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Electronic Payment Systems and Performance of the Nigerian Banking Industry

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study examined the effect of electronic payment systems on the performance of the Nigerian banking industry. The electronic payment systems considered were automated teller machine, point of sale, mobile payment technology and internet or web assisted payment medium on the bank performance indicator of return on assets. The study used quarterly frequency data from 2010Q1 to 2019Q4 and the static and dynamic models was estimated using the autoregressive distributed lag (ARDL) method. Stability of the series was tested using the augmented Dickey-Fuller and the bound test method was employed in testing for cointegrating relationship among the interest variables. From the bounds test, the study discovered common trend movement among the variables of interest. The long run result indicated that the usage of mobile phone technology and point-of-sale increase bank performance, but only insignificant. In addition, increased use of automated teller machine and web payment medium insignificantly cause decline in performance of banks in Nigeria. These results indicated that the performance of Nigerian banking industry is unaffected by the use of electronic payment systems. Following these results, it was recommended that banks invest in improving the speed, carrying capacity and accuracy of the payment systems.

Keywords: Electronic payment systems; ATM; point of sale; mobile payment technology; banking industry.

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1. INTRODUCTION

The banking industry plays pivotal role in the economic growth and development pursuit of a company. The banking system engage in the century old activity of transferring money from surplus individuals within the economy to deficits individuals who desired such capital to finance their business ideas or activities [1]. The role of the banking industry also extends to facilitating the transmission of monetary policy in line with set targets of the Central Bank of Nigeria. This makes the growth and survival of banks critical as their non-existence due to limited performance would threaten the transfer of capital to the deficit units from individuals with surplus capital and render ineffective any monetary policy decisions of the Central Bank of Nigeria.

The environment which deposit money banks in Nigeria operate in has become extremely dynamic and there have been rapid changes, due in part to technological innovation, which has made customers to demand of their bank certain electronic services. These electronic services range from been able to transfers fund to third parties to meeting other obligations such as utilities payments, among others. To ensure continuity, deposit money banks in Nigeria have harnessed technology to improve their services and product offered to their teeming customers, with the intention of retaining customers and winning over new ones to secure their bottom lines [2].

The position of Lawrence and Onazi [3] is that the electronic payment system or electronic banking has revolutionize the traditional means of conducting banking activities as accounting procedures which were done using paper invoice and ledger books has been transitioned online and payments and billing done through the use of information and communication technology (ICT).

Though the rapid changes in information and communication technology and its adoption in the banking system has transformed banking tasks, making them cheaper and efficient, the use of these technology involves huge capital investment which would have serious implication for the resources of the bank and her revenue. Notwithstanding the associated costs such as personnel and maintenance costs, the massive progress in technological innovations has made technology take up growing chunk of the budget of banks [4,5]. The increasing associated costs with use of electronic banking systems is also tied to the drive by Central Bank of Nigeria, the regulators of deposit money banks in Nigeria, to increase the number of financially included Nigerians. According to the Central Bank of Nigeria (CBN), about 41.6% of the Nigerian population or 40.1 million Nigerians are financially excluded as at 2016.

Several empirical findings have taken diverse position on the argument as to whether electronic banking system or electronic payment system affects performance of the banks. For instance, Okonkwo and Ekwueme [6] used the ordinary least square method to show that performance of banks in Nigeria is unaffected by the usage of automated teller machine (ATM) and point-of-sale (POS). This insignificant impact was also reported by Frank and Binaebi [4] and Sakanko and David [7], among others. Mohammed, Ibrahim and Muritala [8] who employed the autoregressive distributed lag (ARDL) method found that internet payment and mobile payment increased bank profitability. This position was also taken by studies such as Demaki, Eromafuru and Imasuen [9], Lawrence and Onazi [3] and Thankgod, Alhassan and James [2], among others.

This study is necessary as it has been able to explain the role of electronic payment systems on the performance of Deposit Money banks in Nigeria. The study will also help to expose managers of deposit money banks to the significant importance of electronic payment system on performance of deposit Money banks.

Hence, this study tries to address this conflict by employing the autoregressive distributed lag (ARDL) method to analyse the impact of electronic payment systems on the performance of the banking industry in Nigeria, with focus on electronic payment systems such as automated teller machine, points of sale assisted transactions, mobile payment technology assisted transactions, and internet assisted transactions.

The succeeding part of this paper focused on review of related literature. The methodology for this paper was provided in Section 3. The results from the estimation are presented in Section 4. In Section 5, conclusion was made and recommendations offered.

1.1 Research Hypotheses

HO_1: There is no significant relationship between automated teller machine and return on asset of Deposit Money Banks in Nigeria.

HO_2: The relationship between point of sale and return on asset of Deposit Money Banks in Nigeria is insignificant.

HO_3: There relationship between mobile payment technology and return on asset of Deposit Money banks in Nigeria is insignificant.

HO_4: There is no significant relationship between internet assisted transfer and return on asset of Deposit Money Banks in Nigeria.

2. LITERATURE REVIEW

2.1 Theoretical Review

Theoretically, one of the models that tends to support the relationship between electronic payment system or digital technology and performance of the banking industry is the technology acceptance model or theory (TAM) [5]. The TAM which was developed by Davis (1989) holds that the willingness to engage a particular technology is determined by the intent of the user of that technology. Put differently, the theory holds that the individual's intent to use a given technology is what determines the use of technology. According to Demaki, Eromafuru and Imasuen [9], the intent to use a given technology is determined by two factors – perceived usefulness and perceived ease-of-use. Thankgod, Alhassan and James [2] noted that perceived usefulness is the subjective opinion of the user that engaging or applying the technology will be beneficial, as it will increase performance level on the one hand. Perceived ease-of-use, according to them, denote the degree the user believes that engaging the technology will not be cumbersome and using it will be without hurdles. Thankgod, et al., [2] noted that some relationship exists between perceived usefulness and ease-of-use, stating that perceived usefulness varies directly with ease-of-use. Demaki, Eromafuru and Imasuen [9] noted that where organizations and/or individual perceived that using a particular technology will improve performance level and the process to learning its use is not cumbersome and stringent, then the intent and usage of that technology will increase. According to Okonkwo and Ekwueme [6], where such technology is not made available by banks, their market share and profitability level will decline. The innovation diffusion theory of Rogers (1962), also provide theoretical background on the subject matter. The theory explains and describes how innovations, particularly in technology and in this case electronic or digital banking, become widespread and/or successful. This theory provides justification for the use of the regressors. According to Rogers (2003), five factors determine diffusion of new inventions and they include; compatibility, relative advantage, observability, complexity and triability. The theory posits that, the adoption of new inventions by an organization depends on how the technology is perceived by the organization in terms of the technology's compatibility, relative advantage, observability, complexity and triability.

2.2 Empirical Literature

Annual data of 22 deposit money banks in Nigeria covering from 2009 to 2019 and the ordinary least square (OLS) method was employed by Okonkwo and Ekwueme [6] in analysing how the use of automated teller machine (ATM), point of sale (POS) and firm size affecting return on assets, the proxy of banks' performance. The result showed that increased use of ATM and POS reduced banks' performance, but only insignificantly. For Mohammed, Ibrahim and Muritala [8], who used the autoregressive distributed lag (ARDL) method and quarterly data from 2007Q1 to 2020Q4, the use of POS, internet payment and mobile payment caused growth in return of assets of banks in Nigeria. They noted that use of real-time gross settlement (RTGS) insignificantly reduced return on assets.

Arilesere, Olaleye, Asaolu and Akienabor [10] studied 21 deposit money banks in Nigeria using quarterly data from 2009 to 2020 to examine how electronic payment techniques affect their performance. Measuring performance using return on asset, the ordinary least square (OLS) result revealed that mobile banking and automated teller machine significantly contribute to bank performance. Debit cards was found to significantly reduce bank performance, while evidence suggest that internet banking enhances performance but only insignificantly.

Demaki, Eromafuru and Imasuen [9] used descriptive and inferential method to examine if electronic banking predicts bank performance. Nigerian quarterly bank data from 2009 to 2019

and inferential methods like cointegration and error correction model was used. From regressing return on asset on electronic payment medium, it was revealed that point of sales (POS), mobile banking and automated teller machine (ATM) significantly affect bank performance. Only internet banking was reported to have insignificant influence. Analysis revealed mobile banking, internet banking and ATM as having positive impact, while POS generated negative impact.

While examining how digital financial services of thirteen (13) banks in Nigeria affect their performance, Isa-Olatinwo, Uwaleke and Ibrahim [5] employed a panel approach to investigating how automated teller machine (ATM) and point of sale (POS) affect earnings per share of the 13 banks. The cointegration and fixed effect methods were used and estimation result showed that both POS and ATM are significant drivers of banking performance.

Lawrence and Onazi [3] used the ordinary least square (OLS) method and data from 2011 to 2017 to analyse the type of relationship existing between electronic payment and performance of banks. While using profit after tax as measure of financial performance, the regression result revealed that mobile banking and automated teller machine usage as means of payment significantly enhanced bank performance. Increased usage of point of sale and online banking caused decline in bank profitability. From the result, only online banking had significant effect.

In Nigeria, Thankgod, Alhassan and James [2] conclude that automated teller machine usage contributed negatively to bank profitability. This negative effect, the result showed, was insignificant. Also, they noted that point of sale and internet and mobile banking usage significantly enhanced profitability of banks. This followed the use of data of all deposit money banks from 2009 to 2018. The authors measured bank profitability using net profit and analysed the regression model using the ordinary least square (OLS) method. This result corroborated that of Bagudu, Mohd Khan and Roslan [11] who sampled 22 deposit money banks in Nigeria and found that increased usage of mobile banking contributed significantly to bank performance.

Frank and Binaebi [4] inquiry about the influence of electronic payment systems on bank performance in Nigeria followed the use of data from 2009 to 2019 and the ordinary least square (OLS) method. In their study, bank assets was used a proxy of performance and the analysis performed indicated that, increased usage of automated teller machine and mobile banking significantly drives bank performance and the use of point of sale for payment diminishes the performance of banks. Also, they reported that internet banking has potential of enhancing performance, but only insignificantly.

Torki, Rezaei and Razmi [12] followed a panel approach in their investigation as they pooled data of 12 Islamic countries from 2011 to 2017. The focus of their inquest was examining the connection between electronic payments and financial sector performance. They employed five vector indicators of electronic payment and controlled for interest rate, population, inflation and growth as factors that could affect net profit margin, the measure of performance. From the random effect model, the variables that significantly raises net profit margin were electronic card, point of sale, internet bank, automated teller machine and mobile bank. Population and economic growth also increased financial performance, significantly. They showed inflation and interest rate as significantly reducing net profit margin.

Sakanko and David [7] study was carried out at the micro level, as they focused on COE-Minna microfinance bank limited in Niger State, Nigeria, analysing if the use of five electronic payment systems affects their performance. The ordinary least square (OLS) method was used for estimation and from the result, it was discovered that the use of cards, internet payment and mobile banking caused growth in bank performance, significantly. This positive result was obtained in the case of telephone banking, but the growth caused by its usage was insignificant. Automated teller machine also had positive and insignificant performance effect.

A balanced panel data of 13 banks in Bangladesh from 2003 to 2013 was used by Siddik, Sun, Kabiraj, Shanmugan and Yanjuan [1] to examine the effect of electronic banking, bank specific and macro variables on bank performance, measured using return on asset, net interest margin and return on equity. The pooled panel OLS result revealed that the adoption of electronic banking significantly enhanced returns on equity (ROE), but after two years. In the first year of adoption, the result showed negative response of ROE to electronic banking usage.

3. DATA AND METHODOLOGY

The methodology adopted for this study is in line with the research of Lawrence and Onazi [3] and ThankGod, Alhassan and James [2]. The study used quarterly frequency data which covered from 2010Q1 to 2019Q4 in examining the payment systems that affects performance in the banking industry. The period selected was on the basis of when electronic payment system had a general awareness. The data for this length of time was collected for the performance index of return on asset (ROA), the payment systems measure of automated teller machine (ATM) assisted transactions, points of sale (POS) assisted transactions, mobile payment technology (MPT) assisted transactions, and internet (WEB) assisted transactions. These data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin. The study considered all the Deposit Money Banks captured by Central Bank of Nigeria Statistical Bulletin. The sampling technique was on the basis of convenience sampling as captured by CBN Statistical Bulletin.

The theoretical foundation for the model is the Technology Acceptance Model (TAM). The model highlights how technology could improve performance. On an empirical basis, the model of Isa-Olatinwo, Uwaleke and Ibrahim [5] was adopted and structurally modified.

The model used for this study is given as:

$$\mathrm{roa_t} = \mathrm{f(atm_t, pos_t, mpt_t, web_t)} \quad (1)$$

The econometric form of equation (1) becomes:

$$\mathrm{roa_t} = \delta_0 + \gamma_1 \mathrm{lnatm_t} + \gamma_2 \mathrm{lnpos_t} + \gamma_3 \mathrm{lnmpt_t} + \gamma_4 \mathrm{lnweb_t} + \varepsilon_t \quad (2)$$

The transactions using automated teller machine, points of sale, mobile payment technology and internet, are abbreviated using atm_t, pos_t, mpt_t, and web_t respectively. roa_t is for return on asset (the performance index), ln and ε_t are logarithm operator and stochastic term respectively.

Equation (2) was estimated using the Pesaran, Shin and Smith (2001) developed autoregressive distributed lag (ARDL) estimator to derive the relationship between the performance index and payment system measures. This estimator was employed as unit root showed that the variables of interest are mixed of I(0) and I(1), and this method is considered appropriate due to its flexibility and ability to give efficient estimates when small samples are used [13,14]. For unit root testing, the augmented Dickey-Fuller (ADF) procedure was followed and cointegration was testing by means of bound test. This was followed by post-testing of the coefficients and errors to ensure meaningful prediction. These post-tests were serial independency, heteroscedasticity, normality and stability [15-17].

Where the direction of cointegration among the variables is not known, the long- and short-run autoregressive distributed lag (ARDL) model is specified as:

$$\Delta\mathrm{roa_t} = \delta_0 + \sum_{j=1}^{\rho} \gamma_1 \mathrm{roa_{t-j}} + \sum_{j=0}^{\omega} \gamma_2 \Delta\mathrm{lnatm_{t-j}} + \sum_{j=0}^{\omega} \gamma_3 \Delta\mathrm{lnpos_{t-j}} + \sum_{j=0}^{\omega} \gamma_4 \Delta\mathrm{lnmpt_{t-j}} + \sum_{j=0}^{\omega} \gamma_5 \Delta\mathrm{lnweb_{t-j}} + \pi_1 \mathrm{roa_{t-1}} + \pi_2 \mathrm{lnatm_{t-1}} + \pi_3 \mathrm{lnpos_{t-1}} + \pi_4 \mathrm{lnmpt_{t-1}} + \pi_5 \mathrm{lnweb_{t-1}} + \varepsilon_{1t} \quad (3)$$

$$\Delta\mathrm{lnatm_t} = \delta_0 + \sum_{j=1}^{\rho} \gamma_1 \mathrm{lnatm_{t-j}} + \sum_{j=0}^{\omega} \gamma_2 \Delta\mathrm{roa_{t-j}} + \sum_{j=0}^{\omega} \gamma_3 \Delta\mathrm{lnpos_{t-j}} + \sum_{j=0}^{\omega} \gamma_4 \Delta\mathrm{lnmpt_{t-j}} + \sum_{j=0}^{\omega} \gamma_5 \Delta\mathrm{lnweb_{t-j}} + \pi_1 \mathrm{lnatm_{t-1}} + \pi_2 \mathrm{roa_{t-1}} + \pi_3 \mathrm{lnpos_{t-1}} + \pi_4 \mathrm{lnmpt_{t-1}} + \pi_5 \mathrm{lnweb_{t-1}} + \varepsilon_{2t} \quad (4)$$

$$\Delta\mathrm{lnpos_t} = \delta_0 + \sum_{j=1}^{\rho} \gamma_1 \mathrm{lnpos_{t-j}} + \sum_{j=0}^{\omega} \gamma_2 \Delta\mathrm{roa_{t-j}} + \sum_{j=0}^{\omega} \gamma_3 \Delta\mathrm{lnatm_{t-j}} + \sum_{j=0}^{\omega} \gamma_4 \Delta\mathrm{lnmpt_{t-j}} + \sum_{j=0}^{\omega} \gamma_5 \Delta\mathrm{lnweb_{t-j}} + \pi_1 \mathrm{lnpos_{t-1}} + \pi_2 \mathrm{roa_{t-1}} + \pi_3 \mathrm{lnatm_{t-1}} + \pi_4 \mathrm{lnmpt_{t-1}} + \pi_5 \mathrm{lnweb_{t-1}} + \varepsilon_{3t} \quad (5)$$

$$\Delta\text{lnmpt}_t = \delta_0 + \sum_{j=1}^{\rho} \gamma_1 \, \text{lnmpt}_{t-j} + \sum_{j=0}^{\omega} \gamma_2 \, \Delta\text{roa}_{t-j} + \sum_{j=0}^{\omega} \gamma_3 \, \Delta\text{lnatm}_{t-j} + \sum_{j=0}^{\omega} \gamma_4 \, \Delta\text{lnpos}_{t-j} + \sum_{j=0}^{\omega} \gamma_5 \, \Delta\text{lnweb}_{t-j} + \pi_1 \text{lnmpt}_{t-1} + \pi_2 \text{roa}_{t-1} + \pi_3 \text{lnatm}_{t-1} + \pi_4 \text{lnmpos}_{t-1} + \pi_5 \text{lnweb}_{t-1} + \varepsilon_{4t} \quad (6)$$

$$\Delta\text{lnweb}_t = \delta_0 + \sum_{j=1}^{\rho} \gamma_1 \, \text{lnweb}_{t-j} + \sum_{j=0}^{\omega} \gamma_2 \, \Delta\text{roa}_{t-j} + \sum_{j=0}^{\omega} \gamma_3 \, \Delta\text{lnatm}_{t-j} + \sum_{j=0}^{\omega} \gamma_4 \, \Delta\text{lnpos}_{t-j} + \sum_{j=0}^{\omega} \gamma_5 \, \Delta\text{lnmpt}_{t-j} + \pi_1 \text{lnweb}_{t-1} + \pi_2 \text{roa}_{t-1} + \pi_3 \text{lnatm}_{t-1} + \pi_4 \text{lnpos}_{t-1} + \pi_5 \text{lnmpt}_{t-1} + \varepsilon_{5t} \quad (7)$$

4. RESULTS AND DISCUSSION

The summary statistics as seen in Table 1 shows weak performance of the Nigerian banking industry as return on asset averaged 1.7724 percent over 40 quarters. There was mild fluctuation in industry performance, as return on asset fluctuated between 0.1217 percent and 2.4304 percent. In terms of payment system platform, it is evident that transactions are performed more using the automated teller machine, than other payment systems. Transactions using ATM averaged N323.6993 billion; those using mobile phone technology (MPT) averaged N75.4123 billion; POS transactions averaged N73.0846 billion and the least medium of payment been web as an average of N13.9245 billion is made every quarter. As observed, transactions using ATM and MPT fluctuated wildly as transactions using ATM ranged between N20.8633 billion and N610.85 billion, while those conducted using MPT ranged between N0.29 billion and N563.3666 billion. Transactions using POS fluctuated between N0.6233 billion and N321.4233 billion. For web transaction, the value of transactions rose to N73.84 billion from a minimum of N1.1233 billion.

The skewness statistics revealed dwindling performance of the banking industry and decline in transactions using the ATM given that both series are negatively skewed. The positive skewness of POS, MPT and WEB revealed that Nigerians now prefer employing this payment system for food and services payment, which may be due to convenience these systems bring. The study observed that all the series, except ATM, do not follow a normal distribution.

4.1 Unit Root Test

In modelling, it has become increasingly necessary to determine the order of integration of series in order to avoid the situation of a spurious result. This study tested the integration properties of the series using the augmented Dickey-Fuller (ADF) approach and found that return on asset and automated teller machine (ATM) transactions series do not have unit root in their series. However, it was discovered that point of sale, web and mobile banking technology have unit root as shown in Table 2. Following first differencing of these series, they became stable. Summarily, the test of unit root points to the series been of I(0) and I(1), which gives the foundational backing to employed the bound test and autoregressive distributed lag (ARDL) method of Pesaran, et al. (2001).

The test to determine if there is co-movement among automated teller machine, point of sale, mobile phone technology, web transactions and return on asset was done on the back of presence of non-stationary series in the adopted model. The test result reported in Table 3 was carried out to provide backing to the long run, reflecting that whatever relationship that may exist between the performance index and payment system proxies are not misleading and shocks to the model are transitory. The test for co-movement based on the bound test indicate presence of long run relationship among automated teller machine, point of sale, mobile phone technology, web transactions and return on asset. The F-statistics value of 5.0074604 is higher than the 5% upper bound critical value of 3.49. By this, the null hypothesis is rejected, which leads to the study concluding that there is cointegrating relationship among the variables.

Table 1. Descriptive statistics

	ROA	ATM	POS	MPT	WEB
Mean	1.7724	323.6993	73.0846	75.4123	13.9245
Median	1.8267	328.9850	32.1083	32.0100	7.5249
Max.	2.4304	610.8500	321.4233	562.3666	73.8400
Min.	0.1217	20.8633	0.6233	0.2900	1.1233
Std. Dev	0.4465	178.9498	90.9681	126.3605	17.4525
Skewness	-1.4596	-0.0538	1.2850	2.6477	2.1724
Kurtosis	6.5372	1.7501	3.4400	9.4867	7.1671
Jarque-Bera	35.0570	2.6229	11.3315	116.8660	60.4051
Prob.	0.0000	0.2694	0.0034	0.0000	0.0000
Obs.	40	40	40	40	40

Source: Authors' compilation (2023)

Table 2. Unit roots result

Variable	ADF			I(d)
	Level	1st Diff	5% Critical Value	
roa_t	-3.9044***	-	-2.9484	I(0)
$lnatm_t$	-5.0167***	-	-2.9389	I(0)
$lnpos_t$	-1.1221	-8.2227***	-2.9411	I(1)
$lnmpt_t$	-0.9931	-9.4757***	-2.9411	I(1)
$lnweb_t$	-0.4072	-6.4133***	-2.9434	I(1)

*Note: *, **, and *** denote significance at 10%, 5% and 1%, respectively*
Source: Authors' compilation (2023)

Table 3. Bound test result

Estimated Model		F-statistics
$F_{ROA}(roa/lnatm, lnpos, lnmpt, lnweb)$		5.0074604***
K = 4		
Critical Value	I(0)	I(1)
1%	3.29	4.37
5%	2.56	3.49
2.5%	2.88	3.87
10%	2.2	3.09

Note: *Null hypothesis: No level relationship; K = number of regressors; *, ** and *** denote significance at 10%, 5% and 1% level, respectively.*
Source: Author's computation (2023)

Table 4. ARDL long and short run results

Dependent Variable: ROA_t				
Panel I: Long run results				
$Variable$	$Coefficient$	$Std.Error$	$t-Stats$	$Prob.$
$lnATM_t$	-0.5875	0.6069	-0.9680	0.3431
$lnMPT_t$	0.0318	0.1522	0.2095	0.8358
$lnPOS_t$	0.1259	0.3215	0.3917	0.6989
$lnWEB_t$	-0.0891	0.1730	-0.5149	0.6115
C	4.9905	2.8757	1.7354	0.0960
Panel II: Short run results				
$Variable$	$Coefficient$	$Std.Error$	$t-Stats$	$Prob.$
$D(ROA_{t-1})$	0.1935	0.1223	1.5828	0.1271
$D(ROA_{t-2})$	0.3172***	0.1164	2.8416	0.0092
$D(ROA_{t-3})$	0.2226**	0.0951	2.3401	0.0283
$D(lnATM_t)$	-1.3348***	0.3095	-4.3117	0.0003

$D(lnATM_{t-1})$	0.9031***	0.2749	3.2841	0.0033
$D(lnATM_{t-2})$	0.2594	0.2592	1.0009	0.3273
$D(lnATM_{t-3})$	-1.8451***	0.2630	-7.0132	0.0000
ECM_{t-1}	-0.7554***	0.1249	-6.0478	0.0000
R^2 = 0.8176		Adjusted R^2 = 0.7721		

*Note: *, ** and *** denote significance at 10%, 5% and 1% level.*
Source: Author's computation (2023)

The results of Table 4 are both the long- and short-run split into two parts. Reported in Part I is the static result which informs on how banking industry performance respond to changes in the payment system proxies. The dynamic results which speak to the time effect of changes in payment system proxies on performance index is presented in Part II. From Part I, it was observed that increase in ATM transactions reduces the performance of the banking industry as return on asset declined by 0.5875 percent as transactions on ATMs increase by 1 percent. This relationship which is contrary to the a priori expectation is insignificant. In contrast, it was revealed that both mobile phone technology (MPT) and point of sale (POS) transactions are drivers of banking industry performance. While MPT raises return on asset by 0.0318 percent following 1 percent change, the effect of changes in POS appears to be higher, increasing banking industry performance by 0.1259 percent. Though these results are impressive, the improvement in banking industry performance from changes in POS and MPT transactions are insignificant. This aligns with the findings of Frank and Binaebi [4] and Sakanko and David [7]. Transaction via the web negatively affect industry performance, causing return on asset (ROA) to shrink by 0.0891 percent following 1% increase in payments for goods and services via the system. Like other payment systems, this decline in ROA from increase in web transactions is insignificant. In Nigeria, a bulk of banking businesses are done with the oil and gas sector and companies in the oil and gas value chain, and this could explain why these payment systems exerted insignificant effect on their performance.

Part II showed that, the third and second quarter performance positive influence performance of the banking industry in the current quarter, and this positive effect is significant. ATM transaction in the first quarter significantly improve performance of the banking industry, raising ROA by 0.9031 percent. In contrast, ATM transactions in the third and current quarters are detrimental to banking performance, as they shrink ROA by 1.8451 percent and 1.3348 percent respectively. The error correction term appears to satisfy the conditions of negativity and significance as the coefficient of -0.7554, which is significant even at 1 percent, indicates that, in every quarter, 75 percent of the short run disequilibrium is corrected. By implication, a maximum of two quarters is used to correcting short run deviation to long run equilibrium.

The ARDL (4, 4, 0, 0, 0) model was subjected to diagnostic tests to ensure the model is devoid of any classical linear regression problem such as heteroscedasticity, serial dependence, stability and normality issues. The summary of the tests are reported in Table 5.

The study observed that the model used in examining how payment systems affect performance of the banking industry has serially independent, normal and homoscedastic errors. Also, the estimates which are used for forecast are stable as indicated by the CUSUM and CUSUM of Squares plots.

Table 5. Diagnostic test results

Tests	CLRM Problem	χ^2 Value	χ^2 Prob.	Decision
Breusch-Godfrey LM	Serial Correlation	7.8512	0.0972	Serial independence
ARCH	Heteroscedasticity	0.6711	0.4127	Constant Variance
Jarque-Bera	Normality	0.6443	0.7245	Normal residuals
CUSUM	Stability	-	-	Stable Model
CUSUM of Squares	Stability	-	-	Stable Model

Note: CLRM stands for classical linear regression model
Source: Authors' compilation (2023)

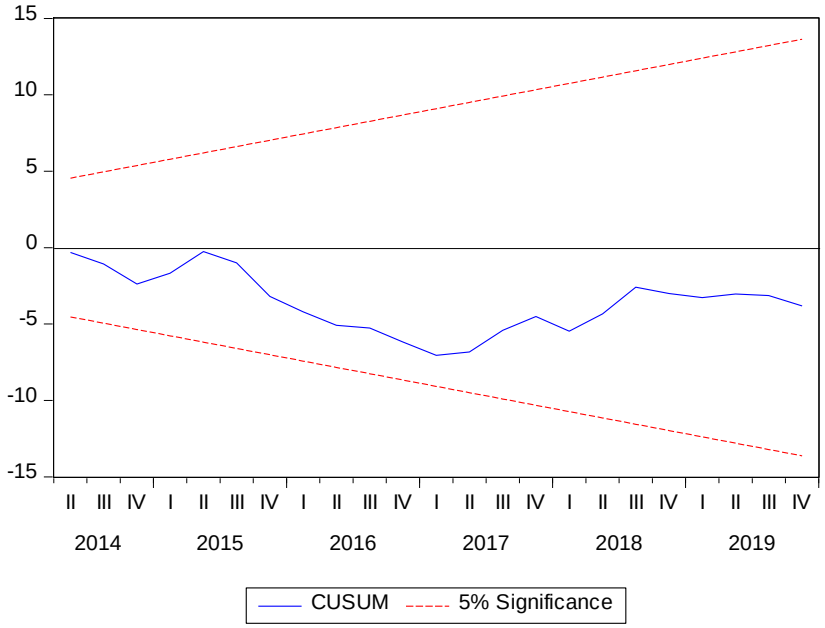

Fig. 1. CUSUM Plot

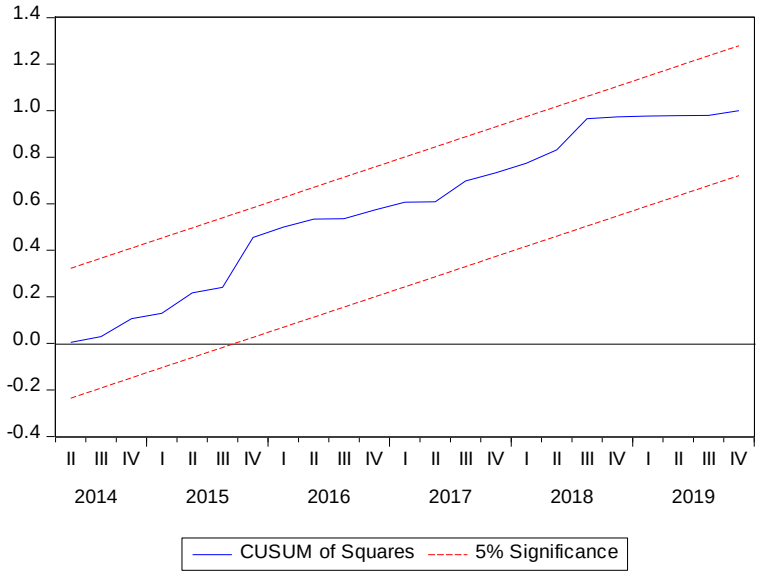

Fig. 2. CUSUM of squares plot

5. CONCLUSION AND RECOMMENDATIONS

With the growing use of information and communication technology in the banking industry and the increasing share of technological investment in the budget of banks, there has concern about the effect of electronic payment systems on the performance of the Nigerian banking industry. This study used banking quarterly data from 2010Q1 to 2019Q4 and the autoregressive distributed lag (ARDL) method to investigate if the use of electronic payment systems such as ATM, point of sale, mobile payment technology and web affect performance of the banking industry, proxy by return on assets. From the estimation, increased use of mobile phone technology and point-of-sale improve banking performance, while the use automated teller machine and web for payment caused decline in performance. Surprisingly, it was observed that none of electronic payment systems were significant in their impact. The study will be of importance to the captains of

industries as it will help them to know the relevance of electronic payment system on the performance of Deposit Money Banks. The study will also help scholars as it will help to fill the gap in existing literature. The study recommends that banks invest in improving the speed, carrying capacity and accuracy of the payment systems. Also, there is need to develop home grown digital payment technology to reduce the cost of procuring and maintaining foreign payment system.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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