Innovations

The Impact of Digital Payment System on Financial Deepening in Nigeria

[1] Ndili, Stephen Ebialim; [2] Prof. (Mrs.) Onyeanu, Edith Ogoegbunam; [3] Ugwoke, Obioma Vivian

[1] Bursary Department, University of Nigeria, Nsukka, Enugu State, Nigeria

[2,3] Department of Accountancy, Faculty of Business Administration, University of Nigeria, Enugu Campus, Enugu State, Nigeria

Abstract: *The studyevaluated the impact of digital payment system on financial deepening in Nigeria. It specifically examined the impact of automated teller machine, point-of-sale terminals, electronic cheques, web pay and mobile pay on the ratio of credit to private sector to gross domestic product in Nigeria.The research variables were examined for the period beginning from January 2009 to the end of December 2023 (a period of 15 years). The research employed ex-post facto design. Six variables used as sample size in the study were obtained from the Central Bank of Nigeria quarterly/annual statistical bulletin. Auto Regressive Distributed Lag (ARDL) Model was used to analyze data collected for the studyand an Error Correction Model (ECM) of ARDL was implemented, which indicated the absence of multicollinearity.The result showed a statistically significant impact of digital payment systems on the ratio of credit to private sector to gross domestic product in Nigeria. It is recommended that the Nigerian government and financial institutions should consider expanding and improving digital payment infrastructure across the country, in order to enhance the dependability and accessibility of digital payment channels, reduce transaction cost, advance access to the unbanked population, increase the speed of transfer of value, in order to further improve financial deepening through the ratio of credit to private sector to gross domestic product in Nigeria.*

1.0. Introduction

1.1 Background to the 3 Study

The Nigerian Financial System is an important component of the country's economy, involving various financial institutions such as banks, insurance firms, pension funds, capital markets, and microfinance institutions. These institutions act as intermediaries, gather funds, distribute resources, offer financial services, and manage risks. The interconnectedness of these institutions facilitates the provision of

financial services, allocation of funds, and risk management in the Nigerian economy(Central Bank of Nigeria, 2017). In recent years, there has been a notable disruption in the global financial landscape due to the advent and widespread use of digital payment systems, as highlighted by Khando, Islam, and Gao (2022). Nigeria, a key African economy, is rapidly expanding its use of digital payment systems, aided by technological advancements and the increasing use of smartphones, which is expected to enhance financial stability and economic growth. (Igwebuike, Udeh& Okonkwo, 2019).Zwingina, Onoh and Chukwu (2023) emphasizedthe impact of digital payment methods on Nigeria's financial deepening and also highlighted their benefits like enhanced financial inclusion, transaction convenience, and improved security. (Edoka&Anyanwaokoro, 2019; Takon et al., 2019; Okifo&Igbunu, 2015; Abbas, 2022; Uduak, & Christopher, 2022). Digital payment systems have a significant number of economic benefits which include: promoting financial inclusion (Efanga, Umoh, Essien, &Umoh, 2020; Afaha, 2019), discouraging robbery and cash related crimes (Armey et al., 2014); increasing the effectiveness of the financial markets and system at large, boosting consumer confidence, and eases trade (BIS, 2003); bringing operational competence, enhanced income and lesser business operating cost (Alliance, 2003); among others. Studies have indicated that digital payment systems enhance output and cost-effectiveness (Berger, 2003).EdokaandAnyanwaokoro (2019), financial deepening refers to the increase in the availability and accessibility of financial services and products, which can lead to economic growth and development (Nguena& Abimbola, 2014).

1.2. Statement of the Problem

Despite the increasing acceptance of digital payment systems in Nigeria, there is need to examine their influence on financial deepening metrics such as money supply and lending to private sector. While some studies have highlighted favourable benefits of digital payment systems on financial deepening, others have highlighted problems connected with their implementation (Edoka&Anyanwaokoro, 2019; Abbas, 2022; Uduak, & Christopher, 2022). Therefore, there is need for more study to offer further knowledge on the influence of digital payment system on financial deepening indicators in Nigeria. Studies by Manasseh et al. (2023), shows that digital financial innovation significantly impacts long-term financial system development. Oyelami et al. (2020), their study analyzed the factors influencing electronic payment adoption in Nigeria, revealing that educational attainment, financial inclusion, income level, internet service availability, and other financial infrastructures like point-of-sale machines and mobile banking services are critical determinants. Afaha (2019) demonstrated that there is a considerable positive association between the electronic payment system and economic growth in terms of real gross domestic product (GDP). Nwakobi, Oleka and Ananwude (2019), their study analyzed the influence of financial deepening on economic growth in Nigeria.

They concluded that economic growth in Nigeria is not affected by financial deepening. The study also claimed that the degree of growth in the economy is what impacts the level of development in the banking sector. The study by Olawumi, Lateef, &Oladeji, (2017),shows that there is astrong association between each component of financial deepening indicators, indicating that financial deepening significantly contributed to the profitability of these banks. Various studies have been conducted on the impact of digital payment systems on Nigeria's economic growth and financial deepening. While most scholars have studied the effects, benefits, and challenges of these systems, others have measured their impact on the performance of banks or other financial institutions. However, the conclusions reached by researchers in this domain are often conflicting. Therefore, the major problem to be addressed in this study is to analyze the impact of digital payment system on financial deepening in Nigeria by investigating the nexus betweenfinancial deepening anddigital payment metrics in Nigeria.

1.3. Objective of the Study

The broad objective of this study is to evaluate the impact of digital payment system on financial deepening in Nigeria. While the specific objective is to:

- examine the impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria

1.4. Research Question

- To what extent does digital payment system impact on the ratio of credit to private sector to gross domestic product in Nigeria?

1.5. Statement of the Hypothesis

- There is no statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

1.6 Limitations of the Study

The study did not cover the whole digital payment system and all metrics of financial deepening. However, the metrics selected were consistent throughout the fifteen (15) years period adopted for the study.The data used were only available in the Central Bank of Nigeria Statistical bulletin. This will limit the researcher from having comparable data that would have helped to further validate the research result. That notwithstanding, the Central Bank of Nigeria Statistical bulletin is one of the most consistent and reliable financial data sources in Nigeria.There is also the issue of data limitation, especially as it concerns digital payment. The data on digital payment as contained in the Central Bank of Nigeria Statistical bulletin commenced from the first quarter of 2009. This will constrain the number of years of empirical evidence to be used for the research to fifteen (15) years, notwithstanding that data on financial deepening indicators are available for over forty (40) years. However, to cover for this lapse, the researcher further interpolated yearly data into quarterly

data to improve observations to a total of sixty (60), which will further enhance the empirical result.

2.0. Review of Related Literature

2.1 Conceptual Review

2.1.1 Payment System

A payment system is a set of shared rules and processes that allow the transfer of payments between people, corporations, and financial organizations (American Psychological Association, 2020). Payment systems comprises of payment tools such as cash, cards, cheques, and electronic funds transfers, which clients utilize to make payments (Seidenberg & McClelland, 1993). Payment systems are utilized in lieu of tendering cash in domestic and international transactions (Better Than Cash Alliance, n.d.). They are needed to support the day-to-day activities of the economy, and a safe and efficient payments system is necessary to ensure the smooth functioning of the economy (Seidenberg & McClelland, 1993). Payment systems can be traditional or digital, and they are used to settle financial transactions through the transfer of monetary value (Better Than Cash Alliance, n.d.).

2.1.2 Traditional Payment System

Traditional payment systems comprise of a number of established ways that have been integral to financial exchanges for decades. These methods include cash, checks, and various sorts of electronic payments transfers. Unlike digital payment systems, conventional payment methods frequently incorporate physical instruments and actual currency, indicating a historical approach to monetary transactions (American Psychological Association, 2020).

2.1.3 Digital Payment System

Piyush and Armaan (2023), digital payment system is a financial transaction that does not entail the physical transfer of currency. Instead, it is the transfer of value from one payment account to another utilizing a digital device or channel. Digital payments can be made using bank transfers, mobile money, quick response codes, and payment instruments such as credit, debit, and prepaid cards. Digital payments might be mostly digital, primarily digital, or totally digital. They offer considerable benefits to individuals, companies, governments, and international development groups.

2.1.4 Types of Digital Payment System

There are various sorts of digital payments, including online electronic payment systems, mobile payment apps, mobile wallets, digital wallets, e-wallets, digital cards, and peer-to-peer digital payments (Morgan, 2023). Online electronic payment systems include electronic bank transfers, eChques, and wire payments. Mobile payment apps include PayPal, Venmo, and Zelle, while mobile wallets/digital wallets/e-wallets include Apple Pay, Google Pay, and Samsung Pay.

Digital cards include credit and debit cards, while peer-to-peer digital payments allow users to transfer money to an individual or corporation via a mobile device. Other examples of digital payment techniques include point of sale (POS) systems, contactless payments, and biometric authentication (Entrust, 2023).

2.1.4.1 Automated teller machine (ATM)

Automated Teller Machine (ATM) is an electronic telecommunications equipment that enables consumers of financial institutions to complete different financial operations without the need for direct interaction with bank staff. ATMs are commonly utilized for cash withdrawals, deposits, funds transfers, balance queries, and account information inquiries (Mavers & Baker, 2021).

2.1.4.2 Point-of-sale terminals

The history of the point of sale (POS) terminal dates back to the late 1800s when James Ritty, a saloon owner, devised the cash register to track cash transactions at his institution. This development represented the beginning of POS systems, which grew over the years to incorporate functions for inventory management, personnel monitoring, and cloud-based services (Research Guides, n.d.). The Central Bank of Nigeria (CBN) played a major role in establishing the landscape of electronic payments in the country. The implementation of the Cashless Policy in 2012 aims to minimize the dominance of physical currency in the economy and boost the use of electronic payment methods. This strategy acted as a driver for the rapid use of POS terminals across many sectors (Central Bank of Nigeria, 2019).

2.1.4.3 Electronic cheques

The origin of electronic cheques, usually known as e-cheques or electronic funds transfers (EFT), may be traced back to the growth of traditional paper-based cheques and the larger development of electronic payment systems. Electronic cheques were introduced to enhance the efficiency, security, and speed of financial transactions. Electronic cheques (e-cheques) can be particularly attributed to the Cheque Clearing of the 21st Century Act, popularly known as " Cheque 21," which was enacted in the United States in 2003. This federal statute created the regulatory groundwork for electronic cheques, making them lawful, quick, secure, and convenient for all parties involved in a transaction. E-checks reach their destinations more quickly than traditional paper cheques, as they are handled electronically, removing the need for physical cheques or cash transactions (Shopify, 2024).

2.1.4.4 Web pay

The transition to electronic payment systems, particularly web pay, has been a response to the need for efficient, secure, and convenient payment options. The usage of electronic payments, such as e-cheques, has been gaining traction in Nigeria, as the country attempts to lessen its reliance on cash and traditional paper-based payment systems (Okifo& Igbunu,2015). The government has been

encouraging an enabling environment for the production of payment solutions, and there has been a considerable push towards digital payments and financial technology in the country (Adeyanju, 2023). Globally, the shift to digital payments has been quickening, with electronic payments becoming a booming business that has attracted enormous investment.

2.1.4.5 Mobile pay

The origin of mobile pay is linked to the development and use of digital payment systems in many countries. In recent years, the world has experienced a substantial shift towards electronic payments, with many countries embracing real-time and digital banking systems. Nigeria, for instance, has emerged as Africa's undisputable real-time and digital payment leader, recording 3.7 billion real-time transactions in 2021 (Adeyanju, 2023). Globally, electronic payments have witnessed remarkable development and opportunity, attracting more investment than any other financial-services sector and offering the highest returns.

2.1.5 Financial Deepening

Financial deepening refers to the process of increasing the size, efficiency, and growing the diversity of the financial sector in a country (Nwosu, Itodo&Ogbonnaya-Orji, 2021). Chinweze, (2017), The process of financial deepening is vital for economic growth and development, as it creates additional prospects for continuous and sustainable growth. The process of financial deepening entails growing the size of the financial sector, enhancing its efficiency, and raising its diversity. This can be achieved through several measures, such as boosting financial inclusion, increasing access to credit, and establishing a conducive climate for financial growth (Nwosu, Itodo&Ogbonnaya-Orji, 2021).

2.1.5.1 Ratio of Credit to Private Sector to Gross Domestic Product as a Measure of Financial Deepening

The ratio of credit to the private sector to gross domestic product (GDP) in Nigeria is an important economic statistic that measures the amount of credit extended by financial institutions to the private sector as a percentage of the country's GDP. According to the World Bank, the domestic credit to private sector (% of GDP) in Nigeria was recorded at 14.09% in 2022 (Oyinlola &Oyebisi, 2021). This suggests that the private sector in Nigeria has access to a considerable quantity of credit from banking institutions. The ratio of credit to the private sector to GDP is an important indicator of the level of financial development in a country. A high percentage shows that the private sector has access to a considerable quantity of credit, which can be utilized to finance investments and stimulate economic growth. On the other hand, a low percentage may imply that the private sector is not able to access sufficient financing, which can impede economic growth.

2.2. Theoretical Review

2.2.1 Financial Development Theory

Financial Development (FD) Theory was developed by Joseph Schumpeter in 1911. The theory proposes a link between finance and development. According to Schumpeter (1911), the presence of uncertainty in an economy encourages innovators to create financial and technological innovations that influence the level of financial sector performance and by extension economic development. According to the theory, financial intermediaries' services, which include mobilizing savings, evaluating projects, managing risk, monitoring managers, and facilitating transactions, are critical for technological innovation and economic development (King & Levine, 1993). The theory states that developing the financial sector such as the introduction of electronic payment system to enable it ease financing conditions, and offer credit to deficit units, is the key to unlocking growth in an economy (Ozili, 2023).

2.2.2 Financial Inclusion Theory

Barajas et al. (2021) opines that financial inclusion theory, as a separate theoretical framework, does not have a single, widely accepted originator. Instead, it has developed throughout time via contributions from many academics, international organizations, and officials. The notion of financial inclusion attracted substantial attention in the late 20th and early 21st centuries as a crucial component of economic growth and poverty reduction initiatives. Financial inclusion is the availability and equality of opportunities to access financial services, including banking, loans, equity, and insurance products. It attempts to increase economic inclusivity by allowing the unbanked people access to savings, investment, and insurance, enhancing family income and lowering income inequality. It focuses on unbanked and underbanked persons, especially involving women and the underprivileged in rural regions (Ozili, 2023). Sen (1999) early talks on financial inclusion may be traced back to development economists who highlighted the necessity of access to financial services for poverty reduction and economic progress. This theory affirms that digital payment systems can promote financial inclusion by offering access to financial services to previously unbanked or underbanked individuals and enterprises. This can lead to increased financial deepening, as more people join in the formal financial system (USAID., n.d.). Kaur and Kaur (2018) believe that financial inclusion theory is the ease of access to, and the provision of, essential financial services to all members of the population, with the purpose of improving their welfare and economic well-being.

2.3. Empirical Review

Nzotta and Okereke (2009) researched on financial deepening and economic development in Nigeria during the period covering 1986 to 2007 (22 years), with the purpose of ascertaining if financial deepening is an essential variable required to fast-track economic growth in Nigeria. They employed the two stages least square and trend analysis for data evaluation during the investigation. Their work used the ratio of money supply to GDP as the measure of financial deepening. They observed that four of the explanatory variables (value of cheques cleared to GDP, value of cheques to money supply, ratio of private sector credit to GDP, financial savings to GDP, rate of inflation, real lending rates, deposit money bank assets to GDP, Currency outside Banks to money supply) had a statistically significant association with financial deepening in Nigeria. Onwumere, et al. (2012), their work centered on the impact of financial deepening on economic growth in Nigeria using broad money velocity, money stock diversification, economic volatility, market capitalization and market liquidity as proxies for financial deepening and gross domestic product growth rate for economic growth for the period covering 1992 to 2008. Data for the work were obtained from the Central Bank of Nigeria Statistical Bulletin and analyzed using Multiple Regression Model (MRM). It was revealed that there is a positive and significant association between financial deepening and economic growth in Nigeria.Olawumi, Lateef and Oladeji (2017) their work examined the extent to which financial deepening has influenced profitability performance of selected commercial banks in Nigeria using ratio of credit to private sector to gross domestic product and ratio of deposit liabilities to gross domestic product as proxies for financial deepening, while using interest earnings as a measure of profitability. They employed descriptive research methodology to explore the relevance of financial deepening on banks performance and used Ordinary Least Squares (OLS) estimate method for data analyses. They discovered that each component of financial deepening has a strong association and are statistically significant which provides empirical proof that financial deepening made beneficial contributions to the level of profitability of the selected commercial banks in Nigeria. Khan et al. (2017) the purpose of the research was to examine the present status and growth of online payment systems in world markets and also to take a look at the future of online payments. This study also made efforts to investigate the many elements that affect the adoption of online payment systems by customers using descriptive (frequency and percentages. It was revealed that experience of online payment systems is positively associated to the present and the future.Nwakobi, Oleka and Ananwude (2019) they evaluated the influence of financial deepening on economic growth in Nigeria during the period between 1986 to 2018 (33 years). They collected data from statistical bulletins of the Central Bank of Nigeria (CBN) and factbooks of the Nigerian Stock Exchange (NSE) and data was analzed using Auto-regressive

Distributive Lag (ARDL) Approach. The effect was calculated using the Granger Causality technique. It was determined that growth in Nigeria economy is not affected by financial deepening. It was also revealed that the amount of growth in the economy effects the level of development in the banking sector.

3.0. Methodology

3.1 Research Design

The ex-post facto design was adopted for the study, which isused to study the impact of the independent variable on dependent variable. It explicitly explores how past events or qualities influence current results (Shadish et al., 2002).

3.2. Area of Study and Sources of Data

The study was conducted in Nigeria. The studyrelied exclusively on secondary data. The data were retrieved from the Central Bank of Nigeria quarterly/annual statistical bulletin. This is a notable, reliable and verifiable publications from one of the foremost institutions in Nigeria.

3.3 Population and Sample Size

The population of the study consist of seventeen (17) variables of digital payment system and financial deepening as contained in the Central Bank of Nigeria quarterly/annual statistical bulletin. The data used covers the period, January 2009 to December 2023. Digital payment methodss selected for this study include; automated teller machine, point-of-sale terminals, electronic cheques, web pay and mobile pay. While financial deepening indictor used is; the ratio of credit to private sector to gross domestic product in Nigeria. Out of 17 variables in the population of the study, 6 variables were selected as the sample size.

3.4 Model Specification

The framework employed to evaluate the impact of digital payment system on financial deepening in Nigeria is the Financial Development (FD) Theory developed by Joseph Schumpeter in 1911. The theory proposes a link between finance and development. According to Schumpeter (1911), the presence of uncertainty in an economy encourages innovators to create financial and technological innovations that influence the level of financial sector performance and by extension economic development. According to the theory, financial intermediaries' services, which include mobilizing savings, evaluating projects, managing risk, monitoring managers, and facilitating transactions, are critical for technological innovation and economic development (King & Levine, 1993).

The functional form of the model to be estimated is;

$$CPS_t = \beta_0 + \beta_1 ATM_t + \beta_2 PST_t + \beta_3 ELC_t + \beta_4 WBP_t + \beta_5 MBP_t + \beta_6 NDB \ldots\ldots\ldots\ldots\ldots (3.1)$$

Where:

CPS = the ratio of credit to private sector to gross domestic product in Nigeria
ATM = Automated teller machine:
PST = Point-of-sale terminals:
ELC = Electronic cheques:
WBP = Web pay:
MBP = mobile pay:
NDB = number of deposit money banks in Nigeria

Assuming a linear relationship between the dependent variables and the independent variables, the Classical Linear Regression model is econometrically specified in the following form:

$$CPS_t = \beta_0 + \beta_1 ATM_t + \beta_2 PST_t + \beta_3 ELC_t + \beta_4 WBP_t + \beta_5 MBP_t + \beta_6 NDB_t + \mu_{1t} \ldots\ldots (3.2)$$

Where:

$\beta_0, \alpha_0, \partial_0, \lambda_0$ and θ_0 represents the intersect associatingthe models

$\beta_i, \alpha_i, \partial_i, \lambda_i$ and θ_i are their slope coefficients with i = 1, 2, 3, 4, 5 and 6

t - represents the period under study or simply the number of observations of the study

μ- represents the stochastic error term (inherent random unpredictable variables)

3.5 Technique for Data Analysis

This study made use of the Auto Regressive Distributed Lag (ARDL) Model. The autoregressive distributed lag (ARDL) model is a statistical technique used to estimate the relationship between a dependent variable and a set of explanatory variables. The basic idea behind the ARDL model is to include both lagged values of the dependent variable and lagged values of the explanatory variables in the model, in order to capture any possible long-run relationship between them. One advantage of the ARDL model is that it can be used for time series data with different orders of integration, such as integrated of order one (I(1)) and integrated of order zero (I(0)). This makes it a useful tool for analyzing the long-run relationship between economic variables that may exhibit different patterns of stationarity (Emeka, &Aham, 2016). This model was used by Shahbaz et al., (2014) Lawal et al., (2016), Nwakobi et al., Olayungbo and Quadri, Afaha, Okoyeuz et al., (2019). It was also deployed by Ugwuanyi et al., Samuel-Hope et al., (2020) and Onah et al., (2021). Auto Regressive Distributed Lag (ARDL) Model was used by Misati et al., Andrea, Mohammed et al.,

(2022). Again, it was employed by Manasseh et al., Mustapha et al., Onwere et al., and Enebeli-Uzor et al (2023).

4.0 Data Presentation and Analyses

4.1Data Presentation and Brief Interpretation

Table 4.1 presents the descriptive statistics (mean, standard deviation, skewness, kurtosis, etc.) of the variables used for the study's analysis. It indicates the measurement of normality of the variables. The table shows the summary statistics of the data used to evaluate the impact of digital payment system on financial deepening in Nigeria.

Table 4.1: Descriptive Statistics of the Variables

	ATM	CPS	ELC	MBP	NDB	PST	WBP
Mean	4855.853	18.91600	6554.152	1134.511	26.66667	1142.744	242.4622
Median	4988.133	18.82000	5829.549	756.8975	25.00000	758.9965	132.3603
Maximum	9448.565	22.75000	29436.02	5080.965	33.00000	3204.753	675.9167
Minimum	399.7100	15.07000	-9300.856	1.270000	21.00000	11.03000	25.05000
Std. Dev.	2893.177	1.671592	10339.82	1311.072	3.563785	1072.486	211.6217
Skewness	-0.072635	0.042892	0.608080	1.698427	0.484705	0.403859	0.598018
Kurtosis	1.736732	4.044453	2.895965	5.882363	2.000260	1.713397	1.899300
Jarque-Bera	4.042372	2.745601	3.724673	49.61659	4.848094	5.769391	6.605110
Probability	0.132498	0.253396	0.155309	0.000000	0.088562	0.065872	0.066789
Sum	291351.2	1134.960	393249.1	68070.66	1600.000	68564.65	14547.73
Sum Sq. Dev.	4.94E+08	164.8590	6.31E+09	1.01E+08	749.3333	67863395	2642241.
Observations	60	60	60	60	60	60	60

Source: Researcher's computation using E-Views 12 (2024)

Where:

CPS = the ratio of credit to private sector to gross domestic product in Nigeria
ATM = Automated teller machine:
PST = Point-of-sale terminals:
ELC = Electronic cheques:
WBP = Web pay:
MBP = mobile pay:
NDB = number of deposit money banks in Nigeria

The data shows a balance observation of 60 quarterly data points for all the variables. The mean value of the ratio of credit to private sector to gross domestic product (CPS) for the period under study is 18.9. CPS is one of the strong indicators of financial deepening that measures the performance of deposit money banks in Nigeria. This data indicates that the average financial deepening from 2009 to 2023 in Nigeria, in terms of the ratio of credit to private sector to GDP is 18.9. The indicators for digital payment system used in the study such as automated teller machine (ATM), point-of-sale terminals (PST), electronic cheques (ELC), web pay (WBP), and mobile pay (MBP), measured in billion Naira, shows average mean values of 4855.9, 1142.7, 6554.2, 242.5 and 1134.5 billion naira, respectively. The data reveals that electronic cheques and automated teller machine have the highest mean values of 6554.2 billion and 4855.9 billion transactions within the periods of 2009 to 2023 in Nigeria, respectively. The least values are that of web payment and mobile payment systems, with mean values of 242.5 billion and 1134.5 billion-naira transactions within the study period.Another important result from Table 4.1 is the Jarque-Bera (JB). The JB test is a statistical test used to determine whether a given sample of data follows a normal distribution by evaluating its skewness and kurtosis. This test is particularly relevant in this study as it helps to validate the assumptions underlying the methods of analysis of this study, such as t-tests and regression analyses. The null hypothesis (H_0) posits that the data is normally distributed, while the alternative hypothesis (H_a) suggests that it is not. A higher JB statistic indicates a greater deviation from normality. A small p-value (typically less than 0.05) implies strong evidence against the null hypothesis, leading to its rejection. The JB p-values associated to the variables, indicates that the data are normally distributed. The finding is an interesting one knowing that most financial data often exhibit skewness and kurtosis that deviate from normality due to factors like volatility clustering and fat tails.The Augmented Dickey-Fuller (ADF) unit root approach was employed for this analysis. Thedecision rule is to reject the null hypothesis when the ADF statistic is greater (in absolute term) than the critical values (i.e., ADF > 5% critical value).

Table 4.2 Augmented Dickey-Fuller (ADF) Unit Root test statistics

	Level			**Difference (1st)**			
Variable	t-Stat.	**5% crit. Value**	**Prob***	**t-Stat.**	**5% crit. Value**	**Prob***	**Remark**
ATM	-0.607329	-2.91552	0.8602	-3.44802**	-2.9155	0.0133	I(1)
CPS	-2.99200	-2.91173	0.0555	-7.49465	-2.9126	0.0000	I(0)
ELC	-1.66729	-2.91173	0.4424	-8.04550**	-2.91263	0.0000	I(1)
MBP	-1.92019	-2.91173	0.3210	-7.50649**	-2.91263	0.0000	I(1)
NDB	-0.10246	-2.91173	0.9633	-7.84508**	-2.91263	0.0000	I(1)
PST	-0.89241	-2.91173	0.7840	-7.65831	-2.91263	0.0000	I(1)
WBP	-1.12852	-2.91173	0.6989	-7.55755**	-2.91263	0.0000	I(1)

Source: Researcher's computation using E-Views 12 (2024)

Key: I(0) denotes that the variable is not integrated (or has unit root), while I(1) means that it is integrated. The null hypothesis of unit root is rejected when t-stat is greater than 5% critical value. ** denotes significant at 5% critical value.

Table 4.2 result indicates that all the variables, with the exception of CPS which is significant in level, I(0), are integrated of order one I(1). This signified a mixed order of integration, therefore analysing them in their different form yields a short-run result. Consequently, to avoid estimating a short-run result when, fundamentally, the underlying theories shows that most financial data often exhibit long-run associations. This study proceeds to cointegration analysis.Engle-Granger single equation cointegration approach was employed for this analysis. The null hypothesis states that variables (series) are not cointegrated. This approach computes two statistics, the tau-statistic and z-statistic. Lag length selection was done automatically. At 5% significant level, the null hypothesis can only be rejected if probability value is less than 0.05. The result obtained for the co-integration test is presented in Table 4.3.

Table 4.3 Cointegrating equation deterministic Result

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*	No. of Lags	No. of Obs	No. of Stoc. Trends
ATM	-1.925876	0.9999	-14.97710	0.9953	8	51	11
CPS	-1.699225	1.0000	-12.13198	0.9991	8	51	11
ELC	-2.453047	0.9990	-29.31427	0.6802	8	51	11
MBP	-1.865125	0.9999	-15.34793	0.9944	8	51	11
NDB	-2.149324	0.9997	-43.42080	0.1074	8	51	11
PST	-3.138850	0.9856	-17.61826	0.9865	0	59	11
WBP	-3.083897	0.9881	-41.20512	0.1899	4	55	11

Source: Researcher's computation using E-Views 12 (2024)

Table 4.3 indicates that the number of stochastic trends of the variables is the same at 11 for all the variables, while the number of observations varies according to the lag length. It means that the p-values are estimated using results for 11 stochastic trends. Note, also, that the lower the lag length the higher the number of observations. Based on the result, both the tau-statistic and the z-statistic found no evidence of cointegrating vector in all the cointegrating equations. On this note, the study concludes that there exist no linear combination among the variables, however, since all the variables are of mixed integration order, I(0) and I(1), an Error Correction forms of ARDL is implemented.

Table 4.4: Correlation Matrix for Multicollinearity Test

	ATM	CPS	ELC	MBP	NDB	PST	WBP
ATM	1.000	0.064	-0.610	0.676	0.595	0.678	0.727
CPS	0.064	1.000	0.002	-0.118	0.116	-0.044	-0.054
ELC	-0.610	0.002	1.000	-0.517	-0.753	-0.707	-0.647
MBP	0.676	-0.118	-0.517	1.000	0.656	0.920	0.775
NDB	0.595	0.116	-0.753	0.656	1.000	0.836	0.808
PST	0.678	-0.044	-0.707	0.920	0.836	1.000	0.736
WBP	0.727	-0.054	-0.647	0.775	0.808	0.736	1.000

Source: Researcher's computation using E-Views 12 (2024)

The result above indicates the absence of multicollinearity problem because in the correlation matrix, there is no pair-wise correlation coefficient that exceeds 0.8 or -0.8. Hence, all the variables were retained for use in estimations.

4.2 Test of Hypothesis

Model Estimated Results

This study's analysis was conducted using autoregressive distributed lag (ARDL) models. The integrating disposition of the variables influenced the ARDL model selection. The ARDL model is appropriate for dealing with time series data that contains variables integrated in different orders, specifically I(0) and I(1).

Ratio of credit to Private Sector (CPS) and Digital payment system

H_o: There is no statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

H_a: There is statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

Decision Rule:

Decision Rule 1: Accept null hypothesis if P-value is greater than 0.05 and reject null hypothesis if P-value is less than 0.05.

The first presentation (Table 4.5) is the result of objective one, which examines the impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

Table 4.5: ARDL Error Correction Regression Result for CPS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPS(-1))	-0.546199	0.080430	-6.790984	0.0000
D(CPS(-2))	-0.546199	0.080430	-6.790984	0.0000
D(CPS(-3))	-0.546199	0.080430	-6.790984	0.0000
ATM	-5.59E-06	0.000157	-0.035577	0.9718
PST	-0.000804	0.000923	-0.871147	0.3883
ELC	0.000258	2.60E-05	9.930959	0.0000
WBP	-0.001741	0.001650	-1.054864	0.2971
MBP	0.000623	0.000358	1.741078	0.0885
NDB	0.281920	0.039697	7.101793	0.0000
CointEq(-1)*	-0.249084	0.026388	-9.439378	0.0000
R-squared	0.794961	Mean dependent var		-0.037857
Adjusted R-squared	0.754845	S.D. dependent var		0.964600
S.E. of regression	0.477604	Akaike info criterion		1.520363
Sum squared resid	10.49286	Schwarz criterion		1.882033
Log likelihood	-32.57016	Hannan-Quinn criter.		1.660582
Durbin-Watson stat	0.890091			

Source: Researcher's computation using E-Views 12 (2024)

Table 4.5 result indicates that the ratio of credit to private sector to gross domestic product (CPS) exhibits a short-run negative spillover-effect that runs from the past performance to the present set. The result suggests that past performance of CPS exacts up to 55% influence on its present performance. Table 4.5 result further reveals that Electronic cheques (ELC) and the number of deposit money banks (NDB) have positive relationship with CPS. The result indicates that a 1%-point increase in the value of electronic cheques and the number of deposit money banks would significantly increase financial deepening via the ratio of credit to private sector to gross domestic product, by 0.0026% and 28%, respectively, in the short-run. The result supported the fact that mobile technologies are pillars for a range of financial services that unlock development possibilities for homes and organizations, including facilitating payment, savings and credit services, confirming credit-worthiness and processing consumer or corporate transactions.The automated teller machine (ATM), point-of-sale terminals (POS), and web pay (WBP) suggests to exact insignificant and negative impact on the ratio of credit to private sector to gross domestic product in Nigeria. Analyzing the speed of adjustment from the short-run disequilibrium to the equilibrium, the result suggests an approximately 25% speed of adjustment. That is, 25% annual adjustment in financial deepening via the ratio of credit to private sector to gross domestic product, is observed from the shocks that comes from different electronic payment system used in the analysis. This is an indication that it would take four years for the ratio of credit to private sector to gross domestic product (CPS) to adjust back to equilibrium state from the distortion/disequilibrium caused by the volatility in the electronic payment systems in Nigeria. The test of fitness of the model using R-Squared shows that 79% of the variation in the ratio of credit to private sector to gross domestic product was explained by the digital payment system variables included in the model. By implications, only 21% variables were unaccounted in the model, suggesting a good fit. Based on the result presented in Table 4.5, the study rejects the null hypothesis and accepts the alternative hypothesis and concludes that there is statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

4.3 Discussion and Interpretation of findings

Specific objective: To Examine the impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

The outcome of the test of hypothesis reveals that there is statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria. In addition, the finding indicates that the ratio of credit to private sector to gross domestic product (CPS) exhibits a short-run negative spillover-effect that runs from the past performance to the present set. The result

suggests that past performance of CPS exacts up to 55% influence on its present performance. Theresult further reveals that Electronic cheques (ELC) and the number of deposit money banks (NDB) have positive relationship with CPS, which implies that a 1%-point increase in the value of electronic cheques and the number of deposit money banks would significantly increase financial deepening via the ratio of credit to private sector to gross domestic product, by 0.0026% and 28%, respectively, in the short-run. The result is in consonant with the findings of several scholars (Burhan, Rashidah, Asifa, Adil, &Shahul, 2017; Najeeb & Hussain, 2022; and Piyush and Armaan, 2023). This finding also collaborates the work of Najeeb and Hussain (2022) which found that mobile networks offer ease of access to unbanked places, notably cheaper service costs, with strong adoption rates for mobile service customers in emerging economies.

5.0 Summaryof Findings, Con++Clusion and Recommendations

5.1 Summary of Findings

This study examined the impact of digital payment system on financial deepening in Nigeria. It focused on selected digital payment system and how it influences the ratio of credit to private sector to gross domestic product in Nigeria for the period covering January 2009 to December 2023 (15 years).The auto regressive distributed lag (ARDL) model analyses were done using the e-views software.

The study concluded that there is statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria

5.2Conclusion

Relying on the data collected from the central bank of Nigeria quarterly/annual bulletin for the period starting from January 2009 to the end of December 2023 and the analysis and evaluation of the study's hypothesisas it relates to digital payment system and its impact on financial deepening in Nigeria. The study concludes that: there is statistically significant impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria.

5.3 Recommendations

In line with the conclusions of this study, the Nigerian government and financial institutions should consider expanding and improving digital payment infrastructure across the country, in order to enhance the dependability and accessibility of specific digital payment channels (automated teller machines, point-of-sale terminals, mobile, and web payments), reduce transaction cost, advance access to the unbanked population, increase the speed of transfer of value, in order to further

improve financial deepening through the ratio of credit to private sector to gross domestic product in Nigeria.

5.4 Contribution to Knowledge

To begin with, the study made a significant contribution with empirical evidence supporting theories of financial deepening, such as financial development theory and financial inclusion theory. The study was therefore aimed at evaluating the validity of the research hypothesis and interpreting the corresponding results of the impact of digital payment system on the ratio of credit to private sector to gross domestic product in Nigeria. Existing literature shows a need for more extensive investigations on the impact of digital payments in developing economies like Nigeria. This study had partly filled that vacuum by offering a detailed examination of how these systems interact with local economic conditions, therefore, contributing to scholarly discourse on digital payment and financial deepening in Nigeria.Additionally, recommendations obtained from this research will inform government efforts targeted at increasing digital payment use, hence fostering economic growth.

5.5 Suggestions for Further Studies

This study had its fair share of limitations. The study only selected five indicators of digital payment and one proxy for financial deepening in Nigeria. There are other measures of financial deepening and digital payments such as market capitalization to gross domestic product ratio, volume of electronic payment transactions, Insurance penetration, financial literacy rates, unstructured supplementary service data (USSD) Payments, third-party payment apps, quick response (QR) code payments, NIBSS instant payment (NIP) etc. This could be a source of further research on the impact of digital payment system on financial deepening in Nigeria.

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