Impact of Digital Financial Services on Financial Performance of Commercial Banks in Nigeria

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Abstract: Since the introduction of information communication technology and the widespread use of the internet, the banking business has undergone considerable changes. Information and communication technology (ICT) is at the heart of Nigeria's current worldwide shift curve in the electronic banking system. In light of this, this study looked into the influence of digital financial services (DFS) on the financial performance of Nigeria's publicly traded commercial banks. The study aims to see if there is a link between the dependent variable, which is financial performance as assessed by banks' earnings-per-share (EPS), and the main independent variables, which are the volume of ATM and POS transactions as a proxy for digital financial services (DFS). Secondary data was employed in the study. The data was collected from the annual report of target banks and the Central Bank of Nigeria from 2012 to 2020. The study used both descriptive and inferential statistics in analysing the data. In general, the study revealed that digital financial services (DFS) have substantial and significant marginal effects on earnings per share in Nigeria's banking sector. Thus, there exists a positive relationship between digital financial services (DFS) and bank financial performance. In conclusion, electronic banking has made banking transactions to be more accessible by bringing services closer to its customers hence improving banking industry performance. Thus, the study recommends that bank management should enhance digital banking to improve financial performance in commercial banks.

1. Introduction

In the last decade, the banking industry has seen significant changes as technological advancements, and the inexorable forces of globalisation have created both opportunities for expansion and challenges for banking executives seeking to remain profitable in an increasingly competitive environment. Banking industries around the world are increasingly becoming more connected to information technology infrastructure, making banking operations, services, and commercial activities more accessible, faster, more efficient, and effective for individuals and businesses alike [1]. [2] describes Digital Financial Services (DFS) to include a broad range of financial services accessed and delivered through digital channels, including payments, credit, savings, remittances and insurance. Digital channels refer to the internet, mobile phones, ATMs, and POS device. According to [3], Digital financial services can be described as a method of banking that uses digital means to conduct transactions.

The concept of digital financial services (DFS) has been beneficial in improving the banking industry. DFS must be made through a sound analysis of risks and costs associated with avoiding harm to banks' performance. Bank performance is directly dependent on the efficiency and effectiveness of DFS and, on the other hand, tight controls in standards to prevent losses associated with internet banking frauds. This is only possible if the impacts of DFS on the financial performance of banks and their customers are well analysed and understood.

Digital financial services have contributed enormously to banks' profits [4]. Hence, the impact of Digital Financial Services in the banking sector is very evident like products and services through various delivery channels. The introduction of direct banking and Internet-based financial services over the past decade has spurred profound changes in customer behaviour and service expectations. In today's financial services, customers demand immediate fulfilment. In short, they want to conduct real-time transactions from any location, through any device, for products and services, all at their convenience. At the same time, they demand consistent levels of service across all delivery channels [5]. Several recent studies have also explored in great detail the resultant impact of technology on the Nigerian banking sector. A causal study by [6] revealed bank performance is enhanced by digital financial

services adoption. In the happening, a recommendation emphasized that banks must focus on their needs to achieve their goals by using the appropriate technology. Electronic banking service provides convenience and promptness to customers along with cost savings; banks are also interested in expanding their market through digital financial services [3], [7] [8], [9], [10], [9], [11], [12], [13], [14], [15] studies report that digital financial services and innovation in banking is one of the key profitability drivers of banks and, in the 21st century, it is becoming increasingly decisive in performance and competitiveness. While the deployment of digital financial services (DFS) has proliferated, there is not enough evidence of its impact on the performance of banks, particularly within the Nigerian banking industry. A gap still exists on exactly whether Digital financial services (DFS) have resulted in the growth of commercial banks' profitability. Therefore, it would be fascinating to know which aspect of the Digital financial services (DFS): Automated Teller Machine (ATM) services, Point of Sale (POS) services, Mobile Banking services and internet banking (web) services is more impactful to the financial performance of the commercial banks in Nigeria. A Survey of existing literature worldwide revealed conflicting results: [4], [16]–[21]. Moreover, despite the increasing rate of deployment of e-channels by Nigerian banks, there is a scarcity of empirical research that provides quantitative information on the influence of digital financial services on bank financial performance in Nigeria. Furthermore, technology is projected to improve service delivery efficiency, which would help a company improve its performance. The most recent research in operations improvement has assumed that technological innovation has a direct impact on improving performance and profitability [22]. The concept is the same in the banking sector, with banks incorporating it with the expectation of great returns. However, the adoption of technology requires high initial capital, which affects the profits of the firm in the short run. This is caused by the heavy capital expenditure and /or debts with attendant interest expense in acquiring the technology. This affects the dividends payout to shareholders and casts doubts on the worthiness of the investment. Digital financial services can only be supported with technology, and banks' performance in the current competitive environment is tied to how banks can deliver banking products and services efficiently through digital financial services.

Therefore, this paper seeks to reduce the conflict by investigating the impact of digital financial services using the mainly used e-channels (ATM and POS) as a proxy for Digital Financial Services on the financial performance of quoted commercial banks in Nigeria.

1.1 Objectives of the Study

The main aim of this research is to assess the impact of digital financial services on the financial performance of quoted commercial banks in Nigeria. The study pursues the following specific objectives and thus described in Fig.1 below:

i. Examine the impact of Automated Teller Machine (ATM) transaction volume on the earnings per share of the quoted commercial banks in Nigeria.

ii. Determine the influence of Point of Sale (POS) adoption on the earnings per share of the quoted commercial banks in Nigeria.

1.2 Research Hypotheses

The following hypothesis is formulated to address the problem of the study:

Ho_1: There is no significant impact of the Automated Teller Machine (ATM) volume on the earnings per share of quoted commercial banks in Nigeria.

Ho_2: There is no significant effect of Point of Sale (POS) service adoption on earnings per share of the commercial banks in Nigeria.

Fig. 1. Conceptual Framework
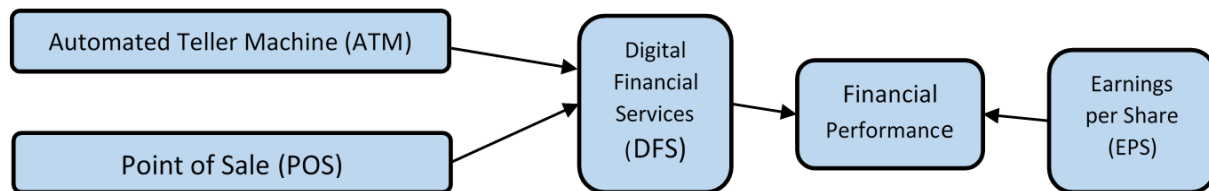
Source: Researcher, 2021

2.2 Theoretical Framework

Theoretical review is a foundation or basis that which every research or study underpins its variables and hypothesis; this is to ascertain whether the findings agree with a particular selected theory or not. Adopted theories for this study are:

Innovation Diffusion Theory (IDT), this theory is used to underpin this study because it emphasizes the introduction of new financial innovation by improving the traditional ways of rendering banking services. This study considers this theory because innovation in the banking system, more especially the Digital financial services (DFS), will lead to lower transaction costs and thus have

some impact on the general organizations' performance as described in the study of [23]–[25].

Technology Acceptance Model (TAM): In like manner the technology acceptance model is also used to underpin this study because it has advocated for the establishment of a relationship between individuals' behaviour and the use of Information and Communication Technology (ICT) as in the digital finance services of the banks [26], [27]. This model brings in the behavioural aspect of individuals to the acceptance and use of technological innovations.

3. Methodology

Research Design: The study adopts an ex-post facto research design. The methodology is preferred because the study analyses quantitative statistical secondary data and makes inferences on the effect of digital financial services on the financial performance of commercial banks in Nigeria. Emphasis is on the four most popularly used digital payment channels: Automated Teller Machine (ATM) and Point of Sale (POS), which are taken as the independent variables to explain the effect on the banks Earning Per Share (EPS) as a proxy for the financial performance of the bank.

Population and Sample size of the study: The population of the study is all the thirteen (13) licensed commercial banks that are listed on the Nigeria Stock Exchange (NSE) and are operating in Nigeria as of December 31, 2020. The sample size is thus the thirteen (13) quoted banks operating in Nigeria as of December 2020, which is termed a universe study.

Method of Data Analysis: The statistical instrument employed is the Pearson correlations, and variance inflation factor to check for the presence of multicollinearity and the variables attain stationarity at either level or first difference. Then if there is no presence of collinearity among variables and the variables are stationary at either level or first difference, the ARDL model will be used to fit the long and short-run relationship between the digital financial services variables and the banks' performance. Otherwise, panel data Ridge and Weighted Regression is used to fit the relationship between digital financial services and the banks' performance. Since the principle of ridge-regression is correct for multicollinearity in a linear model. It is worthy of note that other modelling procedures like the difference and system GMM will not be robust if the independent variables are highly collinear. Thus, violating the basic assumption of multicollinearity in fitting any linear model.

Collected data were scrutinised for errors of omission before being inputted into the statistical data analysis software (E-views 9 and STATA 15). Descriptive

statistics, which includes mean and standard deviation and all the pre-modelling diagnostics were performed in Eviews. At the same time, the modelling proper was done in STATA due to its solid and detailed computational capabilities over e-views for any panel data related analysis.

Model Specification: The model specification is for this study is therefore adapted from studies of [4], [28], [29] to describe the relationship between the variables in the study in a mathematical functional form:

$$ln\,EPS_t = \alpha_0 + \alpha_1\,ln\,ATM_t + \alpha_2\,ln\,POS_t + \varepsilon_t \qquad ...1$$

Where: α_0 is the intercept, α_1 and α_2 are the slope or coefficient to capture the nature and effect of the relationship between the variables, and μ is the error term.

4. Data Analysis and Interpretation

Descriptive Statistics: This sub-section presents the descriptive statistics of the bank-specific digital financial service indicators that determine the financial performance of deposit money banks in Nigeria. It shows their respective mean, median, maximum/minimum value, standard deviation and the Jarque-Bera normality test, which is a goodness-of-fit test to ascertain if the sample data have the skewness and kurtosis that show normal distribution. This is a precondition for fitting the panel regression model. Table 1 below shows the descriptive statistics of all the variables in the study.

Table 1 Descriptive Statistics and Test of Normality for the two (2) digital financial services Indicators and the Financial Performance of Quoted Deposit Money Banks in Nigeria

	LNEPS	LNATM	LNPOS
Mean	4.52	16.912	14.716
Median	4.585	16.713	14.858
Maximum	6.599	19.161	18.872
Minimum	1.386	14.496	9.554
Std. Dev.	1.324	1.218	2.117
Skewness	-0.36	0.206	-0.153
Kurtosis	2.333	1.952	2.4
Jarque-Bera	4.704	6.183	2.209
Probability	0.095	0.045	0.331
Sum	528.841	1978.687	1721.746
Sum Sq. Dev.	203.258	172.112	519.924
Observations	117	117	117

Source: Researcher's computation

Descriptive statistics in table 1 explains and summarises the variables with the fundamental statistic like mean, standard deviation and maximum and minimum value of each series. The Jarque-Bera test of normality also shows

that all of the variables in the models are normally distributed as expected and are a prerequisite for the application of any OLS based model.

4.1 Pre-model Diagnostic Test

This checks for probabilities of the presence of conditions and biases that may occur so as not to undermine the accuracy of outcomes. The tests are carried out to ensure that the data meets the basic assumptions of a panel regression model.

4.1.1 Correlational Analysis

Pearson Correlation as a statistical method is employed to evaluate the strength of the relationship among various variables and the extent of linearity. The outcome is as shown in Table 2

Table 2 Correlational Matrix of Study Variables

	lnEPS	lnATM	lnPOS
lnEPS	1		
lnATM	.665**	1	
lnPOS	.551**	.745**	1
n	117	117	117

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key:
EPS: Earnings per share
ATM: Automated Teller Machine
POS: Point of Sale

Source: Researcher's computation

The correlation matrix table 2 presents the correlation coefficient for the variables on the effect of the complete set of two (2) prudential indicators and the financial performance of quoted deposit money banks in Nigeria as considered in this study. Correlation values ranged from -1 to +1; where 0.75-0.99 signifies a "very strong" relationship between the intersecting variables, 0.5-0.74

implies a "strong" relationship within the intersecting variables, and 0.35-0.49 implies a "weak" relationship among variables as presented in table 2. As observed, there exists a strong relationship between all the digital financial services indicators and EPS. Also, a very strong but negative relationship was observed between the digital financial services indicators and the EPS. And so on, as seen in the correlation matrix table above.

4.1.2 Cointegration and Unit-Root Test for Stationarity of Data

This is a test for stationarity in time series data. Stationarity is present in a time series if a shift in time does not cause a change in the shape of the distribution, and on the other hand, there is no stationarity if a shift in time causes a change in the shape of the distribution. The unit root is a cause of non-stationarity. The test result and interpretation are contained in the Cointegration test and Unit-Root Table 3 a & b.

Table 3a Kao Residual Cointegration Test

Series: LNEPS LNATM LNPOS

Sample: 2012 2020

Included observations: 117

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.970848	0.0244
Residual variance	0.595168	
HAC variance	0.490048	

The cointegration test result shows that panel is cointegrated since the ADF p-value of 0.0244 is less than the 0.05 (5%) level of significance.

Table 3b Unit-Root

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Series	Test	Unit root	p-value	Panel
LNEPS	Levin, Lin & Chu t*	-1.59905	0.055	13
LNPOS	Levin, Lin & Chu t*	-2.11032	0.012	13
LNATM	Levin, Lin & Chu t*	-8.62523	0.000	13

Source: Researcher's compilation

As a precondition for modelling panel data variables, the need to ensure that the variables are stationary requires unit root tests of each of the variables in the model. The outcome of our unit root tests using the Levin-Lin-Chu

unit-root test for panel data shows all variables are stationary in the natural logarithm form; all other variables are stationary, as seen in the unit root test table above.

Table 4 Test of Multicollinearity

Independent variable	Collinearity Statistics	
	Tolerance	VIF
1 lnATM	0.38	2.633
1 lnPOS	0.001	747.628

a. Dependent Variable: lnEPS

Source: Researcher's computation

From the test multicollinearity shown in section table 4, it was not noticed that POS exceeded the minimum condition (>5) for no collinearity stated by the Variance Inflation Factor (VIF). As such, it is seen that POS exceed the minimum condition, thus implying that POS is highly collinear, and hence we cannot apply ARDL, GMM modelling technique as the case may be. The panel data Ridge and Weighted Regression will be used to fit the relationship between digital financial services and the banks' performance since the principle of the ridge is proposed to correct for multicollinearity in any linear model.

4.2 Test of Hypothesis: Assessment of the plausibility of the hypotheses was carried out on the available data, using the Ridge and Weighted Regression. Ridge and Weighted Regression Table 5 are generated to explain the various relations between the digital financial service variables and the banks' performance.

Ridge and Weighted Regression model is a statistical model containing model parameters of random variables. The assumption is that the data being analysed are drawn from a hierarchy of diverse populations, and differences are related to the hierarchies. This is depicted in Table 5.

Table 5 The Fixed-Effects Panel Data: Ridge and Weighted Regression

```
===============================================================================
  lnEPS2 = lnATM + lnPOS
-------------------------------------------------------------------------------
  Ridge k Value      =   0.00130     |  Generalized Ridge Regression
-------------------------------------------------------------------------------
  Sample Size        =        117    |  Cross Sections Number   =          13
  Wald Test          =   911.7375    |  P-Value > Chi2(2)       =      0.0000
  F-Test             =   455.8688    |  P-Value > F(2 , 102)    =      0.0000
  (Buse 1973) R2     =     0.9746    |  Raw Moments R2          =      0.9746
  (Buse 1973) R2 Adj =     0.9711    |  Raw Moments R2 Adj      =      0.9711
  Root MSE (Sigma)   =    24.2209    |  Log Likelihood Function =   -530.8936
-------------------------------------------------------------------------------
- R2h= 0.9522   R2h Adj= 0.9457  F-Test = 1136.13 P-Value > F(2 , 102) 0.0000
- R2v= 0.8064   R2v Adj= 0.7798  F-Test =  237.43 P-Value > F(2 , 102) 0.0000
-------------------------------------------------------------------------------
     lnEPS2 |    Coef.    Std. Err.     t     P>|t|    [95% Conf. Interval]
-------------------------------------------------------------------------------
      lnATM |  1.90e-06   1.41e-07   13.47   0.000    1.62e-06    2.18e-06
      lnPOS |  1.19e-06   1.37e-07    8.68   0.000    9.16e-07    1.46e-06
      _cons |  2.909206   2.239219    1.30   0.197   -1.532275    7.350686
-------------------------------------------------------------------------------
```

4.3 Discussion of Findings

The first variable with a null hypothesis - *H_{o1}: There is no significant impact of the Automated Teller Machine (ATM) volume on the earnings per share of quoted commercial banks in Nigeria"*. The variable automated teller machine volume (ATM) has a panel regression coefficient of 1.90e-06. This implies that the ATM has a positive impact on the bank's earnings per share (eps) as a measure of financial performance; thus, suggesting that, with a unit increase in the ATM, the banks will see about the 1.90e-06-unit increase in financial performance as explained by their earnings per share. Furthermore, the automated teller machine volume (ATM) has a p-value of 0.000, which is less than the 0.05 (5%) level of significance. Hence, the null hypothesis *"There is no significant impact of the Automated Teller Machine (ATM) volume on the earnings per share of quoted commercial banks in Nigeria"* is then rejected. We, therefore, conclude that the relationship observed between the automated teller machine volume (ATM) and the earnings per share is significant and generalizable.

Similarly, the second variable with a null hypothesis - *H_{o2}: There is no significant effect of Point of Sale (POS) service adoption on earnings per share of the commercial banks in Nigeria"*. The variable point of sale (POS) has a panel regression coefficient of 1.19e-06 which implies that the point of sale (POS) has a positive impact on the bank's earnings per share (eps) as a measure of performance. This, suggests that with a unit increase in the point of sale (POS), the banks will see about a 1.19e-06-unit increase in their performance, as explained by their earnings per share. Furthermore, the point of sale (POS) has a p-value of 0.004, which is less than the 0.05 (5%) level of significance. Hence, the null hypothesis that states that *"There is no significant effect of Point of Sale (POS) service adoption on earnings per*

share of the commercial banks in Nigeria" is rejected. Hence, a conclusion that though there is an observed relationship between the Point of Sale (POS) service adoption and the earnings per share of the banks and therefore we conclude that the relationship observed can be generalized in the long run.

5. Conclusion

The impact of the two (2) key digital financial services of the banks: ATM and POS on financial performance (using the earnings per share (EPS) as the proxy) of the quoted deposit money banks (DMBs) in Nigeria's banking sector jointly is tested with Wald statistics. The Wald statistics were obtained to be 911.7375 with a p-value of 0.000, which is greater than the 0.05 (5%) level of significance for the EPS model, therefore implying that there is a significant joint impact of the digital financial services indicators on the quoted deposit money banks' performance as observed in EPS model. Also, the models return an r-squared adjusted value of 97.46%, which is the extent to which the digital financial services have impacted the banks' performance in terms of EPS, leaving less than a 5% effect on other extraneous variables not captured in the model.

These findings thus corroborate the studies of [8], [9], [10], [11], [12], [13], [14], [15] who researched the impact of digital banking services on banks' financial performance variables experience and financial performance but negates the findings of [30] whose study evaluates the relationship between financial innovation mostly in aspect of digital financial services and bank efficiency as well as the impact of financial innovation on efficiency ratio of deposit money banks in Nigeria from 2006 to 2014. The findings also disagree with the study of [6], who investigated internet banking in Northern Cyprus for some time 2004-2009, in a panel data of 22 retail banking and found that despite the internet banking increases the performance in different sectors, the authors entail that in case of these two ratios they were not used wisely or adequately.

5.1 Recommendations

The study recommends that bank management should improve digital banking services to boost the banks' financial performance. The necessity for commercial banks to implement internet banking is obvious, as it has brought the benefit of constant access to certain key services, eliminating the need for many individuals to engage with bank staff and improving banks' earnings per share (EPS). The government, through the financial sector regulatory bodies, particularly the CBN, should encourage banks to strengthen digital banking while also tightly regulating such development expenditures to ensure the integrity of payment systems in particular. According to the findings of the study, digital banking is the engine of increasing EPS in banks. Financial assistance that is both faster and more comprehensive financial service delivery spurs the development of businesses and economic growth in all other sectors in addition to facilitating financial deepening.

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