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THE LONG-RUN IMPACT OF E-PAYMENT ON FINANCIAL INCLUSION IN NIGERIA

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ABSTRACT

The link between e-payment system and financial inclusion (FI) is the fundamental interest of this paper. Series from the economy of Nigeria were adopted in testing the long-run equations of e-payment and FI. Furthermore, the normalized cointegration technique was applied to ascertain the definite relationship among our series. Our findings suggest that a long-run positive relationship existed between the surrogates of e-payments and financial inclusion in Nigeria. We recommended the widening and deepening of the e-payment mechanism in Nigeria to enhance sustainable financial inclusion.

Keywords: E-payment, Financial Inclusion, Normalized Cointegration, Nigeria.
JEL Classification:G20,G21,G28,C520.

INTRODUCTION

Recent empirical analyses investigating the appropriate and well-disaggregated indices of FI have identified e-payment as a mechanism that is fundamental to the efficient performance of FI globally. However, including measures of e-payment in the basket of indices of FI is cardinal, epochal, and necessary but has left numerous questions unanswered. For instance, at

what point in time will e-payment become a potent determinant of the effectiveness of FI? Is it in the short-run? or in the long-run?

To the best of our knowledge, the studies investigating the non-short-run relationship between FI and the mechanism of e-payment are too scarce to be acknowledged as available and adequate. The sustainability of the influence of e-payment on the effectiveness and efficiency of FI must transcend the short-run period to avoid the occurrence of ephemeral, transient, ' cosmetic' and relatively couched impacts. Hence, our empirical and econometric-study is poised to investigate the long-run impact of e-payment on the effectiveness and efficiency of FI in Nigeria.

Furthermore, majority of the previous studies such as Adrian and Mancini-Griffoli(2019), Reuben and Anyanwaokoro(2019), Khiaonarong and Goh (2020),Ughulu and Agbonkhese (2020),UNSGSA (2020), Khera et al.,(2021a, 2021b), and UNCTAD (2021) devoted to the construction of the FI index either concentrated on only a narrow aspect of e-payment such as Automated Teller Machine (henceforth e-ATM) or omitted e-payment completely. This observation was acknowledged by Gupta, Venkataramani and Gupta (2012). Gupta et al. (2012) noted that previous studies that constructed FI index omitted essential aspects of financial access (as provided by e-payment).

Hence, a major hallmark contributions of our study is the extension of the definition of e-payment to include internet-powered-electronic payment system (hereinafter known as e-INTUSS). e-INTUSS covers many e-payment systems including but not limited to Point of Sales (POS) transactions, online transfers, mobile App transfers and mobile money.

Based on this microcosm, the rest of this paper is structured as follows: section two presents both empirical and theoretical issues of FI, e-ATM and e-INTUSS; section three contains the methodological issues while the rest discussed the findings and offers conclusion.

Financial Inclusion and E-Payments in Nigeria

The volume and value of electronic payments (e-payments) made in Nigeria using different electronic financial channels (such as ATM , POS, i-Mobile, and Internet-enabled electronic devices) experienced an unprecedented rise in 2017 and 2018 respectively (CBN, 2018; 2019 and 2020).

Table 1:*Volume and Value of E-Payments in Nigeria (2016-2018).*

S/No	Electronic Payments	Years			
		2016	2017	2018	% Change 2017/2018
1	Volumes of electronic Payments (# Millions)	715	1,023	1,282	+25 per cent
2	Value of electronic Payments (# Billions)	6,636	9,134	10,503	+15 per cent

Source: Central Bank of Nigeria (CBN, 2019)

Table 1 shows that the volume of e-payments was about 715 million Naira in 2016, but rose to about 1,023 Million Naira in 2017. Between 2017 and 2018, the volume of e-payments made in Nigeria increased from about 1,023 Million Naira in 2017 to 1,282 Million Naira in 2018, representing an annual percentage change of about 25 percent (CBN,2020).

The value of e-payments made in Nigeria in 2016 was about 6,636 Billion Naira; it increased to about 9,134 Billion Naira in 2017. This rose to about 10,503 Billion Naira in 2018, representing about 15 percent change. The usage of internet-enabled electronic device was the least among digital channels, accounting for about 4.0 per cent of the total e-payments. In terms of value, the ATM was one of the most used e-payment channel accounting for about

61.7 per cent while the POS accounted for 22.7 per cent. Other digital channels such as mobile electronic device and internet-enabled payment systems represented about 11.8 per cent and 3.8 per cent respectively.

CBN (2019) observed that , a keen review of the trend and pattern of e-payment transactions made in 2018, simply show that the ATM digital channel was the most used and patronized (accounting for about 68.3 per cent); this was followed by the POS digital terminals and mobile electronic payments representing about 23.1 and 4.6 percentage points respectively.

LITERATURE REVIEW

E-payment is comprised of various electronic systems and platforms through which transactional activities such as payments, services, and products enable economic agents such as individuals, households, firms, industries, and the government and its agencies to receive and/or transfer money without the use of cash.

Electronic banking has been described by the Central Bank of Nigeria (CBN, 2020) as the provision of small-value and retail banking services (such as electronic bill payment, management of account, deposits, lending including the provision of e-payment services) via electronic channels and platforms (see Orji, *et al*.,2018; Muotolu and Nwadialor, 2019). Through innovative electronic financial technology and platforms, e-payment financial services act as strategic opportunity to improve access and reach of basic financial services to Nigeria's unbanked and 'underbanked' population (Ishioro, 2020b and 2022b).

Following the similar empirical paths of Zhu et al. (2004) and Ram et al. (2008), Morales, Perez, Bernal, and Paz (2016) x-rayed the reasons why economic agents are financially excluded from e-payments and FI. Some economic agents are financially excluded from e-payment and FI because of their socioeconomic status (gender discrimination, unstable streams of income, lack of economic empowerment), geographic location (landlocked rural areas and difficult terrain), and technological ignorance and restrictions, and self exclusion (Morales *et al*,2016).

Reuben and Anyanwaokoro (2019) conducted a study to evaluate the contributions of electronic payment system (measured as volume of ATM transactions, volume of web payment and volume of POS transactions) to the performance of financial deepening (measured as GDP/(M2GDP) and credit to the private to GDP (CPSGDP)) in Nigeria using quarterly data. The Granger Causality test (GCT) and other estimation techniques were applied. One of the findings of the GCT show that ATM and CPSGDP Granger caused each other, and ATM and M2GDP Granger-caused each other (See .

MATERIALS AND METHODS

The main features of our time series data including the definition and sources of data are highlighted here. Besides that, we provided a highlight of the estimation techniques that we applied (considering the stationarity and the long-run Johansen cointegration tests as in Ishioro, 2020b; 2019; 2018 and 2015b; Akpobasa and Ishioro, 2022).

Sources and Description of Data.

We extracted our series from the World Bank World Development Indicators (WDI) Database for various years. The data consists of annual time series from the economy of Nigeria covering the period 1990 to 2020.The series we employed include: Financial inclusion (denoted as FI), proxy for e-payment include : ownership of internet-powered-e-payment device (denoted as e-INTUSS) and Automated Teller Machine card (denoted as e-ATM)

ownership and usage. We used e-payment as a comprehensive index (representing both availability of bank infrastructure and, access to electronic banking infrastructure). Also, e-payment was adopted as one of the broad determinant of FI (following Ishioro, 2022b).

The selection of the e-payment indicators is very appropriate for the following reasons:

First, e-payment combined the 'usage' dimension of the indicator using e-ATM and financial 'access' measure that represents the demand-side and supply-side of FI.

Second, e-payment combines both the traditional and electronic dimensions of FI indices thereby representing a comprehensive determinant of FI. Our series are presented in Table 2.

Table 2

Data:Notation,Measurement and Sources

Notation	Variable	Measurement	Source
e-INTUSS	Internet Users (% of total population)	E-payment internet-powered device users are those who have used the internet (from any location) in the last 3 months through a computer, mobile phone, personal digital assistance.	WDI, 2021
FI	Financial inclusion	Financial inclusion (FI) is measured as the sum of money supply that includes broad money (M2) including time deposits, etc	WDI, 2021
e-ATM	Automated Teller Machines (per 100,000 adults)	E-payment ATM are computerized devices that enable users to carry out financial transactions in non-private places.	WDI, 2021

Source: Author's Compilation.

Estimation Technique

Unit Root Test

Unit root test is a very important econometric process whenever time series are involved in the modelling process (Ishioro, 2022c, 2020a, 2015b, 2015c). A serious problem that has made unit root testing an integral part of econometric analysis is that, time series are often susceptible to persistent innovations and are almost always trended (Ishioro, 2015a, 2015c, 2017, 2019).We applied the Augmented Dickey Fuller (hereafter ADF) test in the determination of the nature of stationarity of our series.

The ADF test equation is specified as:

$$\Delta Y_t = \Gamma Y_{t-1} + \Theta_1 \Delta Y_{t-1} + \Theta_2 \Delta Y_{t-2} + ... + \Theta_p \Delta Y_{t-p} + \sigma_t \quad (1)$$

In equation(1), Γ represents the t-statistic of the estimate of the Ordinary least squares(OLS) . This is known as the ADF test statistic. P represents the optimal number of augmenting lag.

The subscript P can be obtained by minimizing the Schwartz Bayesian (SB) criterion or lags are obtained by reducing p until the suitable and appropriate lag becomes significant (statistically).We can also obtain p by minimizing the Akaike information criterion (AIC), Ishioro and Maku (2022) ,Maku and Ishioro (2023), and Maku, Ishioro and Asagba (2023).

The hypothesis (null) of the ADF is stated as:

$H_0 : \phi = 0$ implying that the series are not stationary and needs to be differenced to attain stationarity.

The hypothesis (alternative) of the ADF is stated as:

$H_1 : \phi < 0$ implying that the series are stationary and does not need to be differenced to attain stationarity.

The Johansen Cointegration Test (JCT)

The Vector Autoregression (VAR) has been adopted following the pragmatic practice of Ishioro (2022a, 2022b , 2022d, and 2016) as the starting point of the JCT. Hence, we specified the VAR of order k as:

$$Y_t = \Phi + A_1 Y_{t-1} + ... + A_k Y_{t-k} + \mu_t \quad (2)$$

In equation (2),Yt represents an *nx1* vector of the series that are I(1):integrated of order one; and represents an *nx1* vector of the stochastic terms of the VAR. Hence, we recast equation (1) as:

$$\Delta Y_t = \varphi + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \varpi_i \Delta Y_{t-i} + \mu_t \quad (3)$$

In equation (3),

$$\Pi = \sum_{i=1}^{k} A_i - I \quad (4a)$$

$$\varpi_i = -\sum_{j=i+1}^{k} A_j \quad (4b)$$

In equation (4a) and (4b), assuming the coefficient matrix (denoted as Π) has $r < n$ reduced rank, then it can be inferred that the matrices α and β has *nxr* dimensions with each having the rank r (r represents the cointegrating equations of the model) : $\Pi = \alpha\beta'$ and, $\beta' Y_t$ has no unit root (Ishioro,2020b,2018). The columns of β represent the vector of the cointegrating equations.

The JCT has two varied likelihood tests: Trace test(henceforth TT) and maximum eigenvalue test (MET). The TT is specified as:

$$J_{trace} = -S \sum_{i=r+1}^{n} \log(1 - \hat{\lambda}_i) \quad (5a)$$

The hypothesis (presented in null form) of the TT states and /or implies that there exists *r* cointegrating equations in the model while the other hypothesis (alternative) asseverates the existence of *n* cointegrating equations in the model.

$$J_{\max(e)} = -S \log(1 - \hat{\lambda}_{r+1}) \quad (5b)$$

The hypothesis (expressed in the null form) of the MET states and/or asseverates the confirmed existence of *r* cointegrating equations in the model while the alternative hypothesis states that: there are *r+1* cointegrating equations in the model.

Discussion of Findings

We discussed the findings of the unit root / stationarity test and the bivariate JCT as detailed as possible. The results of the ADF test are discussed first, then the cointegration results follow thereafter.

Table 3

Results of ADF Unit Root Test

Variables	At Level ADF	First Difference ADF	Decision at Level	Decision at First Difference
e-ATM	0.466(0.806)	-2.124 (0.035)	Not Stationary at level	I(1):Integrated of order one
e-INTUSS	3.452 (1.000)	-3.319 (0.026)	Not Stationary at level	I(1):Integrated of order one
FI	-1.685 (0.423)	-2.889 (0.063)	Not Stationary at level	I(1):Integrated of order one

Source: Author's Computation

NOTE: (**, *** represent significance at 5% and 10% level) e-ATM represents Automated Teller Machine per 100,000 users), e-INTUSS represents internet and mobile banking platforms (web and mobile payments), FI represents Financial inclusion exemplified by money supply-to-GDP.

The results of the ADF unit root test presented in table 3 indicated that , all the series are not stationary at levels implying the presence of unit root at levels. Therefore, all the series : e-ATM , e-INTUSS and FI are not integrated of order zero (at 1, 5 and 10 percent level of significance).But they became stationary after first differencing, that is, they are integrated of order one [I(1)].Since stationarity at first difference has been confirmed, we proceed to investigate the nature of the long-run relationship of our variables.

Results of the JCT for Financial Inclusion and E-payment

For a distinct identification of the nature of the long-run relationship existing between the variables on one-on-one basis, we adopted the one-on-one cointegration test akin to Ishioro(2022a) . The results are as reported in table 3 .

The results of the one-on-one cointegration test between FI and e-ATM usage indicated that there is one long-run cointegrating relationship existing between FI and e-ATM usage, that is, there is a cointegrating relationship or equation between them. The results are not surprising because, although e-ATM is an instrument of e-payment, it is a restricted instrument of e-payment. This means that e-ATM is not an e-payment-inclusive electronic instrument. Our results can be further explained using the current practice whereby e-ATM cards are sparsely distributed and used among those who are either financially excluded or unbanked.

The results of the normalized cointegration show that, at the conservative 10 percent significance level, e-ATM card ownership and usage reduces FI by about 14 percent. This suggests that 1 percent e-ATM card usage and ownership increases financial exclusion by 14 percentage point. That means that in Nigeria, e-ATM card ownership and usage is an instrument of financial exclusion but only in the long-run and during the period under consideration.

Table 4

Results of FI Versus e-ATM

Cointegration Results of FI Versus ATM					
Hypothesized No. of CE(s)	Eigen Value	Trace Statistics (TT)	0.05 Critical Value	Max. Eigen Statistic (MET)	0.05 Critical Value
None	0.753	18.068**	15.494	16.791**	14.264
At most 1	0.100	1.276	3.841	1.276	3.841
Normalized Cointegrating Coefficients of FI Versus e-ATM					
Series	FI	e-ATM			
	1.000	0.136			
		(0.072)			

Source: Author's Computation using Eviews 10.1

Furthermore, our results can be explained in the light of the threat of cyber-attacks that has made a lot of persons to be e-ATM-averse. Our results seem to suggest that, although most persons are basking in the glee of cashless payments, they are also wary of some negative perceptions such as e-ATM usage security threat, poor and unstable network coverage including lack of users' adequate knowledge of the e-ATM technology. The policy implication of our finding is that, any banking sector policy restricting the ownership and usage of e-ATM cards will not have adverse effects on FI in Nigeria.

Results of the JCT for Financial Inclusion and Internet Users

For a specific identification of the type of the long-run relationship existing between financial inclusion and Internet electronic device usage on one-on-one basis, the one-on-one cointegration test was applied.

Table 5

Results of FI versus e-INTUSS

Cointegration Results of FI versus e-INTUSS					
Hypothesized No. of CE(s)	Eigen Value	Trace Statistics (TT)	0.05 Critical Value	Max. Eigen Statistic(MET)	0.05 Critical Value
None	0.853	35.058**	15.494	32.603**	14.264
At most 1	0.134	2.455	3.841	2.455	3.841
Normalized Cointegrating Coefficients of FI versus e-INTUSS					
Series	FI	e-INTUSRS			
	1.000	-0.236 (0.089)			

Source: Author's Computation

The results of the JCT shown in table 5 indicated that there is one cointegrating equation in the model, that is, there is a long-run relationship existing between FI and e-INTUSS usage in Nigeria. This imperatively implies that any banking sector or financial sector policy inhibiting e-INTUSS usage will negatively affect FI; given that both series are tending to a common positive long-run equilibrium position. Furthermore, it can be perceptibly inferred that , at least , a one-way causal linkage must exist between the series. However, one of the conclusions drawn from the nature of the normalized cointegrating coefficient show that, in the long-run, a percentage increase in e-INTUSS usage will increase FI by about 24 percentage points in Nigeria but only during the long-run and period covered by this study.

Results of the JCT for Internet Users and ATM Usage

For specific identification of the type of long-run relationship existing between e-INTUSS usage and e-ATM ownership and usage on a one-on-one basis the JCT was applied. The empirical outcomes of the one-on-one cointegration test between e-INTUSS usage and e-ATM ownership and usage are as displayed in table 6.

Table 6

Results of e-INTUSS Versus e-ATM

Results of Cointegration of e-INTUSRS Versus e-ATM					
Hypothesized No. of CE(s)	Eigen Value	Trace Statistics (TT)	0.05 Critical Value	Max. Eigen Statistic (MET)	0.05 Critical Value
None	0.494	15.915**	15.494	14.323**	14.264
At most 1	0.073	1.591	3.841	1.591	3.841
Normalized Cointegrating Coefficients of e-INTUSS Versus e-ATM					
Series	e-INTUSRS	e-ATM			
	1.000	-0.217 (0.048)			

Source: Author's Computation

From the JCT results displayed in table 6, 15.915 > 15.494 for the TT and 14.323 > 14.264 for the MET, it can be inferred that only one cointegrating equation can be authenticated for the e-INTUSS and e-ATM model; meaning that, there exists an established long-run relationship existing between e-INTUSS and e-ATM in Nigeria. The empirical connotation of the results is that, any conservative banking or financial sector policy inhibiting e-INTUSS will negatively affect e-ATM; given that both series are tending to a common positive long-run equilibrium position. But normalizing the cointegrating coefficient of e-INTUSRS versus

e-ATM, the coefficient of e-ATM (-0.217) suggests that, in the long-run, a 1 percent rise in the proportion of the population using e-ATM would increase e-INTUSS by at least 22 percent and by implication also increase the population and proportion of the Users of e-payment for both financial and monetary transactions.

Policy Implications

The policy implications discussed below are distilled from our findings; therefore, they are evidence-based. The policy implication of the long-run relationship between FI and e-INTUSS is very unique and important; since banks (especially deposits-accepting institutions) and other financial service providers rely essentially on Internet Service Providers (ISPs), it is important for policy makers to look beyond banks and other service providers, and adopt a comprehensive FI policy that would integrate ISPs into the paradigm. This will bring long-term landmark achievements to the FI process to enable the gains of such policies to be far-reaching and quite sustainable. Also, following the pragmatic findings of Muotolu and Nwadialor (2019), in the long-run, any FI policy designed and implemented without incorporating the ISPs will be liable to fail because the co-movement and co-direct relationship existing between them implies that.

CONCLUSION AND RECOMMENDATION

The thrust of this current research which is Nigeria-based is to explore the impacts of e-payments (wholesomely represented by a comprehensive duo-proxy) on FI. A detailed review of both empirical and other thematic but purposeful analysis was conducted. The JCT was innovatively applied as a major estimation technique in determining the genre of the long-run co-movement and co-performance between e-INTUSS and e-ATM. The cardinal conclusion obtained as an aftermath of our critical and painstaking analysis and review which was in accordance with the defined objectives was the affirmation of the existence of a long-run co-performance and co-movement between FI and e-INTUSS usage in Nigeria- an evidence of complementarity of performance between them. Also, the existence of a long-run relationship was confirmed between e-INTUSS and e-ATM in Nigeria.

We recommend that, similar to Ishioro (2022b), e-payment as an e-banking mechanism should be adopted and, widened and deepened to ensure its far-reaching and sustainable impacts on FI.

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