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Effects Of Electronic Payments Systems On The Economy Of Nigeria: A Pre-Covid-19 Era Ardl Analysis

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Abstract
This study investigated the effects of E-payment systems on the economy of Nigeria. Secondary quarterly data spanning over a period of eleven (11) years (2009-2019) contained in Central Bank of Nigeria statistical bulletin were used for this investigation. This study used ARDL model to investigate the relationship between Nigeria economy (dependent variable) and E-payment systems in terms of volume and value of transactions (independent variables) in both the short run and long run. EViews Student 11 Version Lite x64 was used to perform these analyses. In terms of volume, while results revealed non-significant relationship between the variables in the long run, Volume of Point of Sales (POSV) exhibited significant positive relationship with Gross Domestic Product (GDP) in the short run and Volume of Automated Teller Machine (ATMV), Volume of Web (WEBV) and Volume of Mobile Payment (MOPV) exhibited respectively significant negative relationships with GDP in the same short run. However, in terms of value, results established that while ATMN, POSN and WEBN exhibited non-significant respective positive and negative relationships with GDP in the long run, MOPN and @TREND exhibited significant respective positive and negative relationships with GDP in the same long run. On the contrary, only D (POSN (-3)) exhibited significant positive relationship with GDP in the short run. Findings no doubt, have both theoretical and practical implications. Practically findings established that only volume and value of point of sale transactions stimulates the growth of Nigeria economy. This study therefore recommended that to grow Nigeria economy, automated teller machine, web (internet) and mobile payment volume and value of transactions should be vigorously deepened.
Keywords: electronic payment system, automated teller machine, point of sale, web (internet), mobile payment, GDP
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1.0 Introduction

Payment for goods or services consummates the production circle and guarantees the going concern of the manufacturing/servicing sector. Also, payment for consumptions guarantees the recovery of funds earlier injected by private or institutional lenders (including commercial banks) into the production processes (Massimo & Gracia, 2008). It therefore, means that payment for goods and services already consumed remains the nucleus of all economic activities. In this regard, commercial banks world over are constantly devising efficient and effective payment platforms. Accordingly, Nigeria commercial banks keeping pace with global trend technologically, embraced E-payment systems in 1987 (CBN, 2019; Jegede, 2014).

No doubt, the change or advancement from manual system of payments in the form of physical immediate or future cash payment, physical depositing of cash in the bank account of creditors (beneficiaries), issuance of cheque to be cashed or paid into creditors account over bank counters, endorsement of bill of exchange in favour of creditors; to E-payment platforms devices such as automated teller machine, point of sale, web (internet) and mobile payment, present a good research standing for our study to provide answers to some germane questions in relation to the Nigeria economy, particularly, in times that world economies are troubled by COVID-19 scourge. Hence, in the context of this study, while the basic question is "what is the potency of E-payment systems in revamping and sustaining the Nigeria economy", answers to this question may also, reveal strength and weaknesses of the E-payment systems in relation to manual system of payment.

Therefore, this study is launched to investigate the strength of E-payment mechanisms in achieving the traditional but highly sensitive objective of the banking sector in advancing an economy. Specifically, this study is designed to investigate the effects of E-payments systems on the Nigeria economy. Essentially, there are basically two aspects of E-payment systems transactions (i.e. volume or size of transactions and value or money worth of

transactions). Statistically the behaviour of these different aspects of E-payment statistics in relation to any dependent variable no doubt, will significantly differ. Therefore, to achieving the objectives of this investigation, conclusions would be based on these critical aspects of variables employed.

Evidences in literature have submitted that payment systems are designed to lubricate economic activities, consummate economic transactions to attaining perfection in the functioning of an economy. Therefore, the introduction of technology into payment system, an invention known as E-payment system is logically expected to enhance efficiency in settling economic obligations. Also, technological advancement or a change from a system to another rationally demands a continuous post implementation or adoption assessment of alternatives. Thus, assessing the effectiveness and efficiency of E-payment systems in greasing economic relationships among stakeholders in the economic web is academically merited.

However, against theoretical expectation, few studies on E-payment systems have been conducted. Unfortunately, these studies generally discussed issues relating to rudimentary knowledge of payment systems (Nakajima, 2017), emergence of E-payment systems (Sumanjeet, 2009), adoption, architecture and essential elements of E-payment systems (Masihuddin, Khan, Mattoo & Olanrewaju, 2017), determining factors in using E-payment systems (Ntukanyagwe & Mulyugi, 2017; Oney Oksuzoglu & Rizvi, 2017), benefits and challenges (including E-payment systems security challenges) of E-payment systems (Masihuddin et al., 2017; Okifo & Igbunu, 2015), E-payments adoption and customers' retention and service delivery (Odusina & Onakoya, 2017; Oladejo, 2016) and E-payment systems related institutional arrangements (Briggs & Brooks, 2011).

It is therefore, clear that several years of implementing E-payment systems (1918 in USA and 1987 in Nigeria), available little academic discussions about E-payment systems can be described as obsolete since discussions merely focused on developmental aspects of E-payment systems. By implication, existing studies undermined the economical essence of E-payment systems and therefore, failed to investigate the potentials of E-Payment systems in boosting economic wellbeing. Hence, the scarcity of empirical academic findings on the relationship between E-payment systems and the performance of economies presented a strong research platform for our study to thrive.

In addition, Saidi (2018) and AL-Adwan, AL-Zyood and Ishfaq (2013) examined respectively the relationship between E-payment technology and bank performance in emerging economies including Nigeria. Frankly, the findings of these studies in relation to the entire economy cannot be generalised and accordingly misrepresenting, since the banking sector is just an institution among several institutions and activities in every economy. Therefore, investigating the effectiveness of E-payment systems in relation to economic performance, particularly, during this period of global economic recession caused by COVID-19 pandemic, is theoretically worthwhile.

In view of the above discussion, this study is launched to investigate the effects of E-payment systems on the Nigeria economy. Specific objectives of this study include:

i) To investigate the effect of volume and value of Nigeria automated teller machine transactions on the Nigeria economy (GDP).
ii) To investigate the effect of volume and value of Nigeria point of sale transactions on the Nigeria economy (GDP).
iii) To investigate the effect of volume and value of Nigeria web (internet) transactions on the Nigeria economy (GDP).
iv) To investigate the effect of volume and value of Nigeria mobile payment transactions on the Nigeria economy (GDP).

2.0 Literature Review

This section provides discussion on conceptual and theoretical reviews including findings of current but related studies.

2.1 Conceptual Framework

E-payment systems have been defined in diverse ways by different authors in the literature. To start, Nakajima (2017) defined "payment system" as a mechanism that facilitates the smooth settlement of transactions or transfer of funds between purchasers and merchants, payee and payer, and or between banks. Similarly, BIS (2008) in detail established that "a payment system is made up of a set of mechanisms, banking procedures and typically, interbank funds transfer systems that ensure the circulation of money". By extension, Masihuddin et al. (2017) defined E-payment system as an inter-organizational information system designed and implemented for executing money related transactions by linking several businesses, bodies and individuals monetarily. Also, E-payment system according to Okifo and Igbunu (2015), is a technologically-based system that brings together instruments and infrastructure, institutions, rules, procedures and standards with the sole objective of settling economic transactions or transferring monetary values between connected parties thereby, discharging mutual economic obligations.

Rationally, the essence of embracing technology at the point of settling or completing economic transactions is with the view to upholding and enhancing the efficiency and effectiveness in consummating economic transactions

and activities. Specifically, Massimo and Gracia (2008) asserted that the technical efficiency of E-payment systems underpins the efficiency with which transaction money are recouped by merchants including reduction in associated risk. Generally, Masihuddin et al. (2017), Sumanjeet (2009), Jegede (2014), Adeoti (2011), Okifo and Igbunu (2015), Saidi (2018), Oney et al. (2017), CBN (2019) and AL-Adwan et al. (2013) collectively affirmed that E-payment systems consummate every economic transaction, lubricates all economic activities, guarantees the going concern of economic undertakings and ultimately, enhances the perfect functioning of an economy.

The economy in focus by our investigation is the Nigeria economy. Nigeria economy in the context of our investigation is defined in terms of gross domestic product (hereafter referred to as GDP). Nwabueze (2009) and Hameed and Ume (2011) defined GDP as the total currency value of all final goods and services produced in an economy over some time period and within the geographical territory of an economy. Khramov and Ridings (2013) particularly, established that one most vital, correct, reliable, representative and commonly accepted yardstick to understanding an economy is the GDP. Hence, this study is launched to investigate the effects of E-payment systems on the Nigeria economy in terms of GDP.

2.2 Theoretical Review

The theory on which our investigation is anchored is known as "endogenous growth theory". The new growth theory is an extension of the "economic growth and growth accounting" theory developed by Solow (1956). Solow (1956) established a significant relationship between accounting growth and economic growth. However, in his model, technological change is exogenous. In other words, the model made no assumptions about the origin of, mechanisms and workings of technological progress in relation to economic growth. Thus, technological advancement is left as an unexplained and automatic process.

Consequently, Lucas (1988), Romer (1990) and Grossman and Helpman (1994) developed the "endogenous growth theory" as an extension of the basic Solow (1956) model. This "new growth theories" endogenise technological progress with the view to providing explanations for technological progresses. Grossman and Helpman (1994) specifically, identified technological growth as catalyst for sustained economic growth. Hence, since the new growth theory establishes relationships between accounting measurement and growth, technological innovations and progresses and economic growth, this study considered it academically worthwhile to investigate the effects of E-payment systems on the Nigeria economy.

2.3 Empirical Review

The stay of merchants in business is principally dependent on successes recorded regarding past economic transactions. Transactions successes are economically established at the point/stage that money or money worth is received by sellers of goods or services from purchasers (Okifo & Igbunu, 2015). Thus, the most critical stage/point of all economic activities (manufacturing, services, wholesaling) is the payment stage. It therefore, means that all payment systems are the essence of all economic activities and transactions. Hence, E-payment systems as a technological driven payment platform are developed to enhance efficiency and effectiveness in settling economic obligations.

Acknowledging the incontestable relevance of payment systems and particularly, E-payment systems in lubricating economic activities and improving an economy, educators, researchers, economists, analysts, policy makers over the years have converged to discussing several aspects of E-payment systems. For example, while Nakajima (2017) discussed rudimentary knowledge of general payment systems with the view to further understand advanced or technologically driven payment systems; Sumanjeet (2009) explored the state of the art emergence of payment systems during the electronic commerce era with particular focus on several types of and other issues about E-payment systems and digital currency. In addition, Masihuddin et al. (2017) conducted a survey on E-payment systems with particular emphasis on concepts like elements, adoption, architecture, challenges and security.

Also, while Oney et al. (2017) developed a conceptual model to survey the determinants of consumers perceived security and trust in relation to E-payment systems; Ntukanyagwe and Mulyugi (2017) focusing on debit cards, found out the determinants of adoption of E-payment systems for Rwandan small and medium business enterprises. Furthermore, while Okifo and Igbunu (2015) focusing on Nigeria, discussed the economic benefits and challenges associated with E-payment systems; Oladejo (2016) explored the influence of E-payment systems implementation on customer's service delivery in the Nigeria Deposits Money Banks. Additionally, Briggs and Brooks (2011) examined the role of institutional arrangements regarding the development of E-payment systems in developing nations.

No doubt, these discussions are generally within the purview of E-payment systems developmental views. The major gap discovered from the review of the above studies is that (over one hundred (100) years of global implementation of E-payment systems and over thirty four (34) years of implementing same in Nigeria) studies

reviewed just focused on developmental issues about E-payment systems. In other words, studies reviewed failed to investigate contemporary academic phenomena like examination of the effectiveness of the E-payment systems in terms of their impacts on trade and business performance, economic transactions, activities and relationships and the overall economic health of adopted nations.

Additionally, few studies on E-payment systems and the banking sector have been conducted. Particularly, while Saidi (2018) providing empirical evidences from Nigeria examined E-payment technology relationship with bank performance in emerging economies, AL-Adwan et al. (2013) investigated the impact of electronic payment systems, particularly, SADAD payment system, on the profitability of Saudi Banks. Saidi (2018) and AL-Adwan et al. (2013) investigation of E-payment systems in relation to just the banking industry and losing sight of the entire economy is another gap in literature to be filled by our investigation. No doubt, investigating the effectiveness of E-payment systems in improving an economy is apt, particularly, in this era that the skies of economies of nations are darkened as a result of COVID-19 pandemic.

Finally, since statistics about E-payment platforms are generally in two aspects (volume and value), this study painstakingly and uniquely investigates the health of Nigeria economy in the light of volume and value of E-payment systems related transactions. This comprehensive but separate investigation of the different aspects of E-payment systems related transactions is worthwhile because statically, different aspects of E-payment systems figures, all things being equal, will impact differently on the health of an economy. Therefore, as a pragmatic or action-oriented research, findings of this study, uniquely, will have both practical and theoretical implications and will serve as a veritable guide to Nigeria policy makers in constructing bridge over economically troubled waters.

3.0 Methodology

This section provides discussion on model specification, type and sources of data used for the study. Discussion on the period of time the data used spanned is equally mentioned in this section.

3.1 Model Specification

To investigate the impact of E-payment systems on the Nigeria economy, this study adapted Saidi (2018) regression model. Since there are two (2) aspects of E-payment systems transactions statistics (volume and value aspects of E-payments systems transactions), this study respectively specified two (2) regression models each having one (1) dependent variable and four (4) independent variables. Particularly, the first multiple regression model specified for this study has GDP as dependent variable and the volume or size of automated teller machine, point of sale, web (internet) and mobile payment respective transactions as independent variables. On the other hand, the second multiple regression model specified for this study also, has GDP as dependent variable and the value or Naira worth of automated teller machine, point of sale, web (internet) and mobile payment respective transactions as independent variables. Thus, these models in terms of volume or size and value or Naira worth explore the connection between variable representing economic performance (GDP) and common E-payment systems transactions. Thus, in terms of volume or size of transactions, multiple regression model formulated is as follows:

$$ln\text{GDP}_t = a_0 + a_1 ln\text{ATMV}_t + a_2 ln\text{POSV}_t + a_3 ln\text{WEBV}_t + a_4 ln\text{MOPV}_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots \quad (1)$$

Where:

$ln\text{GDP}_t$ = Natural log of gross domestic product;

$ln\text{ATMV}_t$= Natural log of volume of automated teller machine transactions;

$ln\text{POSV}_t$ = Natural log of volume of point of sale transactions;

$ln\text{WEBV}_t$ = Natural log of volume of web (internet) transactions;

$ln\text{MOPV}_t$ = Natural log of volume of mobile payment transactions;

ε_t= White noise error term, with the usual stochastic assumptions.

This study used log transformation for all variables.

In terms of value or Naira worth of transactions, the second multiple regression model is given as:

$$ln\text{GDP}_t = a_0 + a_1 ln\text{ATMN}_t + a_2 ln\text{POSN}_t + a_3 ln\text{WEBN}_t + a_4 ln\text{MOPN}_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots \quad (2)$$

Where:

$ln\text{GDP}_t$ = Natural log of gross domestic product;

$ln\text{ATMN}_t$= Natural log of value or Naira worth of automated teller machine transactions;

$ln\text{POSN}_t$ = Natural log of value or Naira worth of point of sale transactions;

$ln\text{WEBN}_t$ = Natural log of value or Naira worth of web (internet) transactions;

$ln\text{MOPN}_t$ = Natural log of value or Naira worth of mobile payment transactions;

ε_t= White noise error term, with the usual stochastic assumptions.

Also, this study used log transformation for all variables.

3.2 Sources of Study Data

Secondary quarterly data about Nigeria GDP, volume and value of automated teller machine transactions, volume and value of point of sale transactions, volume and value of web (internet) transactions and volume and value of

mobile payment transactions obtained from CBN statistical bulletin were used in this study. Quarterly data collected were for period of eleven (11) years (2009 to 2019). Since our investigation is a pre-COVID-19 examination, the period from 2009 when statistics about Nigeria E-payment systems related transactions where first recorded to 2019, the last uninterrupted productive year before the advent of COVID-19 pandemic supported this investigation.

4.0 Discussion of Results

Data about E-payment systems related transactions (series) are commonly available in two forms (volume and value). Hence, two respective regression models (models in terms of volume and value) were specified for this investigation. Accordingly, this study performed significance test of inclusion of series in the ARDL models. Augmented Dickey Fuller test was further performed to test the stationarity of series used in the two (2) regression models. Thereafter, this study used the ARDL F-Bounds Robust test to evidence if series respectively used in both volume and value specified models have long run relationship among themselves. Finally, this study used the ARDL model to investigate both long run and short run relationships between variables respectively used in both volume and value specified regression models. Results of these analyses in the order that they were performed including associated discussion are hereby offered.

4.1 Significance Test for Inclusion of Series

Test of significance at constant and trend for inclusion of series in the ARDL model were first performed for series respectively specified in the two (2) regression models (volume and value specified models). Results of these tests for variables used in volume specified model and variables used in value specified model are respectively offered in Tables 1 and 2.

Table 1: Test of Significance Results for Series used in Volume Specified Model

Variable	Criterion	Coefficient	Std. Error	t-Statistic	Prob.
GDP	C	2.869000	0.358567	8.001294	0.0000
	@TREND	0.074793	0.014360	5.208441	0.0000
ATMV	C	-40.78142	65.36668	-0.623887	0.5361
	@TREND	46.88571	2.617811	17.91028	0.0000
POSV	C	3.126788	0.176500	17.71547	0.0000
	@TREND	0.385710	0.007069	54.56738	0.0000
WEBV	C	3.420697	0.314367	10.88121	0.0000
	@TREND	0.403181	0.012590	32.02441	0.0000
MOPV	C	1.145000	0.129902	8.814346	0.0000
	@TREND	0.151966	0.005202	29.21123	0.0000

Source: Compiled by the Researchers, 2021

Table 2: Test of Significance Results for Series used in Value Specified Model

Variable	Criterion	Coefficient	Std. Error	t-Statistic	Prob.
GDP	C	2.869000	0.358567	8.001294	0.0000
	@TREND	0.074793	0.014360	5.208441	0.0000
ATMN	C	26.10630	0.266008	98.14122	0.0000
	@TRENF	0.303227	0.010653	28.46375	0.0000
POSN	C	12.73976	1.323569	9.625303	0.0000
	@TREND	2.488045	0.053006	46.93856	0.0000
WEBN	C	19.93703	2.084876	9.562696	0.0000
	@TREND	3.226396	0.083495	38.64166	0.0000
MOPN	C	12.73976	1.323569	9.625303	0.0000
	@TREND	2.488045	0.053006	46.93856	0.0000

Source: Compiled by the Researchers, 2021

According to Tables 1 and 2, all series were significant for inclusion in the ARDL analysis at constant and at trend except ATMV that was significant for inclusion only at constant. Since series respectively used in the two (2) regression models passed tests of significance for inclusion in the ARDL analysis, this study based on Augmented Dickey Fuller criterion, further performed stationarity tests for these series.

4.2 Unit Root Tests Based on Augmented Dickey Fuller Criterion

This study performed Augmented Dickey Fuller unit root tests based on Scwarz Info criterion for series respectively used in both volume and value specified regression models with the view to avoid generating spurious results. Hence, based on Scwarz Info criterion, Augmented Dickey Fuller respective tests results for variables used in volume specified model and variables used in value specified model at order zero (0) and trend and intercept are offered in Tables 3 and 4.

Table 3: Variables Used in Volume Specified Model Unit Root Test Results at Order Zero (0) and Trend and Intercept

Series	Type of Test		t-Statistic	Prob*	Decision
GDP	Augmented Dickey Fuller test statistic		0.175529	0.9971	At order zero (0) and trend and intercept, hypothesis that GDP has a unit root was accepted
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
ATMV	Augmented Dickey Fuller test statistic		-2.103121	0.5295	At order zero (0) and trend and intercept, hypothesis that ATMV has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		
POSV	Augmented Dickey Fuller test statistic		-3.024430	0.1376	At order zero (0) and trend and intercept, hypothesis that POSV has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		
WEBV	Augmented Dickey Fuller test statistic		-1.956763	0.6077	At order zero (0) and trend and intercept, hypothesis that WEBV has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		
MOPV	Augmented Dickey Fuller test statistic		-1.498860	0.8146	At order zero (0) and trend and intercept, hypothesis that MOPV has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		

Source: Compiled by the Researchers, 2021

Table 4: Variables Used in Value Specified Model Unit Root Test Results at Order Zero (0) and Trend and Intercept

Series	Type of Test		t-Statistic	Prob*	Decision
GDP	Augmented Dickey Fuller test statistic		0.175529	0.9971	At order zero (0) and trend and intercept, hypothesis that GDP has a unit root was accepted
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
ATMN	Augmented Dickey Fuller test statistic		-5.172796	0.0007	At order zero (0) and trend and intercept, hypothesis that ATMN has a unit root was rejected
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		
POSN	Augmented Dickey Fuller test statistic		-1.506218	0.8120	At order zero (0) and trend and intercept, hypothesis that POSN has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		
WEBN	Augmented Dickey Fuller test statistic		-1.827113	0.6741	

	Test critical values	1% level	-4.186481		At order zero (0) and trend and intercept, hypothesis that WEBN has a unit root was accepted
		5% level	-3.518090		
		10% level	-3.189732		
MOPN	Augmented Dickey Fuller test statistic		-1.092931	0.9999	At order zero (0) and trend and intercept, hypothesis that MOPN has a unit root was accepted
	Test critical values	1% level	-4.186481		
		5% level	-3.518090		
		10% level	-3.189732		

Source: Researchers' compilation, 2021

From Tables 3 and 4, it is clear that for variables used in the two (2) regression models (volume and value specified models), it is only in respect of ATMN that the hypothesis that series has a unit root was rejected at order zero (0) and trend and constant. In other words, at order zero (0) and trend and intercept, all other variables except ATMN used in this investigation had unit root. This situation made this study to subject these series to additional unit root test, particularly, at 1st order and trend and intercept. Hence, based on Scwarz Info criterion, Augmented Dickey Fuller respective tests results for variables used in volume specified model and variables (except ATMN) used in value specified model at 1st order and trend and intercept are offered in Tables 5 and 6.

Table 5: Variables Used in Volume Specified Model Additional Unit Root Test Results at 1st Order and Trend and Intercept

Series	**Type of Test**		**t-Statistic**	**Prob***	**Decision**
GDP	Augmented Dickey Fuller test statistic		-10.18650	0.0000	At 1st order and trend and intercept, hypothesis that GDP has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
ATMV	Augmented Dickey Fuller test statistic		-7.219238	0.0000	At 1st order and trend and intercept, hypothesis that ATMV has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
POSV	Augmented Dickey Fuller test statistic		-7.123009	0.0000	At 1st order and trend and intercept, hypothesis that POSV has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
WEBV	Augmented Dickey Fuller test statistic		-7.132836	0.0000	At 1st order and trend and intercept, hypothesis that WEBV has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
MOPV	Augmented Dickey Fuller test statistic		-7.398170	0.0000	At 1st order and trend and intercept, hypothesis that MOPV has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		

Source: Compiled by the Researcher 2021

Table 6: Variables Used in Value Specified Model Additional Unit Root Test Results at 1st Order and Trend and Intercept

Series	**Type of Test**	**t-Statistic**	**Prob***	**Decision**
GDP	Augmented Dickey Fuller test statistic	-10.18650	0.0000	

	Test critical values	1% level	-4.192337		At 1st order and trend and intercept, hypothesis that GDP has a unit root was rejected
		5% level	-3.520787		
		10% level	-3.191277		
POSN	Augmented Dickey Fuller test statistic		-6.285957	0.0000	At 1st order and trend and intercept, hypothesis that POSN has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
WEBN	Augmented Dickey Fuller test statistic		-7.308895	0.0000	At 1st order and trend and intercept, hypothesis that WEBN has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		
MOPN	Augmented Dickey Fuller test statistic		-6.859101	0.0000	At 1st order and trend and intercept, hypothesis that MOPN has a unit root was rejected
	Test critical values	1% level	-4.192337		
		5% level	-3.520787		
		10% level	-3.191277		

Source: Compiled by the Researcher 2021

Except for ATMN which was not included in the additional unit root test at 1st order and trend and intercept, results of stationarity tests for ATMV, POSV, WEBV, MOPV, POSN, WEBN and MOPN according to Tables 5 and 6 established that hypothesis that series have unit root at 1st order and trend and intercept were rejected. Hence, results of totality of stationarity tests performed indicated that variables used in this investigation were stationary at mixed order (i.e. while ATMN had no unit root at order zero (0) and trend and intercept, ATMV, POSV, WEBV, MOPV, POSN, WEBN and MOPN had no unit root at 1st order and trend and intercept). This condition (mixed order of integration- at order zero (0) and 1st difference), made this study to perform ARDL F-Bounds Robust tests to confirm if series respectively used in both volume and value specified models have long run equilibrium relationships among themselves.

4.3 ARDL Regression Model Test of Significance

ARDL F-Bounds Robust tests for cointegrating relationship were respectively conducted for series respectively used in specifying volume and value regression models. However, to perform ARDL F-Bounds Robust tests, this study first test significance level of both models at constant and trend. Hence, while ARDL model significance test results offered in Table 7 established that volume specified regression model was statistically significant at constant, corresponding results for value specified regression model offered in Table 8 established that value specified regression model was statistically significant at trend.

Table 7: Test of Significance at Constant and Trend Results for Volume Specified Model

Variable	Coefficient	Std. Error	t-Statistic	Prob	Remark
C	-2.837875	1.350053	-2.102047	0.0484	Model is significant at constant but not at trend
@TREND	-0.320012	0.192220	-1.664823	0.1115	

Source: Compiled by the Researcher 2021

Table 8: Test of Significance at Constant and Trend Results for Value Specified Model

Variable	Coefficient	Std. Error	t-Statistic	Prob	Remark
C	-3.947638	3.219519	-1.226158	0.2304	Model is significant at trend but not at constant
@TREND	-0.389594	0.138071	-2.821688	0.0087	

Source: Compiled by the Researcher 2021

4.4 ARDL F-Bounds Robust Tests

Based on the above results, while ARDL F-Bounds Robust tests were performed for volume specified model at constant, for value specified model, it was performed at trend. ARDL F-Bounds Robust tests results for both volume and value specified regression models are respectively offered in Tables 9 and 10.

Table 9: Volume Specified Regression Model ARDL F-Bounds Test Results at Constant

F-Bounds Test		**Null Hypothesis: Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Signif**	**I(0)**	**I(1)**
F-statistic	2.104836	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.75	5.06

Source: Compiled by the Researcher 2021

Table 10: Value Specified Regression Model ARDL F-Bounds Test Results at Trend

F-Bounds Test		**Null Hypothesis: Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Signif**	**I(0)**	**I(1)**
F-statistic	7.151776	10%	2.68	3.53
K	4	5%	3.05	3.97
		2.5%	3.4	4.36
		1%	3.81	4.92

Source: Compiled by the Researcher 2021

For volume specified model, ARDL F-Bounds Robust tests results offered in Table 9 established that there is no cointegration relationship among the variables since the t statistics value of 2.104836 is less than lower bound I(0) value of 2.86 and upper bound I(1) value of 4.01 at 5% significance level. In other words results evidenced that there is no long run equilibrium relationship between the dependent variable (GDP) and independent variables (ATMV, POSV, WEBV and MOPV). Contrary, for value specified model, ARDL F-Bounds Robust tests results offered in Table 10 established that there is a cointegration relationship among the variables since the t statistics value of 7.151776 at 5% level of significance is greater than lower bound I(0) value of 3.05 and upper bound I(1) value of 3.97. In other words results evidenced that there is a long run equilibrium relationships between the dependent variable (GDP) and independent variables (ATMN, POSN, WEBN and MOPN). In view of these contradictions, this study further estimated specific nature of long run respective relationships among series used in volume specified model and series used in value specified model.

4.5 Specific Nature of Long Run Relationships among Series for both Models

Revalidating ARDL F-Bounds Robust tests results that there was no long run equilibrium relationship between variables used in volume specified regression model, ARDL long run specific relationship tests results offered in Table 11 indicated non-significant long run respective relationships between ATMV, POSV, WEBV, MOPV and GDP.

Table 11: Results of ARDL Long Run Form for Volume Specified Model

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ATMV	-0.015886	0.037589	-0.422623	0.6769
POSV	2.003180	5.173446	0.387204	0.7025
WEBV	-0.500560	2.829968	-0.176878	0.8613
MOPV	4.855700	13.94780	0.348134	0.7312
EC=GDP-(-0.0159*ATMV+2.0032*POSV-0.5006*WEBV+4.8557*MOBV)				

Source: Compiled by the Researcher 2021

Though not statistically significant, results specifically evidenced that in the long run while quarterly N100 increase each in ATMV and WEBV degenerate quarterly GDP respectively by N0.016 and N0.5 all things being equal, quarterly N100 increase each in POSV and MOPV increase quarterly GDP respectively by N2 and N4.86 all things being equal. For value specified model, specific long run respective relationships test results for ATMN, POSN, WEBN, MOPN and GDP are given in Table 12.

Table 12: Results of ARDL Long Run Form for Value Specified Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATMN	0.055002	0.132778	0.414243	0.6819
POSN	0.079057	0.047233	1.673758	0.1053
WEBN	-0.001125	0.017007	-0.066139	0.9477
MOPN	0.302057	0.051982	5.810806	0.0000
@TREND	-0.408994	0.128601	-3.180343	0.0036
EC=GDP-(0.0550*ATMN+0.0791*POSN-0.0.0011*WEBN+0.3021*MOPN-0.4090@TREND)				

Source: Compiled by the Researcher 2021

According to Table 12, while ATMN, POSN and WEBN exhibited non-significant respective positive and negative relationships with GDP in the long run, MOPN and @TREND exhibited significant respective positive and negative relationships with GDP in the same long run. Particularly, ARDL long run form results for value specified model established that while every N100 quarterly increase in MOPN increases quarterly GDP by N0.3021 all things being equal, every N100 quarterly increase in @TREND decreases quarterly GDP by N0.409 all things being equal. In all, while volume specified model did not pass the cointegration test, value specified model passed the test.

4.6 Short Run ARDL Test

This study equally estimated short run ARDL test for both models. Results of ARDL short run form for volume and value specified models are respectively offered in Tables 13 and 14.

Table 13: Results of ARDL Short Run Form for Volume Specified Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.728690	0.289575	-2.516413	0.0201
D(GDP(-1))	-0.110785	0.141922	-0.780605	0.4437
D(GDP(-2))	-0.277796	0.129319	-2.148147	0.0435
D(ATMV)	-0.002246	0.000548	-3.844303	0.0009
D(ATMV(-1))	0.001465	0.000618	2.370893	0.0274
D(POSV)	0.537867	0.156131	3.444985	0.0024
D(POSV(-1))	-0.799094	0.180681	-4.422689	0.0002
D(POSV(-2))	0.740457	0.200069	3.701009	0.0013
D(POSV(-3))	-0.944653	0.224503	-4.207757	0.0004
D(WEBV)	-0.261340	0.124834	-2.093492	0.0486
D(MOPV)	-1.426385	0.325881	-4.377017	0.0003
D(MOPV(-1))	1.562650	0.439531	3.555265	0.0019
D(MOPV(-2))	-0.065462	0.379029	-0.172709	0.8645
D(MOPV(-3))	0.734744	0.357072	2.057691	0.0522

Source: Compiled by the Researcher 2021

Table 14: Results of ARDL Short Run Form for Value Specified Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.337232	0.565477	-7.670040	0.0000
D(POSN)	0.035430	0.031909	1.110328	0.2763
D(POSN(-1))	0.009082	0.034172	0.265786	0.7924
D(POSN(-2))	-0.012244	0.033440	-0.366150	0.7170
D(POSN(-3))	0.121472	0.033296	3.648234	0.0011
D(WEBN)	0.030302	0.019750	1.534261	0.1362

Source: Compiled by the Researcher 2021

According to Table 13, while POSV exhibited significant positive relationship with GDP in the short run, ATMV, WEBV and MOPV exhibited significant negative relationship with GDP in the same short run. Particularly, while every N100 quarterly increase in POSV increases quarterly GDP by N0.538 in the short run all things being equal, every N100 quarterly increase in ATMV, WEBV and MOPV decrease quarterly GDP respectively by N0.00225, N0.26134 and N1.4264 all things being equal. On the contrary, only D(POSN(-3)) exhibited significant positive relationship with GDP in the short run for value specified model according to results offered in Table 14. In other words, every N100 quarterly increase in POSN increases quarterly GDP by N0.1215 in a three (3) year lag period all things being equal. Clearly, this investigation as a pioneer, contributed uniquely in terms of functioning of economies to existing literature on E-payment systems. Interestingly, findings generally, validated Masihuddin et al. (2017) assertions that implementation of E-payment systems are associated with salubrious effects, particularly, in relation to the economy.

4.7 Cointegration Equation

Cointegration equation (CointEq(-1)*) statistics or ARDL short run test results for volume and value specified regression models are respectively offered in Tables 15 and 16.

Table 15: Volume Specified Cointegration Equation (ARDL Short Run) Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob
CointEq(-1)*	-0.056978	0.016097	-3.539602	0.0019

Source: Compiled by the Researcher 2021

Table 16: Value Specified Cointegration Equation (ARDL Short Run) Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob
CointEq(-1)*	-0.952567	0.133948	-7.111489	0.0000

Source: Compiled by the Researcher 2021

For the two (2) regression models, the one (1) year period lag error correction term (CointEq(-1)*) coefficient is less than 1 (one), negative and statistically significant. By implication the one (1) year period lag error correction term (CointEq(-1)*) for the two (2) regression models passed the three (3) basic criteria. For volume specified regression model, results established that there is a high speed or average speed of adjustment of 5.7% from the short run to the long run if there is any disequilibrium in the system. On the other hand, if there is any disequilibrium in the system, for value specified regression model, results established that there is a high speed of adjustment of 95.26% from the short run to the long run.

In addition, while respective R-squared and Adjusted R-squared of about 83% and 74% indicated a good fit for our volume specified regression model, they further established that quarterly variation in GDP is explained collectively by the volume of automated teller machine, point of sale, web (internet) and mobile payment transactions. Also, while respective R-squared and Adjusted R-squared of about 69% and 63% indicated a good fit for our value specified regression model, they further established that quarterly variation in GDP is explained collectively by the value of automated teller machine, point of sale, web (internet) and mobile payment transactions. In addition, F-statistic of 8.981654 and Prob(F-statisitc) of 0.000001 for volume specified regression model and F-statistic of 12.02098 and Prob(F-statisitc) of 0.000000 for value specified regression model offered in Table 17 revealed that the two (2) regression models had a good fit.

Table 16: Details of Fitness of Models

Model	R-Squared	Adjusted R-Squared	F-statistic	Prob(F-statisitc)	Durbin-Watson Statistic
Volume Specified model	0.834155	0.741282	8.981654	0.000001	2.305442
Value Specified Model	0.686091	0.629016	12.02098	0.000000	1.990480

Source: Compiled by the Researcher 2021

Finally, respective Durbin-Watson (DW) statistics of 2.305442 and 1.990480 for volume and value specified regression models which fall between 1.5 and 2.5 showed that there was no autocorrelation in the two (2) regression models.

5.0 Conclusion, Implication and Recommendation

Sound economic health is a great issue of concern to economic actors worldwide. Unfortunately, world economies are in appalling times due to the negative effect of COVID-19 scourge. This situation has left economic players with no other alternative than to keep devising remedial measures. Therefore, using pre COVID-19 era quarterly data set (2009-2019), this study was designed to investigate the potentials of technologically driven payment systems (E-payment systems) in revamping economies, with particular emphasis on the Nigeria economy. ARDL model was used to respectively investigate the impact of volume and value of E-payment systems transactions on the Nigeria economy both in the long run and short run. Findings therefore were in four dimensions. First, in the long run and for volume specified investigation, results established that there was no relationship among the series used in volume specified regression model. In other words, findings revealed non-significant long run relationship between volume of automated teller machine, point of sale, web (internet) and mobile payment transactions and GDP. On the other hand, in the same long run and for value specified regression model, of all the regressors (value of automated teller machine, point of sale, web (internet) and mobile payment transactions) findings revealed that only value of mobile payment transactions exhibited significant positive relationship with GDP. In the short run and for volume specified regression model, while volume of point of sale transactions exhibited significant positive relationship with GDP, volume of automated teller machine, web (internet) and mobile payment transactions exhibited significant negative relationship with GDP. Finally, in terms of value specified regression model, only D(POSN(-3)) exhibited significant positive relationship with GDP in the short run. Findings have both theoretical and practical implications. Theoretically, in addition to uniquely contributing in terms of workings of economies to existing literature on E-payment systems, finding of previous studies were further authenticated. Practically, findings established that only volume and value of point of sale transactions demonstrated consistently potentials

to stimulating the growth of Nigeria economy both in the long run and short run. This study therefore recommended that to grow Nigeria economy, volume and value of automated teller machine, web (internet) and mobile payment transactions should be vigorously deepened.

References

Adeoti, J. A. (2011). Automated Teller Machine (ATM) Frauds in Nigeria: The Way Out. *Journal of Social Sciences*, *27*(1), 53–58.

AL-Adwan, M. M., AL-Zyood, M., & Ishfaq, M. (2013). The Impact of Electronic Payment on Saudi Banks Profitability: A Case Study of SADAD Payment System. *IJRRAS*, *14*(1), 1–19.

BIS. (2008). *The Interdependencies of Payment and Settlement Systems, June 2008* (No. 12; 5).

Briggs, A., & Brooks, L. (2011). Electronic Payment Systems Development in a Developing Country: The Role of Institutional Arrangements. *The Electronic Journal on Information Systems in Developing Countries*, *49*(3), 1–16.

CBN. (2019). *Central Bank of Nigeria Statistical Bulletin*. Statistical Bulletin. https://www.cbn.gov.ng/documents/statbulletin.asp

Grossman, G. M., & Helpman, E. (1994). Endogenous Innovation in the Theory of Growth. *Journal of Economic Perspectives*, *8*(1), 23–44. https://doi.org/10.1257/jep.8.1.23

Hameed, I., & Ume, A. (2011). Impact of Monetary Policy on Gross Domestic Product (GDP). *Interdisciplinary Journal of Contemporary Reseach in Business*, *3*(1), 1348–1361.

Jegede, C. A. (2014). Effects of Automated Teller Machine on the Performance of Nigerian Banks. *American Journal of Applied Mathematics and Statistics*, *2*(1), 40–46. https://doi.org/10.12691/ajams-2-1-7

Khramov, V., & Ridings, L. J. (2013). The Economic Performance Index (EPI): An Intuitive Indicator for Assessing a Country's Economic Performance Dynamics in an Historical Perspective. In *IMF Working Papers* (WP/13/214; Vol. 13). https://doi.org/10.5089/9781484381298.001

Lucas, R. . (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, *22*(4), 1–13.

Masihuddin, M., Khan, U. B. I., Mattoo, M. M. U. I., & Olanrewaju, R. F. (2017). A Survey on E-Payment Systems : Elements , Adoption , Architecture , Challenges and Security Concepts. *Indian Journal of Science and Technology*, *10*(20), 1–20. https://doi.org/10.17485/ijst/2017/v10i19/113930

Massimo, C., & Gracia, J. A. (2008). *Measuring Payment System Development* (No. 42; 6).

Nakajima, M. (2017). Essential Elements of Payment Systems. *Journal of Economics and Business Research*, *4*(June), 1–14.

Ntukanyagwe, E. K., & Mulyugi, P. (2017). Determinants of Adoption of Electronic Payment Systems for Small and Medium Enterprises in Rwanda : A Case of R-Switch. *International Journal of Science and Research*, *6*(10), 857–864. https://doi.org/10.21275/ART20177390

Nwabueze, C. J. (2009). Causal Relationship between Gross Domestic Product and Personal Consumption Expenditure of Nigeria. *Journal of Mathematics and Computer Science Research*, *2*(8), 179–183.

Odusina, A. O., & Onakoya, S. A. (2017). Electronic Payment System and Customers' Retention in Banks: Implications for Entrepreneurial Development in Nigeria. *Global Journal of Management and Business Research*, *17*(6), 8–14.

Okifo, J., & Igbunu, R. (2015). Electronic Payment System in Nigeria : Its Economic Benefits and Challenges. *Journal of Education and Practice*, *6*(16), 56–63.

Oladejo, M. O. (2016). E-payments Adoption and Customers ' Service delivery in Nigerian Deposits Money Banks. *International Journal of Application or Innovation in Engineering and Management*, *5*(3), 130–138.

Oney, E., Oksuzoglu, G. G., & Rizvi, W. H. (2017). The Determinants of Electronic Payment Systems Usage from Consumers ' Perspective. *Economic Research-Ekonomska Istraživanja*, *30*(01), 394–415. https://doi.org/10.1080/1331677X.2017.1305791

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy*, *98. 5*, *Par*(5), 71–102.

Saidi, M. A. (2018). E-Payment Technology Effect on Bank Performance in Emerging Economies – Evidence from Nigeria. *Journal of Open Innovation: Technology, Market and Complexity*, *43*(4), 1–14. https://doi.org/10.3390/joitmc4040043

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, *70*(4), 65-94.

Sumanjeet, S. (2009). Emergence of Payment Systems in the Age of Electronic Commerce: The State of Art. *Global Journal of International Business Research*, *2*(2), 17–36.