# EFFECT OF DIGITAL FINANCIAL SERVICE TOOLS ON FOREIGN DIRECT INVESTMENT IN NIGERIA

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## ABSTRACT

*Financial technology has continually gained global attention owing to its significant impact across the globe. Despite the regional differences in the financial landscape, Digital Finance Service tools have played a significant role in financial sectors offering both customers and non-customers financial services. Recently, Nigeria has witnessed a surge in the adoption of Digital Financial Services tools. The technology adoption has played a significant role in the elimination of barriers to investment, meanwhile, introducing new risks that have discouraged Foreign direct investment in certain sectors. The study examined the impact of digital finance service tools and macroeconomic variables on Foreign Direct Investment in Nigeria. The study used normal-power regression analysis to investigate the effects of four tools (Automatic teller machines, Point of Sale, Web Payments, and Mobile Money) and four macroeconomic variables (Gross Domestic Product per capita, inflation rate, official exchange rate, and unemployment rate) on Foreign direct investment. The findings revealed that while Automatic teller machines, Point of Sale, Web Payments, Mobile Money, Gross Domestic Product, Official exchange rate, and Unemployment rate have significant impacts on Foreign direct investment, inflation) does not show a significant effect. The study concluded that enhancing digital finance services, infrastructure, particularly ATMs and web payment systems, can attract more Foreign direct investment. Conversely, addressing the negative impacts of POS transactions is crucial. The study recommended that policies aimed at maintaining economic stability, managing GDP growth, and stabilizing exchange rates are essential to creating a favourable investment climate. Encouraging foreign investment in sectors that can absorb the unemployed workforce is also recommended. This study underscores the importance of integrating technological advancements in financial services with macroeconomic stability to attract and sustain foreign investments.*

**Keywords**: *Automatic teller machines, Digital financial services, Foreign direct investment, Mobile banking, Normal-power model.*

## 1 INTRODUCTION

Financial services continue to garner attention globally, despite the regional differences in the financial landscape, there is however a common theme and standards in innovation, which is

known as digital transformation. Trailblazers are offering a diverse range of cutting-edge financial products and services, catering not only to existing customers but also to those who have never had a banking relationship

before. The banking industry has been thrust into a state of intense competition, fueled by a perfect storm of factors including the emergence of foreign and private players, shifting consumer preferences, and the growing demand for novel and innovative products that meet the evolving expectations of modern customers (Lottu, Abdul, Daraojimba, Alabi, John-Ladega, & Daraojimba, 2023).

Financial sectors are opting for the latest technologies, to aid their growth and survival in the changing market environment, and to serve as instruments of cost reduction and effective communication with people and the financial institution community (Nnaomah, 2024). Hence, the financial sectors are undergoing the process of radical transformation, that can help develop a more flexible structure that can respond quickly to the dynamics of fast changing global market scenario. Rapid growth in accessible digital financial services has extended the reach and usability of financial services and has fundamentally changed how consumers interact with financial products and services, which has therefore, helped individuals around the world to engage with the global economy (Delaporte, & Bahia, 2021).

Nigeria is one of the largest economies in Africa, and the fast-growing economy in the world (Central Bank of Nigeria (CBN), 2021), in order not to be left behind in the Digital Financial System (DFS) competition, the nation has made significant efforts in the rapid digital transformation of its financial sector. This transformation is evident in the widespread adoption of Digital Financial Services (DFS), which includes the adoption of various tools, such as Automatic Teller Machines (ATMs), Point of Sales (POS), Web Pay Services (WPS), Mobile Banking (MB) just to mention a few. These technologies have significantly altered the landscape of financial services in Nigeria, offering greater convenience, accessibility, and efficiency to consumers and businesses alike (Lottu et al., 2023).

Nigeria was previously faced with some challenges in ensuring access to formal financial services for its vast population, particularly in remote and underserved areas. However, with the advent of technology and innovative solutions, the Nigerian financial sector has undergone significant changes, driving the expansion of DFS (Yoganandham, 2024). Digital Financial Services (DFS) has undergone a remarkable transformation, democratizing access to financial solutions that were once reserved for a select few. By harnessing the power of technology and data, DFS has successfully bridged the gap, making a wide range of financial products and services more inclusive and accessible to a vast majority of Nigerians. This includes, but is not limited to, credit facilities, investment opportunities, insurance coverage, savings plans, and retirement schemes, ultimately empowering individuals and businesses to take control of their financial futures.

The delivery of Digital Finance Services has become increasingly ubiquitous, with a multitude of channels now available, including mobile phones, point-of-sale devices, and extensive networks of agents. This has enhanced the efficiency and convenience of business transactions and practices in Nigeria, propelling the country towards a truly digital and cashless economy.

DFS innovation not only enhanced convenience for customers but also reduced the reliance on physical bank branches, especially in urban centres. Following the success of ATMs follows the proliferation of POS terminals, which can now be found at every junction, and are a means of livelihood for many households, which has further revolutionized the retail payments ecosystem in Nigeria. POS services enabled merchants to accept card payments, thereby promoting cashless transactions and reducing the risks associated with handling physical cash. This expansion of electronic payment infrastructure laid the foundation for the growth of digital commerce and the formalization of the informal economy (Siddik & Kabiraj 2020).

In addition, the adoption of mobile banking has been particularly significant in rural and underserved areas, where physical bank branches are scarce (Zhu et al., 2021), which has been instrumental to Foreign Direct Investment (FDI) in Nigeria. Foreign Direct Investment (FDI) plays a pivotal role in driving economic growth and development in countries around the world, including Nigeria. Here are some key reasons why FDI is crucial for economic growth. FDI involves the investment of capital from foreign entities into domestic businesses, industries, and infrastructure projects. This infusion of capital provides much-needed funding for expansion, modernization, and innovation, which are essential for sustained economic growth (Nkogbu, 2015). Hence, the evolution of the DFS in Nigeria has been transformative and has reshaped the landscape of FDI in the country.

As Nigeria strives to position itself as a leading economic hub in Africa, the role of Foreign Direct Investment (FDI) in driving sustainable economic growth and development has become increasingly significant (CBN, 2021). Concurrently, the rapid advancement and adoption of Digital Financial Service (DFS) tools, including Automatic Teller Machines (ATMs), Point Of Sales (POS) services, Web Pay Services, and mobile banking, have reshaped the country's financial landscape (Lyons et al., 2021). However, despite the proliferation of DFS tools in Nigeria, there remains a gap in understanding the extent to which these digital financial innovations influence the inflow of foreign direct investment. While previous studies have explored the impact of various factors on FDI inflows (Al-Smadi, 2022; Akpaku, Arku, & Boateng, 2023; Anastasiou, Helen, & Mike, 2016; Asiedu, 2006; Chimaobi, 2018, Ekum, 2022), the specific impact of DFS tools on FDI in the Nigerian context remains relatively underexplored, thus there exist gap in the literature.

It is important to mention that the rapid growth of digital financial services tools, such as mobile money platforms, online banking, and blockchain-based transactions, has significantly impacted FDI) flows into Nigeria. While these digital tools have improved financial inclusion and access to capital, their effect on FDI has been mixed, as it has introduced new risks that have discouraged FDI in certain sectors, which include cybersecurity vulnerabilities as it exposes digital finance platforms to cyber-attacks, data breaches, and other security threats. In addition, Data Privacy Concerns are another issue of concern (Chimaobi, 2018). The collection and usage of personal and financial data by digital finance platforms raises privacy concerns for foreign investors, who may worry about the security and sovereignty of their data.

The rapid growth of digital finance, if not properly monitored and regulated, could pose systemic risks to a country's overall financial stability, which is an important consideration for FDI.

Evaluating the multifaceted impact of this digital transformation is crucial for policymakers seeking to harness the benefits of financial technology to have a deeper understanding of the challenges the technology integration poses to the financial sector and the nation at large. It is, therefore, necessary to carry out a comprehensive evaluation of the overall impact on FDI to inform policy introduction that can help mitigate the negative impact, while embracing its positive impact for the benefit of financial tech companies to attract long-term foreign investment to the country.

The hypothesis is stated in null form There is no significant relationship between DFS tools and FDI inflows as moderated by macroeconomic variables.

## 2. REVIEW OF RELEVANT LITERATURE

### Digital financial services

The numerous advancements in the way the financial system functions are referred to as "digital financial services." To guarantee effective, safe, and secure modern transactions, these are new technologies used in banking, insurance, oil and gas, and education, among other fields. The usage of Point of Sale (POS), often referred to as Agency Banking, Mobile Banking, Web Services, and Automatic Teller Machines (ATMs) are a few examples in the banking industry. This means that the insurance industry and other financial institutions are not excluded from these technological advancements in business practices and offerings.

According to Sopekan (2021), these technologies have the mystery of offering the whole public, especially the impoverished and ignorant in the rural parts of rising economies like Nigeria, notable, practical, economical, and safe banking services. To guarantee a decent influence or growth on the Nigerian economy through digital financial inclusion, a large number of individuals must be involved in the operations of banking services.

### Digital Financial Service (DFS)

Digital Financial Services (DFS) tools refer to technologies and platforms that provide financial services through digital means, often leveraging mobile phones, the Internet, and other electronic channels. These tools are instrumental in promoting financial inclusion, especially in regions with limited access to traditional banking services. Some of the advantages of DFS tools include the following:

Mobile money solutions, which enable users to store, transfer, and make payments using their mobile phones, often bypassing traditional banking systems.

Digital wallets, which are virtual accounts that allow users to store, send, and receive digital payments, and may also offer additional financial services such as lending and savings.

Online banking platforms, which provide customers with a web-based or mobile app-based interface to access their bank accounts, conduct transactions, and manage their finances.

Peer-to-peer (P2P) lending platforms, which connect borrowers and lenders directly, eliminating the need for traditional financial intermediaries.

Crowdfunding platforms, which enable individuals or businesses to raise funds for various projects or ventures by soliciting small contributions from a large number of people.

Digital insurance services, which offer insurance products and services through digital channels, aiming to improve accessibility and affordability.

These fintech innovations are transforming the way people manage their finances, making it more convenient, accessible, and efficient.

The benefits of DFS tools include increased financial inclusion, greater convenience and accessibility, reduced costs, and the potential for more tailored and personalized financial services.

**Foreign Direct Investment (FDI)**

Foreign Direct Investment (FDI) refers to the transfer of funds across international borders, resulting in the ownership of assets by the investor. This leads to the establishment of multi-national enterprises (MNEs), where multinational corporations fund production in the host nation and generate profits from sales made by their overseas affiliates. FDI involves long-term involvement in another country, often through joint ventures, management, or the transfer of knowledge and technology. It is a preferred investment strategy due to its well-established benefits (Kariuki & Sang, 2018).

Many African countries are actively working to improve their business environment to attract FDI. The New Partnership for Africa's Development (NEPAD) aims to increase available capital to $64 billion through a combination of resource mobilization, reforms, and creating an environment that encourages FDI (Norbert & Saleh, 2003). Research has shown that most countries in Sub-Saharan Africa heavily rely on FDI for various important reasons, as demonstrated by Asiedu (2002).

**Theoretical Framework**

From a theoretical perspective, several frameworks can be employed to explain the relationship between DFS tools and FDI inflows. The investment development path theory suggests that countries progress through stages of financial development, from traditional to modern financial systems, as they attract higher levels of FDI. DFS tools represent a crucial component of this modernization process, facilitating capital flows and enhancing the efficiency of financial intermediation. Additionally, the new institutional economics perspective emphasizes the role of institutions in shaping economic outcomes. DFS tools contribute to institutional development by

strengthening property rights, enforcing contracts, and reducing information asymmetry, thereby creating a conducive environment for FDI inflows (Emako, 2022).

The relationship between digital financial service (DFS) tools and foreign direct investment (FDI) can be examined through various theoretical perspectives that highlight different mechanisms and dynamics underlying this relationship. Here are some theoretical perspectives on the relationship between DFS tools and FDI:

**Investment Development Path Theory**

The Investment Development Path (IDP) theory posits that countries progress through stages of financial development as they attract higher levels of FDI. According to this theory, the adoption and utilization of DFS tools represent a crucial stage in the modernization of a country's financial system. DFS tools enhance the efficiency, accessibility, and sophistication of financial services, thereby attracting FDI inflows from multinational corporations (MNCs) seeking markets with advanced financial infrastructure and technological capabilities (Al-Smadi, 2022).

**Resource Dependency Theory**

According to the Resource Dependence Theory (RDT), developed by Jeffrey and Salancik (1978), an organization's behavior is influenced by the external resources it possesses. The theory suggests that firms adapt and negotiate with their external environment to secure access to the resources necessary for their survival. In other words, organizations are dependent on their external environment for the resources they need to operate, and they will modify their behavior to ensure they can obtain and maintain access to these resources. RDT suggests that firms, including multinational corporations, rely on external resources to minimize uncertainties and achieve their strategic objectives. DFS tools provide foreign investors with access to essential financial resources, payment systems, and banking services in the host country. By leveraging DFS tools, foreign investors can mitigate risks, streamline transactions, and improve liquidity management, thus enhancing their operational efficiency and competitiveness in the local market.

In the context of multinational corporations (MNCs), RDT suggests that they rely on external resources to minimize uncertainties and achieve their strategic objectives in foreign markets. MNCs must adapt and negotiate with their external environment to secure access to the resources they need to operate effectively in the host country. This may involve forming partnerships with local firms, negotiating with government agencies, or investing in local infrastructure.

Digital financial services (DFS) tools play a critical role in facilitating access to essential financial resources, payment systems, and banking services for foreign investors in the host country. By leveraging DFS tools, MNCs can mitigate risks, streamline transactions, and improve liquidity management, thus enhancing their operational efficiency and competitiveness in the local market.

**Institutional Theory**

Institutional theory, pioneered by John Meyer and Brian Rowan in the late 1970s, provides a framework for understanding how organizations interact with and are shaped by their external environments. This theory highlights the significance of formal and informal institutions in influencing economic behavior and outcomes. In the context of digital financial services (DFS), institutional theory is particularly relevant.

DFS tools, such as mobile payments and digital wallets, can contribute to institutional development in several ways. Firstly, they promote financial inclusion by increasing access to financial services for underserved populations. This, in turn, can lead to greater economic participation and empowerment. Secondly, DFS tools can enhance regulatory compliance by providing a transparent and traceable record of transactions. This helps to reduce the risk of fraud and money laundering, which can undermine trust in the financial system. Finally, DFS tools can foster transparency and accountability in financial transactions, making it easier to track and monitor financial flows.

Strong institutional frameworks and well-functioning DFS ecosystems can create a conducive environment for foreign direct investment (FDI). By reducing transaction costs, improving risk management, and enhancing investor confidence in the host country's financial system, DFS can make a country more attractive to foreign investors. This, in turn, can lead to increased economic growth, job creation, and development.

The role of institutions in shaping economic behaviour and outcomes cannot be overstated. Formal institutions, such as governments and regulatory bodies, set the rules and regulations that govern economic activity. Informal institutions, such as social norms and cultural values, influence how individuals and organizations behave and make decisions.

**Empirical Review**

According to Lottu et al. (2023), the research analysed Digital Transformation in Banking; A Review of Nigeria's Journey to Economic Prosperity. The research established that digital transformation in Nigeria

has had a significant positive economic impact. It has promoted financial inclusion, facilitated investment and entrepreneurship, and contributed to job creation. In addition, the research reveals that Nigerian banks face a complex regulatory landscape, including KYC and AML requirements, which must be navigated to ensure compliance. Non-compliance poses serious risks to banks' operations and reputations. The research established some banks still rely on legacy IT systems, making integrating modern digital solutions seamlessly challenging. This incompatibility can hinder efficiency and increase costs. The demand for skilled professionals in cybersecurity, data analytics, and technology outpaces the available talent pool.

According to Suresh's (2022) comprehensive study on the global digital transformation of banking services, India is on the cusp of a rapid shift towards a digital payment economy, echoing the prediction made by Microsoft Co-founder Bill Gates. The introduction of digital payment banks, direct benefit transfers, and universal payments interface is expected to drive this transformation. Furthermore, increased investment in infrastructure, swift project implementation, and continued reforms are likely to fuel growth in the sector. As businesses continue to expand, they will

increasingly rely on banks to meet their credit needs, paving the way for robust growth in India's banking sector. The advent of technology has also brought mobile and internet banking services to the forefront, revolutionizing the way banking is done.

In similar research by Akpaku (2023), the researcher investigated the effects of DFI, and ICT intensity on Socio-Economic Development from a global perspective through a multidimensional analytical approach. The novelty of this study stems from it being the first to establish the required level of factors necessary for socio-economic development and adopt a multi-analytical approach and global dataset to investigate the association between DFI and socio-economic development. Both the necessary condition analysis (NCA) and partial least square structural equation modelling (PLS-SEM) results indicate that ICT regulation has no significant influence on the socio-economic development of a country. DFI and ICT intensity positively influence socio-economic development based on the results from the PLS-SEM analysis. The results from the NCA also identify ICT intensity and DFI as necessary conditions for a country's socio-economic development.

The study also analyzed the mediating effects of ICT regulation in driving DFI and ICT intensity toward the socio-economic development of citizens. The results found that ICT regulation does not mediate the association between DFI and socio-economic development. The mediating effect of ICT regulation on the association between ICT intensity and socioeconomic development was also not supported. Considering the complexity of obtaining a cross-country dataset, the study is limited to a dataset from a single secondary source (i.e., Network Readiness Index). Despite this, the index's trustworthiness is incontestable, as they were developed by credible and approved organizations using appropriate statistical processes. Future research may focus on comparing the results of primary data and other constructs the research could not capture.

Nkechika's 2023 study highlighted the pivotal role of private enterprises in driving digital financial services and financial inclusion in Nigeria. Meanwhile, the government has been actively fostering this growth by introducing supportive initiatives. A significant milestone in this journey is the rebranding of the Federal Ministry of Communications to the Federal Ministry of Communications and Digital Economy, tasked with crafting a comprehensive digital economy roadmap. Furthermore, the ongoing National Identification Number (NIN) registration exercise holds immense potential to revolutionize the financial services sector. By creating a digital repository for identification, it will facilitate seamless onboarding, micro-loan access, and a broader range of financial services for the previously underserved population.

**Role of Financial Institutions in Facilitating FDI**

Foreign Direct Investment (FDI) inflows in the financial sector often flow through banks, which can either retain or allocate these funds to strategic sectors (Kariuki, 2018). However, the absence of government and regulatory support in the host country can significantly hinder FDI inflows. Research has consistently shown that a range of factors influence FDI, including the size and growth of the economy, the development of financial systems, infrastructure, institutional frameworks, economic freedom, geographical distance, cultural differences, inflation, trade openness, and tax rates (Ajayi, 2020; Anastasiou, 2016). These drivers play a crucial role in shaping the flow of FDI into a country.

## Impacts of FDI on the Financial Sector and Performance

The influx of foreign direct investment (FDI) in the banking and financial sector is a relatively recent trend, characterized by financial institutions from emerging and industrialized nations establishing a presence in developing countries (Kariuki & Sang, 2018). This phenomenon has led to a surge in multinational banking activities, resulting in significant capital inflows into developing economies (Chimaobi, 2018). In recent years, FDI in the financial sector has experienced a remarkable upswing, particularly in developing economies, as exemplified by the proliferation of foreign banks in Ghana (Tsaurai, 2014; Trojette, 2016). However, research emphasizes that a host country must possess a well-developed financial sector to reap the maximum benefits from FDI inflows. As Pedro et al. (2014) underscore, a robust local financial market and system are crucial for unlocking the full potential of FDI on economic growth.

## Digital Finance Services Regulatory agencies

The regulatory environment has played a significant role in driving the expansion of DFS in Nigeria. The Central Bank of Nigeria (CBN) has implemented various policies and initiatives to promote financial inclusion and encourage the adoption of DFS. These include the licensing of mobile money operators, the implementation of cashless policies, and the development of regulatory frameworks to govern electronic payments and transactions (Nnaomah et al., 2024). As Nigeria continues to embrace digitalization, the future of DFS holds immense potential to drive further socioeconomic development and prosperity across the country (Olurinola et al., 2021).

The mobile money scheme enables Telcos (Telecommunications companies) to provide the necessary infrastructure for mobile payments, facilitating the exchange of messages. Meanwhile, Payment Service Banks (PSBs) licensed by the Central Bank of Nigeria (CBN) are expected to utilize mobile and digital channels to deliver their services, thereby promoting financial inclusion and stimulating economic growth at the grassroots level by providing access to financial services. As a result, Telcos play a vital role in the digital financial ecosystem and are essential stakeholders in achieving the CBN's objectives of increasing financial inclusion.

Previous research on the relationship between DFS tools and FDI has underscored the importance of digital infrastructure, technology transfer, financial inclusion, regulatory environment, and policy support in attracting foreign investment. By understanding the mechanisms and drivers of this relationship, policymakers, financial institutions, and investors can formulate strategies to leverage DFS for sustainable economic growth and development. Hence, this research will be highly significant, as it will establish further the relationship between DFS tools and FDI, and the role of digital infrastructure, technology transfer, financial inclusion, regulatory environment, and policy support in attracting foreign investment to the country.

In addition, evaluating the multifaceted impact of digital transformation is crucial to understanding the challenges the technology and its integration pose to the financial sector and the nation at large, which has not been properly taken care of by previous research. Hence, this research is therefore, necessary as it will help in the comprehensive evaluation of the overall impact on FDI as it regards its negative implication, as this will help mitigate its negative impact, to help circumvent those

challenges for the benefit of financial tech companies to attract long-term foreign investment to the country.

## 3. METHODOLOGY

### Research Design

This study employs a quantitative research approach using secondary data collected from various sources, including the Central Bank of Nigeria (CBN) and World Bank World Development Indicators (WDI). The secondary data covers the period from 1990 to 2022 and includes variables such as FDI inflows, ATM transactions, POS transactions, web pay services transactions, and mobile banking transactions, as well as control variables such as GDP per capita, inflation rate, official exchange rate, and unemployment rate.

### Variables Description and Measurement

For investigating the effect of digital financial service (DFS) tools on foreign direct investment (FDI) in Nigeria, selecting appropriate variables and defining their measurements is crucial for conducting empirical analysis and drawing meaningful conclusions.

**Dependent Variable**:

Foreign Direct Investment (FDI) Inflows: This variable represents the total value of FDI inflows into Nigeria (billion US $) over a specified period (2000-2022). It is measured in US dollars and sourced from Central Bank of Nigeria (CBN).

**Independent Variables**:

Digital Financial Service (DFS) Adoption: This variable measures the extent of adoption and utilization of DFS tools in Nigeria. It is operationalized using various indicators, such as the volume of ATM transactions (ATM), volume of POS transactions (POS), volume of web pay services transactions (WEP), and volume of mobile banking transactions (MOM).

Macroeconomic Factors: Macroeconomic variables such as GDP per capita (GDP), inflation rate (INF), official exchange rate (OER) stability, and unemployment rate (UEM) can influence FDI inflows in Nigeria. These variables are sourced from Central Bank of Nigeria (CBN) and World Development Indicators (WDI) and included as control variables in the analysis.

**Table 3.1: Comprehensive Variable Definition of Digital Economy on Economic Performance**

| Type | Construct | Variable | Variable description | General definition of Variables | Source |
|---|---|---|---|---|---|
| Depen dent | Foreign Direct Investment | FDI | Foreign Direct Investment | Foreign direct investment (FDI) represents the influx of capital into a country's economy through equity investments. This type of | World Bank database |

| | | | | | |
|---|---|---|---|---|---|
| | | | inflow (billion US $) | investment encompasses three key components: additional funding, retained earnings, and ownership stakes. A specific category of international investment, known as direct investment, occurs when an individual or entity from one country exercises significant control or influence over a business operation in another country. To qualify as a direct investment, the investor must hold at least a 10% stake in the voting shares of the foreign enterprise. The value of FDI is typically expressed in current US dollars. | |
| Independent | Digital Finance Service tools | ATM | ATM transaction volume | Volume of transactions conducted through an automated teller machine or banking machine. | Central Bank of Nigeria |
| | | POS | Point of sales transaction volume | Volume of business that uses a POS system to process card payments or other forms of electronic payments at a physical location. | Central Bank of Nigeria |
| | | WEP | Volume of web pay services transactions | Volume of online payment. An online service that manages the transfer of funds from one party to another. | Central Bank of Nigeria |
| | | MOM | Volume of mobile banking transactions. | Volume of financial transactions made on a mobile device (cell phone, tablet, etc.). | Central Bank of Nigeria |
| Moderating | Macroeconomic variables | GDP | Gross domestic product per capita | The total amount of money created by the central bank. It is also known as reserve money (in ₦ million). | World Bank database |
| | | INF | Inflation rate | The minimal amounts of cash that banks are required to keep on hand in case of unexpected demand (in ₦ million). | Central Bank of Nigeria |
| | | OER | Official exchange rate | The total amount of money (notes, coins, and balances in bank accounts) in circulation (in ₦ million.) | World Bank database |
| | | UEM | Unemployment rate | The rate of return a financial institution pays you on your deposits into its account (%). | Central Bank of Nigeria |

**Source:** Author's Compliation (2024)

## Analytical techniques

The study employs both normal linear and normal-power regression models to identify critical points where the impact of digital finance service tools on FDI changes significantly. Utilize techniques such as multiple linear regression models to capture the linear effect and normal-power regression to capture the non-linear relationship.

**Model Specification**

In this study, normal-power regression model is adopted. The Model takes FDI as dependent with the selected digital finance service tools variables (ATM, POS, WEP, MOM) as independent variables, moderated by macroeconomic variables GDP, INF, OER, and UEM.

$$FDI_{NP} = \beta_0 + \beta_1 ATM_i + \beta_2 POS_i + \beta_3 WEP_i + \beta_4 MOM_i + \beta_5 GDP_i + \beta_6 INF_i + \beta_7 OER_i + \beta_8 UEM_i + u_i, \quad (1)$$

Where: ATM= Automated Teller Machine, POS = Point of Sale transactions, WEP = Web pay services, MOM = Mobile Banking Transactions, GDP = Gross Domestic Product per Capital, INF = Inflation rate, OER = Official Exchange Rate and UEM =Unemployment Rate.

**Model Estimation Technique**

In order to estimate the coefficients of the models, a transformation is done to transform normal-power random variable FDI to normal random variable. Then the normal random variable can easily be generated since the values of *k* and $\lambda$ are known so that the new variable is now linearly related to the linear predictor variables. (Ekum *et al*., 2021, 2023; Ekum *et al*., 2022). The model parameters are estimated using maximum likelihood estimation package in R program.

where: $FDI_{NP} ln\left(\frac{(FDI)_i^k}{\lambda^k - (FDI)_i^k}\right)$, $FDI_{NP}$ is the transformed normal-power FDI, $\hat{k} = \overline{FDI}/(\lambda\text{-}\overline{FDI})$ and $\lambda = \max(FDI) + S_{e(FDI)}$, and where $S_{e(FDI)}$ is the standard error of *FDI* estimated from data.

## 4. RESULTS AND DISCUSSION

**Descriptive statistics of DFS tools and FDI in Nigeria**

Descriptive statistics reveal the trends and patterns of DFS tools adoption and FDI inflows in Nigeria over the study period (2000 - 2022).

**Table 4.1. FDI and DFS tools in Nigeria (2000 - 2022)**

| | FDI | ATM | POS | WEP | MOM |
|---|---|---|---|---|---|
| Mean | 3.686 | 881,900,000 | 1,155,000.000 | 3,995,000,000 | 515,300,000 |
| Median | 3.380 | 820,000,000 | 221,000,000 | 39,903,499 | 67,445,411 |
| Maximum | 7.070 | 1,897,000,000 | 5,840,000,000 | 19,900,000,000 | 2,593,000,000 |
| Minimum | 0.780 | 295,400,000 | 2,588,000 | 2,276,000 | 2,298,000 |
| Std. Dev. | 1.7283 | 528,240,344 | 1,934,683,369 | 6,880,725,556 | 848,102,202 |
| Skewness | 0.3470 | 0.7091 | 1.5407 | 1.3993 | 1.6582 |
| Kurtosis | 2.5770 | 2.2467 | 3.9222 | 3.4477 | 4.2741 |

| | | | | | |
|---|---|---|---|---|---|
| Jarque-Bera | 0.3292 | 1.2893 | 5.1725 | 4.0161 | 6.3108 |
| Probability | 0.8482 | 0.5248 | 0.0753 | 0.1342 | 0.0426 |
| Sum | 44.2400 | 10,600,000,000 | 13,900,000,000 | 47,900,000,000 | 6,180,000,000 |

**Source:** *Author's Computation (2023)*

Table 4.1 shows the time series data and summary results, showing the trends and statistical measures for Foreign Direct Investment (FDI) and various Digital Finance Service (DFS) tools, such as ATM transaction volume (ATM), Point of Sales transaction volume (POS), volume of web pay services transactions (WEP), and volume of mobile banking transactions (MOM) over the period from 2020 to 2022.

The minimum and maximum values for FDI and each DFS tool give a range of observed values over the period. Table 4.2 shows that FDI ranges from 0.7800 to 7.0700, ATM from 295,400,000 to 1,897,000,000 volume of transactions, POS from 2,588,000 to 5,840,000,000 transactions, WEP from 2,276,000 to 19,900,000,000 volume of transactions, and MOM from 2,298,000 to 2,593,000,000 volume of transactions. The mean provides the average value over the period for each variable. FDI has an average of $3.686 billion, indicating the average level of foreign investment per year. For ATM, the average transaction volume is 881,900,000 volume of transactions; for POS, it is 1,155,000.000 volume of transactions; for WEP, it is 3,995,000,000 volume of transactions; and for MOM, it is 515,300,000 volume of transactions.

The standard deviation measures the variability or dispersion of the data. Higher standard deviations indicate more variability. For example, WEP transactions have a very high standard deviation (6,880,725,556), showing significant fluctuations over the years. The Skewness measures the asymmetry of the data distribution. Positive skewness indicates a distribution with a tail on the right side. FDI has a skewness of 0.3470, indicating a right-skewed distribution and all the digital finance tools have positive Skewness as well, ATM is 0.7091, POS is 1.5407, WEP is 1.3993 and MOM is 1.6582. Kurtosis measures the "tailedness" of the distribution. A kurtosis greater than 3 indicates a distribution with heavier tails than a normal distribution. FDI has a kurtosis of 2.5770, suggesting more frequent extreme values, as well as ATM (2.2467), and POS (3.9222) and WEP (3.4477) are almost normal, while MOM (4.2741) is leptokurtic, meaning high kurtosis.

The Jarque-Bera test checks whether the data follows a normal distribution. Higher values indicate a departure from normality. FDI, ATM, POS, WEP are almost normally distributed ($p > 0.05$), WEP is not normally distributed ($p < 0.05$). The sum represents the total of all values for each variable. FDI has moderate variability (Std. Dev. = 1.7283) and a near-normal distribution (Jarque-Bera = 0.3292). ATM and POS show considerable variability with a substantial right skew (high skewness values). WEP has very high variability and a right-skewed distribution. MOM also exhibits high variability and right skewness.

In order to analyze the hypothesis for this study, which states that there is no significant relationship between DFS tools and FDI inflows as moderated by macroeconomic variables, The normal-power model was used.

**Table 4.2**. Modelling the effect of DFS tools on FDI in Nigeria, moderating with macroeconomic variables

| | Estimate | Std. Error | t-stat | p-value |
|---|---|---|---|---|
| (Intercept) | 18500 | 2.07 | 8.945 | 0.00295 |
| ATM | 0. 00000833 | 0.00000000276 | 3.015 | 0.05697 |
| POS | -0. 00000576 | 0.00000000107 | -5.392 | 0.01250 |
| WEP | 0. 000000737 | 0.0000000000892 | 8.256 | 0.00372 |
| MOM | 0. 0000143 | 0.00000000195 | 7.307 | 0.00529 |
| GDP | -40000.021 | 0.00000521 | -8.072 | 0.00397 |
| INF | -77.8 | 0.0484 | -1.609 | 0.2059 |
| OER | -15.7 | 0.00166 | -9.454 | 0.00251 |
| UEM | 620 | 0.0968 | 6.403 | 0.00772 |
| R | 0.9954 | | MSE | 0.0468 |
| $R^2$ | 0.9908 | | F-Stat | 40.58 |
| Adj $R^2$ | 0.9664 | | P-value | 0.0057 |
| Log Lik | 9.6609 | | AIC | 0.6783 |

***Source:*** *Author's Computation (2023) using Eviews 12*

Table 4.2 is the improved model estimation, which includes GDP, INF, OER, and UEM as additional predictor variables, as moderating variables along with the original independent variables ATM, POS, WEP, and MOM. The intercept is statistically significant ($p < 0.05$), suggesting that when all independent variables are zero, the expected value of FDI is 18.5. The coefficient for ATM is positive and close to significant ($p \approx 0.057$). This suggests a positive relationship between ATM and FDI, meaning that an increase in ATMs is associated with an increase in FDI, though the relationship is marginally non-significant.

However, the coefficient for POS is negative and statistically significant ($p < 0.05$). This indicates that an increase in POS systems is associated with a decrease in FDI. The coefficient for WEP is positive and statistically significant (P-value < 0.05). This suggests that an increase in web-based payment systems is associated with an increase in FDI. The coefficient for MOM is positive and statistically significant ($p < 0.05$). This indicates that an increase in mobile money usage is associated with an increase in FDI.

On the moderating variables, the coefficient for GDP is negative and statistically significant ($p < 0.05$). This suggests that an increase in GDP is associated with a decrease in FDI. The coefficient for INF is negative but not statistically significant ($p > 0.05$), indicating that inflation does not have a significant impact on FDI. The coefficient for OER is negative and statistically significant ($p < 0.05$). This suggests that an increase in the official exchange rate is associated with a decrease in FDI. The coefficient for UEM is positive and statistically significant ($p < 0.05$). This suggests that an increase in unemployment is associated with an increase in FDI.

The correlation coefficient (R), 0.9954 indicates a very strong correlation between the observed and predicted values of FDI. The coefficient of determination ($R^2$), 0.9908 suggests that approximately 99.08% of the variance in FDI is explained by the independent variables in the model. The adjusted $R^2$, 0.9664 provides a more accurate measure of the model's explanatory power, adjusting for the number of predictors. It suggests that about 96.64% of the variance in FDI is explained by the model, accounting for the number of predictors. Mean Squared Error (MSE), 0.0468 measures the average squared difference between the observed and predicted values. Lower values indicate better model fit. The F-Statistic, 40.58 tests the overall significance of the model. The P-value associated with the F-statistic (0.0057) indicates that the model is statistically significant at the 0.05 level. The model explains about 99.08% of the variance in FDI ($R^2$), and 96.64% when adjusted for the number of predictors (Adjusted $R^2$). The overall model is statistically significant (F-stat, $p < 0.05$).

The results suggest that while ATM, POS, WEP, MOM, GDP, OER, and UEM have significant impacts on FDI, inflation (INF) does not show a significant effect. The strong positive correlation and high $R^2$ value indicate that the model is a good fit for the data. These findings can be used to better understand the factors influencing FDI and to inform policy decisions aimed at enhancing foreign investment.

**Discussion of Findings**

There has been a consistent increase in the volume of ATM transactions over the years, indicating a growing reliance on ATMs for financial transactions. The standard deviation indicates that while the general trend is upward, there is considerable year-to-year variability in transaction volumes. The slight right skewness and near-normal kurtosis suggest that most years have transaction volumes around the average, with some higher values influencing the trend. This growth in ATM transactions is reflective of the broader trend towards digital financial services, as seen with the increases in POS, WEP, and MOM transactions. The adoption of these digital tools has likely contributed to the accessibility and convenience of financial services for the population, which, in turn, supports the growth in transaction volumes.

The findings suggest that enhancing DFS infrastructure, particularly ATMs and web payment systems, can attract more FDI. This is in line with institutional theory, which posits that institutions and regulatory frameworks shape economic outcomes. In this case, the development of DFS infrastructure can be seen as an institutional factor that creates an enabling environment for FDI. The study's emphasis on the importance of macroeconomic stability, GDP growth, and exchange rate stability also highlights the role of institutions in creating a favorable investment climate. Conversely, addressing the negative impacts of POS transactions is crucial. Policies aimed at maintaining economic stability, managing GDP growth, and stabilizing exchange rates are essential to creating a favorable investment climate. Encouraging foreign investment in sectors that can absorb the unemployed workforce is also recommended.

The study's findings are also consistent with the investment development path theory, which suggests that countries progress through different stages of development, from low-income to high-income economies, as they accumulate capital and technology. The development of DFS infrastructure can be seen as a key factor in a country's transition to a higher stage of development,

as it enables greater access to financial services and increases the efficiency of financial transactions. This study underscores the importance of integrating technological advancements in financial services with macroeconomic stability to attract and sustain foreign investments. The regression analysis indicates that most predictors significantly influence FDI, with strong positive or negative effects. The model fits the data well, as evidenced by high $R^2$ and adjusted $R^2$ values, and significant F-statistic. However, the inflation rate (INF) does not significantly affect the dependent variable.

## 5 CONCLUSION, SUMMARY AND RECOMMENDATIONS

### Conclusion

In conclusion, this study contributes to the existing literature by providing empirical evidence on the relationship between DFS tools and FDI inflows in Nigeria. The findings underscore the importance of digital infrastructure in attracting foreign investment and highlight the role of institutional quality in shaping investment decisions. The regression analysis reveals significant insights into the factors influencing Foreign Direct Investment (FDI). The digital finance service (DFS) tool, ATM, POS, WEP, and MOM, show varied impacts on FDI. ATM and WEP positively affect FDI, with ATM having a marginally significant effect and WEP having a strong positive influence. Conversely, POS negatively influences FDI significantly, while MOM shows a robust positive effect. Among the macroeconomic variables, GDP and OER have significant negative impacts on FDI, suggesting that higher GDP and official exchange rates may deter foreign investments. Unemployment rate (UEM) positively influences FDI, while inflation (INF) does not show a significant effect.

### Summary

This study provides empirical evidence on the relationship between digital finance services (DFS) tools and Foreign Direct Investment (FDI) inflows in Nigeria. The research highlights the critical role of digital infrastructure and institutional quality in attracting foreign investment. Through regression analysis, the study reveals that certain DFS tools, such as Automated Teller Machines (ATMs) and Web-based Electronic Payment (WEP), positively influence FDI, with WEP having a strong impact. However, Point of Sale (POS) systems negatively affect FDI, while Mobile Money (MOM) shows a significant positive effect. Among macroeconomic factors, Gross Domestic Product (GDP) and official exchange rates (OER) negatively impact FDI, indicating that higher GDP and exchange rates may discourage foreign investments. In contrast, the unemployment rate positively influences FDI, while inflation does not have a significant effect. The study underscores the importance of improving digital infrastructure and institutional quality to attract and sustain foreign investment in Nigeria.

### Recommendations

Based on the analysis, several recommendations can be made to further enhance the adoption and efficiency of ATM and other digital financial services in Nigeria.

Policymakers should focus on enhancing digital infrastructure and improving regulatory environment to leverage DFS tools for attracting FDI. Policy makers should expand and improve

ATM infrastructure to meet the growing demand. This includes increasing the number of ATMs in both urban and rural areas to ensure accessibility for all segments of the population.

Policies should be implemented to stabilize GDP growth and manage exchange rates effectively to make the investment climate more favorable. This might include measures to control inflation, enhance productivity, and stabilize the currency. Although not statistically significant, it is crucial to keep inflation at manageable levels to maintain economic stability and investor confidence.

Since higher unemployment rates correlates with increased FDI, policies should focus on leveraging this by creating an environment that encourages foreign firms to invest in sectors that can absorb the unemployed workforce.

By focusing on these areas, Nigeria can continue to build on the positive trends observed in ATM and other digital financial services, fostering an inclusive and efficient financial ecosystem.

## REFERENCES


Al-Smadi, M. (2022). Examining the Relationship between Digital Finance and Financial Inclusion: Evidence from MENA Countries. *Borsa Istanbul Review*. *23(2),* 464-472.

Akpaku, E., Arku, Z., & Boateng, S. (2023). Global perspective of the effects of digital financial inclusion and ICT intensity on socio-economic development. *Int. J. Business Forecasting and Marketing Intelligence*, *8(1),* 13-34.

Anastasiou, D., A., Helen, L., & Mike, T. (2016). Determinants of non-performing loans: Evidence from Euroarea countries. *Finance research letters*, *18(1),* 116-119.

Asiedu, E. (2006). Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability. *The World Economy*, *29(1),* 63-77.

Central Bank of Nigeria. (2021). *Statistical Bulletin: Domestic Production, Consumption and Prices* Published.

Chimaobi, C. M. (2018). *Impact of Internet Banking on Profitability of Commercial Banks in Nigeria: A Study of Zenith Bank Plc (2005 – 2017).* (Unpublished Thesis). Godfrey Okoye University Ugwuomu Nike, Enugu.

Delaporte, A., & Bahia, K. (2021). *The State of Mobile Internet Connectivity* 2021, London: GSMA.

*Ekum, M. I. (2022). A Note on Novel Normal-Power Non-Linear Function. Preprints*, 2022030166. https://doi.org/10.20944/preprints202203.0166.v1.

Ekum, M. I., Job, O., Taylor, J. I., Amalare, A. A., Khaleel, M. A., & Ogunsanya, A. S. (2021). Normal-Power Function Distribution with Logistic Quantile Function: Properties and Application. *American Journal of Applied Mathematics and Statistics*, *9(3),* 90-101.

Ekum, M. I., Adamu, M. O., & Akarawak, E. E. E. (2023). Normal-Power-Logistic Distribution: Properties and Application in Generalized Linear Model. *J Indian Soc Probab Stat.*, *24(1),* 23-54.

Emako, E., & Nuru, S., & Menza, M. (2022). Determinants of foreign direct investments inflows into developing countries. *Transnational Corporations Review*, *14(1).* http://doi.org/10.1080/19186444.2022.2085497.

Feng, L. (2017). Does foreign direct investment improve the productivity of domestic firms? Technology spillovers, industry linkages, and firm capabilities. *Research Policy, 46(1),* 1-12. https://doi.org/10.1016/j.respol.2016.08.007

Kariuki, A. K., & Sang, P. (2018). Foreign Direct investment and bank performance in Kenya. *Research Journal of Business and Management, 20(7),* 10-20.

Lottu, O. A., & Abdul, A. A., Daraojimba, D. O., Alabi, A. M., John-Ladega, A. A., & Daraojimba, C. (2023). Digital transformation in banking: a review of Nigeria's journey to economic prosperity. *International Journal of Advanced Economics*, *5(8),* 215-238.

Lyons, A. C. & Kass-Hanna, J. (2021). *The evolution of financial services in the digital age*. In J. Gable & S. Chatterjee (Eds.), Handbook of Personal Finance. Berlin, Germany: De Gruyter.

Nkechika, C. G. (2022). Digital Financial Services and Financial Inclusion in Nigeria: Milestones and New Directions. *Central Bank of Nigeria Economic and Financial Review*, *60(4),* 151-170.

Nkogbu, G. O. (2015). Enhancing Sustainable Economic Growth and Development through Human Capital Development. *International Journal of Human Resource Studies*. *5(1),* 1-18.

Nnaomah, U. I., Aderemi, S., Olutimehin, D. O., Orieno, O. H., & Abaku, E. A. (2024). Conceptualizing Fintech's Impact on Banking: A Comparative Study of The USA And Nigeria. *Finance & Accounting Research Journal, 6(3),* 437-462.

Nnaomah, U. I., Aderemi, S., Olutimehin, D. O., Orieno, O. H., & Ogundipe, D. O. (2024). Digital Banking and Financial Inclusion: A Review of Practices in the USA and Nigeria. *Finance & Accounting Research Journal*. *6(3),* 463-490.

Norbert, F., & Saleh, N. (2003). *The New Partnership for Africa's Development (NEPAD): Opportunities and challenges* (IMF Working Paper No. 03/69). International Monetary Fund. https://doi.org/10.5089/9781451849080.001

Nsofor, E. S. (2016). Impact of investment on stock market development in Nigeria. *International Journal of Financial economics, 5 (1),* 1-11.

Olurinola, I., & Osabohien, R., Adeleye, B. N., Ogunrinola, I., Omosimua, J. I., & De Alwis, T. (2021). Digitalization and Innovation in Nigerian Firms. *Asian Economic and Financial Review*, *11(3).* 263-277.

Pedro S. S., Jorge R. M., & Jose, G. G. V. (2014). Absorptive capacity from FDI in Spanish Manufacturing firms. *International Business Review*, *23(2),* 429-439.

Siddik, M. & Kabiraj, S. (2020). Digital Finance for Financial Inclusion and Inclusive Growth. *Economic and Financial Review*, *60(4),* 151-170.

Sopekan, D. O. (2021). Digital Financial Inclusion for Economic Progress. *CIC Journal 2:* 55.

Suresh, C. A (2022). Global Perspective of Digital Transformation In Banking Services. *Contemporary Issues in Multidisciplinary Subjects, 2(1),* 34-40.

Terwase, I. T., Abdul-Talib, A, & Zengeni, K. T. (2014). Nigeria, Africa's Largest Economy: International Business Perspective. *International Journal of Management Sciences, 3(7),* 534-543.

Trojette, I. (2016). The effect of foreign direct investment on economic growth: The institutional threshold. *Region et development*, *43(1),* 111-138.

Tshepo, M. (2014). The impact of foreign direct investment on economic growth and employment in South Africa: A time series analysis. *Mediterranean Journal of Social Sciences*, *5(25),* 18-27.

Tsaurai, K. (2014). Banking sector development and foreign direct investment. A case of Botswana. *Risk Governance & Control: Financial Markets & Institutions, 4 (3):* 44-50.

Yoganandham, G. (2024). Revolutionizing Financial Services: The Role of Emerging Technologies and E-Masters in Financial Technology and Management. *Science, Technology and Development, 8(2),* 128-142.

Zhu, Q., Lyu, Z., Long, Y., & Wachenheim, C. J. (2021). Adoption of Mobile Banking in Rural China: Impact of Information Dissemination Channel. *Socio-Economic Planning Sciences*. *83(1).* 1-9.