopenness coexist in the development process: Evidence from Selected Asian and African Countries? *British Journal of Economics, Finance and Management Sciences, 16*(1), 73-94.

Qamruzzaman, M., & Jianguo, W. (2019). Financial innovation and financial inclusion nexus in South Asian countries: Evidence from symmetric and asymmetric panel investigation. *International Journal of Financial Studies, 7*(61), 1-27.Available at: 10.3390/ijfs7040061.

Rasheed, A., Wen, W., Gao, F., Zhai, S., Jin, H., Liu, J., & Xia, X. (2016). Development and validation of KASP assays for genes underpinning key economic traits in bread wheat. *Theoretical and Applied Genetics, 129*(10), 1843-1860.Available at: https://doi.org/10.1007/s00122-016-2743-x.

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development, 23*, 613-625.Available at: https://doi.org/10.1002/jid.1698.

Sekhar, S., & Gudimetla, V. (2013). Theorems and theories of financial innovation: Models and mechanism perspective. *Financial and Quantitative Analysis, FQA, 1*(2), 26-29.Available at: https://doi.org/10.12966/fqa.05.02.2013.

Sethi, D., & Acharya, D. (2018). Financial inclusion and economic growth linkage: Some cross country evidence. *Journal of Financial Economic Policy, 10*(3), 369-385.Available at: https://doi.org/10.1108/jfep-11-2016-0073.

Sharma, D. (2016). Nexus between financial inclusion and economic growth: Evidence from the emerging Indian economy. *Journal of Financial Economic Policy, 8*(1), 13–36.

Shittu, A. I. (2012). Financial intermediation and economic growth in Nigeria. *British Journal of Artsand Social Sciences, 4*(2), 164–179.

Swamy, V. (2012). Impact of macroeconomic and endogenous factors on non performing bank assets. *The International Journal of Banking and Finance, 9*(1), 27-47.