“Financial technology development: Implications for traditional banks in Africa”

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FINANCIAL TECHNOLOGY DEVELOPMENT: IMPLICATIONS FOR TRADITIONAL BANKS IN AFRICA

Abstract

The speed of financial technology (Fintech) adoption in delivering financial services has raised concerns among researchers on the future of traditional banks, especially as authors believe that Fintech comes with both prospects and problems. This study therefore aims to examine the growth, measurements, and the impact of Fintech on traditional banks in a panel of sixteen African countries for the period 1800–2020. These periods were divided into three phases: the analogue (1800–1967), the digital (1967–2008), and the modern phases (2008–2020). The autoregressive distributed lag (ARDL) and descriptive analyses methods were used to investigate the study's objectives. It found that the analogue era witnessed the birth of Fintech ideas, while the digital era witnessed structural changes within the financial system. Results from the pooled mean group ARDL estimation technique based on the third/modern era reveal that, on average, a unit increase in Fintech adoption significantly reduces bank profitability (ROA) by 12.6%. Hence, although early Fintech adoption poses no threat to bank profitability; however, beyond certain threshold, its continuous adoption reduces profitability. Again, the speed of adjustment at 90.9% per annum is an indication that short-run Fintech disruptive impact/disequilibrium is corrected within one year and one month. The Principal Component Analysis used to generate Fintech index shows that African Fintech's operation is more susceptible to changes in mobile banking. The study concludes that too much Fintech adoption is unhealthy for traditional banks in Africa and therefore it recommends that Fintech should collaborate with banks to correct for its disruptive impacts.

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INTRODUCTION

The emergency of financial technology (Fintech) has continued to improve financial service delivery since the global financial crisis in 2008. This could be due to its ability in combining financial models with information technology to extend financial services faster and with minimal cost. It is a building system that models, values, and processes financial services and products such as bonds, stocks, contracts, and money (Freedman, 2006). This definition tries to explain Fintech only from the viewpoint of financial product provision thereby neglecting its financing and payment role. Ryu (2018) tried to fill this gap by defining it as products or services in non-financial institutions created with highly innovative and disruptive service technologies. This suggests that Fintech is a specialized progression, consequential to developed and established financial software capable of influencing the entire banking system (Lee & Kim, 2015). Hence, its progressive and evolving nature makes Fintech to delve into creating and diversifying financial services in a more sophisticated and user-friendly way, thereby threatening the future existence and profitability of traditional banks.

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Before now, the rate technology/innovation adoption is poor among banks in Africa given the high structural transformation it requires. As a result, most banks in Africa resort to the use of manual or crude means to create and extend financial services. Despite the crude means of financial service delivery, most of the financial innovations used by banks are domiciled within the banking system (e.g., ATM). These have led to poor access to financial services. Besides, there is excess regulations of banks by financial authorities in Africa with poor incentives and high rate of system and institutional failures. All these are capable of limiting banks' profitability and further threaten their continual existence. Consequently, researchers and investors are beginning to seek for a technology-enabled financial solution and examine the extent to which the adoption of Fintech can detract from banks profitability. This, among others, is the focus of this study.

1. LITERATURE REVIEW

Over the years, the general focus in the literature on Fintech has been on what are the determinants of its adoption rate and its impact on financial development and growth. Emphasis has not been placed on how Fintech has evolved over the years as that can help to determine its unique functions overtime and how it drives financial services. Therefore, a brief review of this developmental process is necessary to see how it has impacted bank profitability with special reference to African economies. For the sake of clarity of the purpose, this review is summarized in three categories, namely the analogue era, the digital era, and the modern era.

The analogue era dates back to the 18th century until 1967 (Arner et al., 2015). The period that spans from before the two world wars and the immediate or early post-war periods witnessed the birth of Fintech ideas. During these periods, banking and financial activities were done with the use of traditional methods. It marked the emergence of technology and finance and their interplay in the production of the first period of financial globalization. This period was characterized by the introduction of the first telegraph for commercial use in 1838 (Barbiroli, 2013). It also witnessed the laying of the first successful transatlantic cable in 1866 by the Atlantic Telegraph Company (Hills, 2010). This success aided communication thereby leaving the consumer with the possibility of making and receiving orders at a much faster rate than previously known (Müller-Pohl, 2010). Prior to these achievements and other similar developments[1], people had lost confidence in the then Goldsmith banking system[2]; hence they resorted to other alternative ways of securing wealth. Financial inter-linkages across borders were carried out with the use of technologies such as the telegraph, canals, and steamships, thereby allowing an enormous diffusion of financial information, transactions, and payments around the world (Arner et al., 2015). This era of financial globalization witnessed lots of great transformation in technology which continued until the commencement of World War I.

However, shortly after the war, the global financial market experienced some drawbacks and developmental constraints for some years. The drawbacks notwithstanding, remarkable advancement in technology and information communication, which later became a catalyst for post-war economic recovery, were experienced. Not long after, other inventions like the International Business Machines (IBM) and the financial calculator, which was produced by Texas Instruments in 1967, came into existence. By 1950s, credit cards were invented in America (Arner et al., 2015). The adoption of the Interbank Card (now MasterCard) in 1966 at the United States coincided with the introduction of the global Telex network in in the same year (Arner et al., 2015). Consequently, online stock trading, digital record-keeping and e-commerce emerged, and these have continuously evolved at a fast since the 1950s bringing about great transformation within the financial and technology industries. Moreover, Arner et

1 Other similar developments such as steam engine, telephone, locomotive, ironclad ship, and particularly, the great depression of 1930 made people to lose interest in the then financial system (Danelek, 2010).

2 Goldsmith banking style is a banking model that evolved in the 17th century from the London goldsmith who accepted people's wealth in terms of gold and issued them with receipts of ownership and eventually expanded to accept deposits, offer loans, provided bills of exchange and transferred money leading to the development of cheques. It is this cheque that people eventually started using as money.

al. (2015) observed that the Xerox Corporation in 1964 introduced the first commercial version of the telex and the fax machine but under the name of Long Distance Xerography (LDX). This provided the fundamental network of communications that were necessary to build the next stage of Fintech advancement.

These innovations were aimed at giving the consumers high value and satisfaction for their money by bridging the gap between their expectations and their usual experience in banking. However, this gap seems to remain and widens continuously over the years due to its inability to meet the numerous and ever-increasing customers' expectations in service delivery. This gap was more pronounced among African economies/banks as they still adopt traditional means of banking in financial service delivery, hence no remarkable inventions were recorded among African economies at that time. Therefore, the widening of this gap suggests that there is a need for a better means of service delivery. It is this quest and the combined developments already in place that necessitated and gave rise to the commencement of the next era, which is the digital era.

The next phase, which is the digital Era, spans from 1967–2008 and it witnessed diverse Innovations and structural changes within Traditional Banks. This era was necessitated by the increasing commercialization, trade, and financial activities, which commercial banks could not handle with their traditional means of banking. The advent of mobile phones and Internet services also contributed to developments in this period. It was also necessitated by the quest to bridge the gap between customer expectations and usual experience in banking. The challenge of this era was that further innovations seemed to be depleting bank profits. This era posed significant risks to traditional banks in terms of bottom-line – profit. It is noteworthy however that despite the challenges posed by the emerging innovations to the banking sector in this era, banks were quite receptive and supportive of Fintech, and ultimately these financial innovations, contributed to the growth of the banking sector globally (Uskovic, 2015). A case in point was the growth of banks from approximately 18,000 to over 82,000 between 1950 and 2014 in the United States (Desai, 2015). Also in 1968, the Inter-Computer Bureau was established in the UK, which created an inter-switch for Bankers in payment and brought about the establishment of Bankers' Automated Clearing Services (BACS) in the US by 1970 (Welch, 1999). These innovations, as well as the global response to the 1987 stock market crash in the US, significantly marked the beginning of the second period of the Fintech revolution.

In addition, the early 1980s witnessed the invention of bank mainframe computers and more sophisticated approach to data analyses and record-keeping systems to handle large data transactions that might not be handled manually (Desai, 2015). With the emergency of Internet in the 90s, the birth of online banking system was actualized, and the Internet has widened the scope of Fintech to include Google Wallet, Bitcoin, mobile banking, facial recognition and more (Uskovic, 2015). Following these developments, a number of banks in the US reported more than one million online banking customers in 2001 (Arner et al., 2015). The invention of mobile phones, smartphones in particular, has greatly enhanced online mobile banking and fostered the modern Fintech era.

The Modern Era (2008 – to date) witnessed the advent and growth of Fintech. This is because the term Fintech was first used in the financial world in 2008 (Gimpel et al., 2018). This marked the beginning of tremendous innovations in the field of finance following the 2008 global financial crisis. Consequently, many financial authorities began to innovate and employ a technology-enabled solution in creating and extending financial services, thereby leading to a rapid growth of a technology-aided financial service delivery. The inherent benefits of technology-mediated financial solutions led to wide acceptance and adoption beyond the global forecast rate. Its rapid growth has been very beneficial across the globe to in terms of its ability to reach the previously financially excluded communities, low costs of financial transactions, and increased competition (Howard, 2018). This era has witnessed tremendous consumer-friendly innovations that create easy access to funds, better payment systems, greater convenience, advanced security, and speedy financial services.

Innovations such as online banking using computers and smartphones were introduced during this era. Because of the advances in technology-medi-

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ated financial solutions, businesses could now be crowdfunded instead of resorting to the traditional financing option – bank loans. In addition to these innovations, bitcoin was launched in 2009 to provide mobile payment solutions and peer-to-peer money transfer service. Transfer-wise was created in 2011 to make funding available for investment purposes. Bitcoin ensures the privacy of the individual bitcoin-holder. It provides a secure network in which different amounts of money can be transferred from person to person electronically and for free with the use of digital wallets. This gave birth to present day Fintech. This development makes the expensive banking style obsolete and outdated as it gives some flexibility and the power to circumvent the banking system. It generally aims to appeal to end-users with services that are user-friendly, efficient, transparent, and automated than what is presently available (Dorfleitner et al., 2017). In addition, this era is also characterized by the high growth of Fintech with a global adoption rate of 33 percent (Ernest & Young, 2017).

The huge commercialization in businesses has enhanced the dependency of banks on technology-aided transactions given their inability to meet the numerous customers' expectations in service delivery (Eric, 2017). Fintech now fills this demand, thereby entrenching some risk on bank profitability through the extension of loans, management of assets, as well as provides easy methods to pay those loans, hence a huge frustration for banks (Uskovic, 2015). To be more precise, Fintech closes potential profit avenues for banks. Goldman estimated that the amount of bank revenue that Fintech start-ups are capable of depleting is about $4.7 trillion, and $470 billion in profit (Allayannis & Cartwright, 2017). Therefore, the future of traditional banks and the entire financial system seems to be at the mercy of Fintech companies. Therefore, this era is often referred to as the era of competition between commercial banks and Fintech companies. This is because most financial services that were previously performed by banks can now be done by Fintech companies at a faster and better rate.

The issue on debate, therefore, is whether Fintech will replace traditional banks given its (Fintech) fast rate of revolution, ease of adaptation to changes, ability to innovate faster, and tested and maintained products that regulation-laden banks could not do. However, it is unlikely that Fintech will replace existing traditional banks because Fintech companies still depend on existing bank accounts to operate (Eyal, 2017). Consequently, this study seeks to examine Fintech revolutionary process, suggests its possible measurement, and investigates how Fintech can impact the performance of traditional banks in selected African markets.

2. METHODOLOGY

This section comprises a brief discussion of the theory, model specification, data sources and measurements, and the estimation technique used to analyze the data. The CAMEL theory explains that bank profitability is better assessed, using some ratio indicators and its level of technology/assets adoption. The word "camel" is a list of acronyms which states that bank profitability is a function of their capital adequacy (C), assets quality (A), managerial efficiency (M), earning ability (E) and liquidity (L) of the banks (Council, 1996). Therefore, as long as banks generate reasonable percentage of their capital to total assets/technology adopted, keep non-performing loan within a manageable horizon, have competent management, earn good interest on loan and are liquid enough to meet any unforeseen financial obligation, they will continue to be profitable.

Therefore, as banks maintain a good stand of these ratings, it will both continue to make profit, as well as meet any financial unexpected condition that might arise from financial, economic or technology risks. These factors are often referred to as internal determinants of bank profitability; therefore, the external determinants will include Fintech and output growth. For the sake of simplicity and availability of data, this study considers three major internal determinants such as capital adequacy, assets quality and managerial efficiency, whereas the external determinants are Fintech and growth rate of the economy.

2.1. Sources and measurement of data

The study includes sixteen African economies, and data spanning through the period 2004 to 2020 were sourced from the World Bank database.

African markets were the focus of this study as they face intense bank distress following the advent of financial technology (SARB, 2016). The data used consists of both bank-specific and external/macroeconomic variables. The dependent variable is bank profitability, which is measured in terms of profit to asset ratio, whereas non-interest income, bank liquid assets to total assets ratio, growth rate of GDP, and an index of Fintech were the independent variables.

2.2. Model specification

Based on the theoretical framework, the econometric specification of the model is therefore presented thus:

$$ROA_t = f\begin{pmatrix} ROA_{t-1},\ BLA_t,\ NII_t, \\ GR_t,\ FINT_t,\ FINT_t^2 \end{pmatrix}, \quad (1)$$

where ROA_t – Return on Assets (profit of a bank after tax as a ratio of assets), ROA_{t-1} – first lag of profitability, a measure of bank managerial competency; BLA_t – current period banks' liquid liability to assets ratio, a measure of liquidity; NII_t – non-interest income to total income ratio, a measure of bank earning ability; $FINT_t$ – Index of Fintech.

2.3. Estimation technique

The study employed the panel autoregressive distributed lag model. This technique is based on Pesaran et al.'s (1999) dynamic heterogeneous panel regression model. Based on equation (1), the error correction version of the ARDL (p, q) estimation technique is specified as follows:

$$\Delta ROA_{it} = \sum_{j=1}^{p-1} \lambda_j^i \Delta ROA_{it-j} + \sum_{j=0}^{q-1} \beta_j^i \Delta X_{it-j} + \\ +\delta_i \left[ROA_{it-1} - \left(\alpha_0 + \alpha_j^i X_{it-1} \right) \right] + \rho_i + \mu_{it}, \quad (2)$$

where Δ is the difference operator, ROA_{it} is a measure of bank profitability/performance, X is a vector of independent variables as outlined above including Fintech index, λ and β are vectors of the lagged coefficients of the short-run dependent and independent variables respectively. α and δ are the vector of the long-run coefficients and the speed of adjustment coefficient, respectively. p is the lag length for the dependent variable, while and q is the lag length of the independent variables[3]. The subscripts i and t represent country and time identities, respectively. Equation (2) will be estimated using three ARDL estimators of pooled mean group (PMG), mean group (MG) and the dynamic fixed effect (DFE), and then the Hausman test will be applied to select the best estimator. Note that the null hypothesis for the test is that the PMG estimator is a better estimator than the MG and DFE. This will be rejected, and the alternative hypothesis will be accepted if the P-value is more than 5%; otherwise, the MG or the DFE estimator will be more reliable.

3. RESULTS AND DISCUSSIONS

This section presents and discusses the results and findings made from the empirical estimates with their economic interpretation, explanation, and justification. The first part of this section presents results from the principal component analysis, which was used to generate a Fintech index using three components of ATM, mobile cellular subscription/mobile banking, and internet banking. The next part presents unit root test results, while the last part examines the impact of Fintech on bank profitability.

3.1. Fintech measurement/index

The major drawback in previous research is what should constitute the actual measurement of Fintech since there has not been a standard global acceptable measure. This study, therefore, circumvents this challenge by using various fintech startups or outlets to generate an index for Fintech using the principal component analytical tool. The outlets, as discussed above, include mobile banking/mobile cellular subscription, Internet banking and automated teller machine per 100,000 people. As a dynamic indicator, the use of one component/variable to capture the variability in Fintech will not only underestimate its measurement but

3 Note that the model losses a lag after taking the first difference of the model as presented in equation 1.

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Table 1. A Fintech Index generated with the Principal Component Analysis

Source: Estimation.

Components/Correlation					Components (Eigenvectors) Values			
Comp.	**E.Value**	**Diff.**	**Prop.**	**Cumulative**	**Vari.**	**Comp 1**	**Comp 2**	**Comp 3**
Comp 1	2.3623	1.9569	0.7874	0.7874	MCS	0.5894	–0.3998	0.7020
Comp 2	0.4054	0.1731	0.1351	0.9226	ATMs	0.5512	0.8343	0.0122
Comp 3	0.2323	–	0.0774	1.0000	ITB	0.5905	–0.3797	–0.7121

Note: No. of obs = 272; No. of comp. = 3; Trace = 3.

will also be misleading considering the fact that Fintech cuts across both financial and non-financial sectors. This technique is consistent with the works of Okoli (2020), Samargandi et al. (2015), and Campos and Kinoshita (2010).

The index presented in Table 1 reveals that three components and three variables were used to generate the index (Fintech). Under the first component, mobile banking (MCS), automated teller machine (ATMs) and Internet banking (ITB) accounted for about 58.9%, 55.1% and 59.1%, respectively, of the index variability. This means that all the variables contributed almost an equal weight to defining Fintech index within the first component. The situation was different in the second and third components as a negative variation was reported for mobile banking and Internet banking within the second component. Overall, the first component explained about 78.7% variations in the entire index, whereas the second and third components accounted about 13.5% and 7.7%, respectively. This suggests that financial technology among the selected African countries is more susceptible to changes in mobile banking than ATMs and Internet banking.

The generated index is justified using certain assessment criteria. First, mobile banking and Internet banking has been the major outlets through which Fintech operates via e-Wallet, Bit-coin trading, money transfers, etc., therefore including all these variables can lead to the problem of multicollinearity. Moreover, the PCA technique has a way of removing the multicollinearity problem among the variables. Secondly, there has not been a database or any empirical evidence to the best of the author's knowledge that can give a long data range for Fintech index and there has not been a uniform consistent measure for it over the years. As a result, this index is a way forward in measuring Fintech.

The results of the stationarity tests in Table 2 show that the variables are combination of I(0) and I(1) series. In other words, the two unit root tests reveal that the variables are integrated of order one and order zero with no I(2) variable. Consequently, the panel ARDL becomes the most appropriate technique to be employed to investigate the study's objective. Moreover, the lag length selection criterion was based on the Schwarz information criterion. That is, the lag length selection settled for one lag, thus ARDL (1, 1, 1, 1, 1, 1) both for the dependent and independent variables. Meanwhile, since the time dimension is short to accommodate the iteration processes due to possible loss of degrees of freedom, one lag for all the variables was settled and imposed. Demetriades and Siong (2006) assert that the lag structure can be imposed based on data limitation if the time dimension is not long enough to overstretch the lags.

Table 2. Unit root test results

Source: Estimation.

Variables	LLC Test		IMP Test	
	Level	**First Diff.**	**Level**	**First Diff.**
ROA	Sig at Levels	NA	Sig at Levels	NA
NII	Not Sig at Levels	Sig at first diff.	Not Sig at Levels	Sig at first diff.
BLA	Sig at Levels	NA	Not Sig at Levels	Sig at first diff.
FINTECH	Not Sig at Levels	Sig at first diff.	Not Sig at Levels	Sig at first diff.
FINTECH^2	Sig at Levels	NA	Not Sig at Levels	Sig at first diff.
GDP GROWTH	Not Sig at Levels	Sig at first diff.	Not Sig at Levels	Sig at first diff.

Note: NA: Not Applicable; Significance is at 5%.

3.2. Discussion of the PMG and MG estimates

This study adopted the panel ARDL technique based on two major criteria. First, the theory suggests a dynamic model. That is, the first lag of the dependent variable is part of the regressors, and it is used to capture managerial competence. Recall that the unit root tests reported a combination of I(0) and I(1) series. Two different stationarity tests were conducted. They are the Levin, Lin and Chu unit root test and the Im, Pesaran and Shin unit root test. The two tests were employed to argument for the weakness of each other.

Given the peculiar features of the data used for this analysis, as well as the unique characteristics of various estimators, this study adopted only the pooled mean group and the mean group estimators to investigate the study's objectives. This is because these estimators of the PARDL model provide consistent coefficients despite the possible presence of endogeneity due to the inclusion of lags of the explained and the explanatory variables (Pesaran et al., 1999). Moreover, the pooled mean group estimator captures the peculiarity of the data set, which is heterogeneity in short-run coefficients, intercepts, speed of adjustment to long-run equilibrium and the error variance among the groups (countries), but homogeneity among the long-run slope coefficients. This is true as African economies follow the same growth trajectory in the long run. The short-run adjustment term is allowed to be country-specific, due to the widely different impact of the vulnerability to financial crises and external shocks, stabilization policies, monetary policy, etc. (Samargandi et al., 2015). Although the mean group estimator does not impose any restriction, it allows all coefficients to vary both in the short run and long run. The challenge with this estimator is that it requires sufficiently large data set. That is, the cross-sectional element, as well as the time variants should be sufficiently large. These features are still very necessary as various factors affects banks and the entire financial system in Africa.

Therefore, having estimated and presented the two results in the first two outputs in Table 3, the Hausman test results suggest that the pooled mean group estimator is more efficient and reliable than the mean group estimator. This could be attributed to loss of degrees of freedom by the mean group estimator due to the limited time span for this study, which is only 17 years. After that, this study includes a threshold Fintech effect to examine whether, though with no positive/negative impact of Fintech on bank performance among the economies whether beyond a certain threshold of its adoption, a positive/negative impact occurs. This is one of the major arguments in this study as the authors want to establish the fact that Fintech impact on a bank depends on the degree of its adoption.

The PMG results indicate that bank performance (ROA) was basically driven by the bank specific indicator of non-interest income to total income ratio (NII) and an external indicator of economic growth rate (GR) in the long run at 1 per cent significance level. To be more precise, a unit change in NII and GR is associated with 0.015 units and 0.084 units change, respectively, on bank profitability during the long-run impact at one per cent significance level, ceteris paribus. Hence, both internal and external factors drive bank profitability among African economies only in the long run with no short-run causality. The absence of short-run causality follows prior expectation since Fintech adoption and its structural transformation is a long-run phenomenon.

The PMG result further reveals that there was no significant impact of Fintech on bank performance both in the short run and long run, though a positive and negative effect was reported for the two periods respectively. On the other hand, the MG estimator suggests a negative significant impact of Fintech and a positive significant impact of growth rate on bank profitability in the long run with no short-run impact. The fact that Fintech significantly dampens bank profitability in the MG model but could not impact it in the PMG model could be attributed to the absence of restrictions on the long-run coefficients as was the case in the PMG estimator. The argument here is that the adoption process of Fintech varies or is heterogeneous among different countries that make up the panel; therefore, unique factors explain the process of change and its impact on bank profitability in Africa. However, given this dichotomy, in the two estimators, the Hausman tests accept the

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Table 3. ARDL model estimators of PMG and MG results

Sources: Estimation.

	PMG MODEL (1)	MG MODEL (2)	PMG MODEL (3)	MG MODEL (4)
	ΔROA	ΔROA	ΔROA	ΔROA
NII_t	0.015	–0.137	–0.008	9.398
	(2.75)***	(1.22)	(2.28)**	(1.00)
BLA_t	–0.002	0.057	0.001	–0.132
	(0.37)	(1.30)	(0.41)	(0.44)
GR_t	0.084	0.077	0.068	–2.563
	(4.47)***	(2.55)**	(4.52)***	(0.97)
$Fintech_t$	–0.004	–0.862	0.022	9.986
	(0.15)	(2.09)**	(0.52)	(0.88)
$Fintech^2_t$			–0.126	6.043
			(7.60)***	(0.91)
ECT_{t-1}	–0.777	–1.076	–0.909	–1.231
	(6.98)***	(7.39)***	(10.99)***	(8.10)***
ΔNII_{t-1}	–0.015	0.013	–0.0001	0.023
	(0.80)	(0.72)	(0.00)	(0.99)
ΔBLA_{t-1}	0.040	0.023	0.063	–0.014
	(1.58)	(0.53)	(2.06)**	(0.31)
ΔGR_{t-1}	–0.066	–0.035	–0.084	–0.040
	(1.36)	(1.16)	(1.62)	(0.92)
$\Delta Fintech_{t-1}$	0.193	1.239	–2.046	1.776
	(0.24)	(0.91)	(1.31)	(0.97)
$\Delta Fintech^2_{t-1}$			–1.023	0.946
			(1.70)**	(1.01)
Constant	0.222	1.909	1.302	2.679
	(0.61)	(1.74)	(3.37)***	(1.85)*
Observations	256	256	256	256
Hausman Test:	P–Value = 0.9741		P–Value = 0.9975	

Note: H0: PMG is a better estimator. Absolute value of z statistics in parentheses. *** = sig. at 1%; ** = sig. at 5%; and * = sig. at 10%.

null hypotheses of the homogeneity restriction on the long-run regressors, which indicates that the PMG is more efficient estimator than MG.

Next, this study examines a possible threshold effect of Fintech on bank performance. The need for a threshold examination was informed by the contrasting effects of Fintech on bank performance in the long run by the two estimators and the fact that Fintech could not contribute to bank performance in the short run under the two estimators. The result, particularly under the PMG estimator, reveals that although Fintech could not significantly impact bank performance, however, beyond a certain threshold, it does. In other words, bank performance is negatively associated with a one-unit increase in the squared value of Fintech in the long run and short run at 1% and 5% significance levels, respectively, ceteris paribus. This suggests that too much Fintech adoption is a problem to the continual existence of commercial banks in Africa. Similar conclusions were reached by Vives (2017), Navaretti et al. (2018), Fadhul and Hamdan (2020), and Okoli and Tewari (2021). This could be because Fintech provides services that are more user-friendly than the conventional bank customer service provider types among the financial institutions. This is consistent with the findings of Okoli (2020) who examined the impact of Fintech on bank credit risk and found that beyond a certain threshold, Fintech significantly raises bank credit risk in the long run.

Therefore, as Fintech raises banks' credit risk, it invariably detracts from their profitability, as demonstrated in this study; hence, the adoption of Fintech beyond a certain yardstick is detrimental to most indicators of bank development. This assertion is also strengthened as the non-interest income (NII), a measure of bank diversification, turned to a negative impact after the threshold effect in model 3 compared to its initial positive impact in model 1 before the threshold effect. This could also be attributed to structural changes within the banking sector in most African economies following the global financial crisis of 2008. Therefore, future studies in this area should consider the role of structural break in investigating the impact of Fintech on bank profitability. Finally, the speed of adjustment to long-run steady state stood at 90.9% per annum (Model 3). This means that the economies revert back to equilibrium in less than two years whenever contemporaneous shocks from Fintech hit the economy.

CONCLUSION

This research work examines how Fintech has evolved over the years and its implications for commercial banks among selected African economies. This study is motivated by the disruptive effect of financial technology overtime on the creation and delivery of financial services. Therefore, the roles of Fintech side by side with banks were discussed, pointing out the strengths and weaknesses of both Fintech and traditional banks. The study gave a detailed and sequential developmental process of Fintech from the early 18th century till date. A comparative appraisal between Fintech start-ups and traditional banks was also discussed to justify a collaborative relationship between them.

Fintech developed through three unique phases. The first phase is the birth of Fintech ideas when technology and finance first merged to produce the first period of financial globalization. Inventions such as the first telegraph commercial use in 1838 (Barbiroli, 2013) and first successful transatlantic cable in 1866 (Hills, 2010) were made during this era. The second era is the era of innovation within traditional banks. However, the inability of banks to absorb the excess commercialization and trade, and the continuous widening of financial exclusion gap, gave rise to the third era, which is the technology/modern era. This era witnessed remarkable changes in the financial world such as the advent of Blockchain technology, virtual currencies (e.g., Bitcoin), the rapid growth of Fintech, online banking, Internet banking, mobile banking, hence the advent of Fintech.

The empirical analysis, which is based on the third era due to data availability, reveals that Fintech nexus with banks is a long-run phenomenon with no short-run causality. This suggests that the use of short-run monetary policy in the regulation of financial system among African economies can be totally ineffective. Again, that Fintech adoption significantly reduces bank profitability only when its adoption and usage exceed a certain threshold is an indication that moderate Fintech adoption poses no threat to banks' existence but too much adoption does. Moreover, the negative impact of the non-interest income after Fintech adoption reaches a certain threshold, which implies that too much Fintech affects not only bank profitability but other development indicators.

However, the fact that the speed of adjustment to long-run steady state improved with higher Fintech adoption[4] to 90.9% suggests that its adoption has the capacity of mitigating financial crisis and stress. Therefore, Fintech adoption can introduce risk/financial crisis within the financial institutions and shock to the entire macroeconomic environment, and vice versa. Based on the aforementioned, this study recommends that Fintech adoption should be regulated, and macro-prudential policies should be used to maintain a collaborative coexistence of Fintech companies with bank financial institutions.

AUTHOR CONTRIBUTIONS

Conceptualization: Tochukwu Timothy Okoli.
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4 Compare the speed of adjustment in the PMG estimator model 1 at 77.7% with that in model 3 at 90.9%.

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Supervision: Daniel Meyer.
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