

Exploring the Relationship Between Mobile Money Development and Economic Growth: Evidence from Nigeria

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ABSTRACT

There is growing enthusiasm about the role of mobile money in promoting economic growth and its contribution to poverty alleviation via opportunities for savings, credit, investments, and micro insurance. However, the link between mobile money and economic growth has yet to receive wide empirical examination in developing economies. The Nigerian government has embarked on various interventions, often associated with high costs, to promote the adoption of mobile money services. Whether or not these efforts link to economic growth can only be established through research.

This study has aimed at exploring the nature of the relationship between mobile money development and economic growth in Nigeria. It has used a quarterly volume of mobile money transactions and real GDP as proxies for mobile money development and economic growth respectively. The study employed the ARDL bounds tests techniques by Pesaran, Shin, and Smith (2001), along with Augmented Dickey-Fuller tests and causality tests developed by Granger (1969) on time series data from Q12010 to Q42016. Data was obtained from the Central Bank of Nigeria's (CBN) statistics database and the Nigerian National Bureau of Statistics.

Evidence of a long run relationship between mobile money and economic growth was established. The causality pattern discovered has revealed that changes in economic growth have shown a significant influence on mobile money but not vice versa. It was specifically found that with each 0.8 million Naira increase in Nigeria's GDP, a million increases in mobile money transaction occurred. It was recommended that Nigeria's policy makers should focus on policies with stronger effects on economic growth, spill-over effects of which would promote mobile money penetration in the long run. Future research may concentrate on identifying the specific areas with stronger effects on economic growth for the attention of policy makers and opinion formers. It was suggested that the scope of the study be expanded to cover wider periods and more countries within sub-Saharan Africa.

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GLOSSARY OF TERMS

| | |
|---------|---|
| ATM | Automated Teller Machine |
| BPSD | Banking & Payments System Department (of Central Bank of Nigeria) |
| CBN | Central Bank of Nigeria |
| CICO | Cash-in, Cash-out |
| DFS | Digital Financial Services |
| FDI | Financial Development Index |
| FINTECH | Financial Technology |
| GDP | Gross Domestic Product |
| GFCF | Gross Fixed Capital Formation |
| GSMA | Global Satellite Mobile Association |
| M2 | A measure for money supply that includes cash and checking deposits, and near money |
| MFS | Mobile Financial Services |
| MMO | Mobile Money Operator |
| MNO | Mobile Network Operator |
| M-PESA | Mobile PESA. PESA, meaning “money” in Swahili |
| NCC | Nigerian Telecommunications Commission |
| SMS | Short Message Service |
| SDG | Sustainable Development Goal |
| TELCO | Telecommunications company |
| USSD | Unstructured Supplementary Data Service |

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

There is growing enthusiasm about the role of mobile money in promoting economic development and contributing to poverty alleviation. In developing countries, mobile money, which is an aspect of Mobile Financial Services (MFS) is gaining prominence because of the rapid penetration of mobile phones. The effect of MFS on development is expected through the provision of employment opportunities, access to credit, and a platform for savings. Through these, investments are made in sectors like education and agriculture (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018).

Mobile money is a variant of MFS widely utilised as an innovative tool for expanding access to financial services to the poor, the unbanked, and under-banked. Lack of access to DFS makes people resort to the use of cash for payments and monetary transfers, which makes savings and investment more difficult and sometimes impossible to achieve. The use of cash for payments also exposes users to the risks of theft, robbery, and associated dangers, all of which could thwart the chances of any meaningful development.

According to Demirguc-Kunt, Klapper, Singer, Ansar, and Hess (2018), more than half of Nigeria's bankable adults lack access to formal financial services. This is especially true in under-served communities where conventional banks find it unprofitable to establish a branch or deploy an Automated Teller Machine (ATM), perhaps without government or other stakeholder intervention. This in turn contributes to exclusion from financial services. Contrarily, evidence suggests that access to financial services is an essential element that contributes to development and poverty alleviation. Experience has shown that in developing countries like Nigeria, barriers ranging from the high cost of financial services to lack of awareness, have contributed to the exclusion of people from financial services. This has a negative consequence of undermining the concerted efforts to eradicate poverty and attain Sustainable Development Goals (SDGs).¹ Amongst the SDGs include the cardinal goal of eradicating extreme poverty by the year 2030. Mobile money, furthermore, is a veritable tool

¹Sustainable Development Goals (SDGs) replaced the Millennium Development Goals (MDGs) which expired in 2015.

to achieve this objective of poverty eradication.

With respect to financial inclusion, the Maya Declaration was launched by over 90 developing and emerging countries in 2011. A total of 62 commitments were made to develop the financial inclusion strides of the authorities involved (Alliance for Financial Inclusion, 2017). Under the same Declaration, Nigeria committed to 14 declarations that include “increase in access to payments, credits, savings” and “creation of financial inclusion strategy framework.” However, only one (1) declaration—the creation of a national financial inclusion strategy framework—was achieved as of April 2015. The commitment to Maya and similar efforts were often embarked upon by Governments, with the hope that mobile payments could be leveraged to open the doors to financial inclusion which could in turn, lead to economic growth.

In sub-Saharan Africa, access to payments, credit, insurance, and savings are increasingly attained through mobile devices, since conventional banking does not normally extend to large segments of the population in rural areas. According to GSMA (2016), mobile credit services in SSA have risen from six services in Kenya, in 2011, to 39 services across 11 countries in 2016. There were also 60 mobile money-enabled insurance services in 17 countries in the region.

In terms of the provisioning of credit, mobile money-enabled credit services are fast growing in Africa. According to the report by GSMA, (2016) as of 2016, Kenya and Tanzania were at the forefront with Kenya’s M-Shwari having 15 million accounts and USD 1.3bn disbursed in credit, while Tanzania’s M-Pawa had five million accounts with USD 22m disbursed in mobile credits. These two mobile credit platforms represent huge opportunities for access to credit to segments of the population that might ordinarily be unreachable in Kenya and Tanzania. Innovative financial services of this nature seem promising to economic growth and often attract the attention of policy-makers. It is therefore important to ascertain if the growth effects do really exist, as well as establish the pattern of causality.

The mobile money service is increasingly perceived as a platform that could transform the entire global south, since it is adopted across a variety of sectors that include, but are not limited to, commerce, health care, agriculture, and retail (Donovan, 2012). Mobile money appeals to all segments of the population due to its simplicity, reach to under-served communities, and low cost of implementation and maintenance. In most situations, making payments or effecting a transfer is as simple as typing and sending a chat message via a mobile phone.

According to Mallat, Rossi, and Tuunainen (2004, pp. 42-46), “The wide penetration and personal nature of mobile phones, the overall stability of mobile communication technologies, and the positive experiences with m-commerce payments, have made mobile solutions applicable for a variety of financial services”. This has, therefore, made mobile banking services, through Mobile Money Agents,² Mobile Banking Applications (Apps), and USSD banking,³ more visible in recent years, particularly in developing countries like Nigeria.

The economy of Nigeria has been growing in recent years. With the rebasing of Nigeria’s GDP in 2014, the 2013 GDP has risen from USD 270bn to USD 510bn, mostly emanating from the services sector such as telecommunications and banking that were hitherto not included (Amadou, 2015). It is therefore imperative to understand how financial development emanating from the mobile money service contributes to economic growth.

Having perceived the potential of mobile money to economic growth, the Nigerian government embarked on various interventions, often associated with high costs and enormous efforts to promote the adoption of mobile financial services. The interventions, as quoted by CBN (2013) include implementation of a financial literacy framework, consumer protection framework, the cash-less policy, as well as credit enhancement and credit guarantee schemes to micro and small enterprises. The Shared Agent Network Expansion Facility (SANEF) was also launched to support the aggressive creation of agent touch points across the country. Nigerian Tribune (2018) highlighted that the SANEF initiative also provides huge funding support to qualifying companies engaged in mobile payments services and targets the roll out of 500,000 financial service touch points in Nigeria by 2020. Whether or not these efforts could eventually link to economic growth, can only be established through research.

1.2 Problem definition

Nigeria is the most populous country in Africa, with its own deep share of poverty penetration. Nigeria has furthermore subscribed to the Maya Declaration, with one of its aims being to increase financial inclusion which can be achieved by promoting the adoption of mobile payments.

²The use of mobile phone account numbers (not conventional bank accounts) for payments and other financial services. See Institute of Economic Affairs (2017).

³ Unstructured Supplementary Service Data (‘What’s the difference between USSD, MMI and SS codes?’, 2017).

Despite being the most populous country and the largest economy in Africa, Nigeria was relatively slow in terms of adopting mobile banking products. According to the EFInA “Access to Financial Services in Nigeria 2014 Survey” [as cited by Institute of Economic Affairs (2017)], while Kenya, with a population of 45 million, had 26.5 million subscribers to mobile money, only 800,000 people were subscribers of mobile money in Nigeria (with a population of 178 million) demonstrating much less implementation compared to the Kenyan market. As insinuated by Flores-Roux and Mariscal (2010), mobile banking initiatives show an uneven degree of development with the greatest level of success being M-PESA in Kenya, followed by the Philippines. Reasons for the success of the scheme in one jurisdiction and its failure in another, even with nearly the same level of conditions, are not yet clear. This is affirmed by the failure of Vodacom (in spite of its deep association with Kenya’s M-PESA), to succeed with the mobile money business in South Africa despite its remarkable success in Kenya.

The Central Bank of Nigeria embarked on several initiatives to promote the penetration of Mobile Money since 2009. The initiatives involved interventions that cost several billions of Naira (Nigerian Tribune, 2018) as well as efforts to develop policies aimed at facilitating mobile money. Progress has been slow compared to what has been achieved in other economies comparable to Nigeria. People have widely made assertions linking mobile payments to economic development, but it is obvious that very few empirical studies have been conducted to validate the true relationship between development (penetration) of this innovative payment service and economic growth.

Without reliable studies validating or refuting these assertions, policy makers would miss the opportunity to make effective policies with real impact on economic growth. Therefore, there is a strong need for empirical evidence to understand the link (if any) and patterns of behaviour between mobile money development and economic growth.

This study is the first of its kind to examine the finance-growth relationship from the perspective of mobile money in the context of Nigeria.

1.3 Statement of research objectives

This work aims to answer the following research questions:

- I. Does mobile money development have any effect on economic growth?
- II. What is the causal relationship between mobile money development and economic

growth in Nigeria?

Building on the above questions, below are the key objectives of this research.

- I. To ascertain if mobile money development has any effect on economic growth.
- II. To investigate the causal relationship between mobile money development and economic growth in Nigeria.

Hypothesis 1:

H0: There is no link between mobile money development and economic growth.

H1: There is a positive link between mobile money development and economic growth.

Hypothesis 2:

H0: There is no causal relationship between mobile money development and economic growth.

H1: There is a causal relationship between mobile money development and economic growth.

1.4 Justification of the Study

Previous studies have examined the relationship between financial development and economic growth from the perspectives of stock market development, insurance sector development, banking sector development and tax, amongst others. From the perspective of the banking sector, proxies like demand deposit and volume of credit granted have been employed. This study looks at financial development from the perspective of mobile payments which is a relatively new and fast-growing aspect of banking services. It is also a different attribute from what had been used in previous literature.

Therefore, the employment of “mobile money”, in the context of Nigeria, will introduce a new perspective into the entire analysis and might also reduce any biases in previous studies which could have arisen due to proxy selections.

Part of the motivations for selecting the topic was the researcher’s role as a team member in the payment system policy and oversight division at the Central Bank of Nigeria. It is the division’s mandate to develop policies that guide the payments industry of Nigeria and collectively promote the adoption of electronic banking channels in the country. One of the

major challenges facing the country is the predominance of the use cash for payments and settlements. A “cash-less policy” was first introduced in 2011 in Nigeria,⁴ but despite several efforts and interventions, the policy was slow at attaining some of its desired objectives. These interventions included advocacy for reducing the use of cash and promoting the adoption of electronic payment channels. As most of the interventions focused on mobile money for financial inclusion and economic growth, perhaps it is about time policy-makers explored other areas that might be more stimulating to economic growth.

Another justification is from the perspective of Nigeria’s commitment to the 14 declarations of Maya, key among which was the promotion of financial inclusion. This was to be achieved by availing affordable mobile financial services to all. However, the country was rather slow when compared with other sub-Saharan Africa countries like Kenya (Institute of Economic Affairs, 2017).

Nigeria was selected to be the focus of this study because it is the most populous African country and contains the largest economy in the continent with a fast-developing financial sector. Despite this, a significant portion of its population lives below the poverty line (Leke et al., 2014).⁵ This has made Nigeria an interesting case for a study aimed at understanding the link between financial development and economic growth. Determining the causal relationship between mobile money development and economic growth will boost policy makers’ ability to place focus on the most appropriate areas that will stimulate quick and desired growth in both aspects.

This research avoided a cross-section country study and has focused on only a single country. This was to minimise the risk of statistical inference which would treat different economies as homogeneous entities. Some causality studies, such as that by Demetriades and Hussein (1996), insinuate that causality patterns often differ across countries. It is therefore safer to analyse causalities individually.

Jurajda and Mitchell (1993) assert that “financial development” is too generic a term to gauge the impact on economic growth, making it necessary for a researcher to specify the financial

⁴ The policy was relaxed in subsequent years

⁵ As at 2014, almost 130 million Nigerians were living below the poverty line according to Leke et al., (2014)

market concerned. As a result, we employed the mobile money market to serve as a proxy for financial development in Nigeria.

To further justify this study, Leke et al. (2014) demonstrate that the “services sector” has been a major contributor to Nigeria’s GDP in terms of composition, surpassing the “resources sector” which prior to Nigeria’s GDP rebasing in 2014, was considered a major contributor to the country’s overall GDP. Therefore, since mobile money is an important aspect of banking services in Nigeria, and banking services, representing a significant chunk of the “services sector” in GDP composition, its (mobile money’s) choice in this study is justifiable.

Findings from this study will be significant for researchers with interests in financial development and economic growth because the study employs a unique perspective for re-testing the inconclusive nexus of “finance – growth”. Policy-makers in Nigeria will also benefit from the study findings and will be able to establish a link and causality pattern between mobile money and economic growth. It is further expected that the results of this study may be able to guide policy formulation in Nigeria and beyond.

1.5 Limitations of the Study

This study was limited to investigating the relationship between mobile money development and economic growth in Nigeria. This study did not seek to examine the factors that determine user adoption of mobile money, nor did it investigate the factors informing merchant preference, or otherwise, for mobile money as a channel for accepting payments. This is because the underlying theories for the adoption of technology mostly emanate from the field of Information & Communication Technology (ICT) rather than finance and economic development.

The unavailability of sufficient data was another limitation. The data obtained covered only 28 observations from Q12010 to Q42016. This was because of unavailability of relevant data prior to 2010. Mobile money, as a financial service, was only introduced in Nigeria around 2010.

Given that the focus of this study has been centred on a single market, future studies can use extended observation periods, cover wider issues affecting mobile payments, and/or extend scope to cover other developing markets beyond Nigeria.

1.6 Organisation

This work will be presented in the following format: Chapter One will serve as an introduction, presenting this research's problem statement, research questions and objectives, and justification for the study. Chapter Two will review the relevant literature on financial market development and economic growth. It will also give an overview of the mobile money market in Nigeria and further review several conceptual theories, and finally, identify any gaps in the literature. Chapter Three will present the research methodology by stating the type of research method to be adopted (a quantitative one), sources of data (secondary data to be collected) and the tools of analysis. Furthermore, Chapter Four will analyse the data and discuss this research's findings, while the final chapter, Chapter Five, will summarise and conclude the study and offer appropriate recommendations (linked to the research questions and objectives). The recommendations are expected to assist in policy formulation and contribute to the body of literature. Unexpected findings, if any, would also be discussed under Chapter Five, and the limitations of this study will be acknowledged while also identifying relevant areas for future research.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter discusses the literature around financial development and economic growth. The topic has been widely researched using a variety of models and techniques. The volume of mobile money transactions in Nigeria was selected to serve as a proxy for financial development in this study. The chapter begins with explanation of the meaning of “mobile money” followed by an overview of Nigeria’s mobile money ecosystem. It then presents the theoretical framework underpinning finance-growth narratives, followed by a synthesis of empirical studies conducted around financial development and economic growth. There is a focus on the methodologies adopted and evidence found in the various studies reviewed. The conclusion aims to identify gaps in previous studies and errors in methodologies (if any) that this study intends to fill and address.

2.1 What is Mobile Money?

At the most basic level, mobile money is the provision of financial services through a mobile device (Donovan, 2012). The devices themselves vary, ranging from feature phones to smart phones to pads which could be utilised to access a wide range of financial services. UNCTAD (2012) describes “mobile money” in more detail as “money stored using the SIM (subscriber identity module) in a mobile phone as an identifier, as opposed to an account number in conventional banking.” The money stored on a SIM is called e-money because cash is usually collected by an agent and converted to electronic money. In Nigeria, the conventional bank account number is referred to as the “Nigeria Uniform Bank Account Number” (NUBAN) while the mobile money store of value account is referred to as a “wallet”. The mobile telephone number usually serves as the unique identifier for each wallet.

Mobile money allows its users to, among others, make peer-to-peer (P2P) transfers, bill and merchant payments, as well as receive social disbursements (Government-to-Person) and, in most jurisdictions, cross-border remittances using mobile devices. The service has enabled users with access to mobile devices (usually smart or feature phones) to perform basic financial transactions without having to use a conventional bank account or rely on riskier and time-consuming methods, such as carrying cash (Muthiora, 2015). In more developed financial

markets, other services, such as credits, insurance, and pensions, are provided through mobile money channels. The service involves the operation of a wallet that could be funded, and its balance diminished, through transfers, bill payments, purchases, or withdrawals through a mobile money agent at relatively lower costs.⁶ Conventional bank accounts are usually governed by strict Know-Your-Customer (KYC) documentation (such as proof of identify and residence) to open and maintain an account, whereas, mobile money wallets have a variety of requirements lowered or waived in most jurisdictions, to promote its access and usage.

Banking services are heavily supported by information and communication technology which provides the rails on which electronic payments are transmitted. The two services, therefore, are inextricably related, occasioned by the rapid innovations in the global financial services sector. The fusion of finance and information technology gave rise to development of financial technology companies, popularly known as FinTech firms, which develop disruptive technologies, most of which help digitise financial services, products and processes today.

GSMA (2010, p.3) defines mobile money as “a service in which the mobile phone is used to access financial services.” This implies that mobile money is about financial services that are accessible through a mobile phone or, from another perspective, a mobile device, considering that a lot of modern financial services are accessible through variety of mobile devices that include phones, pads, and other devices. Another definition presents mobile money from a more elaborate perspective, describing it as an electronic wallet service that stores, sends, and receives money through the use of a mobile device (World Remit, 2018). This definition has introduced the concept of a “wallet” which is further defined as an account that is primarily accessed through a mobile device (GSMA, 2010, p.3). This includes creating and operating an account that is electronic in nature and is operated either remotely using electronic devices or physically at mobile money agency points. Mobile money wallets are perceived to be more user-friendly than conventional bank accounts. This is mainly because mobile money wallets are easier to access due to low KYC requirements and ease of operation. Overall, accessing money is like sending a short messaging system (SMS) or dialling a phone number to make a call.

⁶An agent is usually a small business owner in a location, recruited by the mobile money service company to provide basic cash-in cash-out and bill payment services on its behalf, usually to mobile money wallet holders.

A confusion that often arises is whether the e-money on a mobile money wallet is synonymous with phone airtime. While mobile money is an electronic version of the currency or legal tender, phone airtime is a product that has been purchased to access services such as phone calls, SMS messages, and data. In most jurisdictions, the use of phone airtime for the purchase of other goods and services is prohibited because airtime is meant to be consumed in telecommunication services and is not considered legal tender currency. Monetary Authorities and Central Banks often express scepticism that the use of airtime for purchases or monetary transfers may weaken their capacity for effective transmission of monetary policies. This concern is attributed to the fact that often, a different regulator inevitably oversees the affairs of telecommunication companies which render monetary authorities unable to have such entities under their regulatory radars. Consequently, they are unable to have control over when and how much airtime telecommunication companies can produce and inject into the economy to serve as “currency”. To allay this concern, sensitisations are sustained to enable operators and users understand the differences between mobile money and airtime, and also to appreciate the fact that the use of airtime should be strictly within its intended context, while mobile money (which is currency-based) should be utilised as a digital wallet for transactions using the e-money loaded thereon.

2.2 Overview of Mobile Money in Nigeria

A framework for mobile money in Nigeria was developed in 2009 and subsequently private companies were licensed to operate the scheme while incumbent banks that indicated interest were also licensed to implement the service. Nigeria had a total of 22 mobile money companies that relied on human agents, mobile applications, and Unstructured Supplementary Service Data (USSD), to provide service to their customers. The ubiquity of agents, though an important success feature of a mobile money service, was lacking in Nigeria which meant that services grew at a slower rate than expected and far below other countries on its level, such as Kenya, Ghana, and Tanzania.

The pricing for mobile money in Nigeria was controlled by the regulator, the Central Bank, to prevent it from becoming exorbitant and therefore less attractive to its intended target.⁷ This is necessary because the low levels of transaction charges associated with mobile money are often

⁷Mobile money products are low-frill financial services intended for the poor and dis-advantaged.

described as reason why its users get attracted to its adoption. As revealed by Donovan (2012), in Kenya, M-PESA was routinely between one-third ($\frac{1}{3}$) and one-half ($\frac{1}{2}$) as expensive as alternative channels of payment. Lower costs immediately translate into savings to the user of mobile money, who is often a low-income earner. In other words, the amount of money remitted in Kenya increased when transferred using M-PESA compared with when traditional forms of remittances were used. On the other hand, where transaction costs are high (as in Botswana where the cost per transaction is a minimum of 8 pula or \$1.07), mobile money has been slow to take root (Donovan, 2012).

In the case of Nigeria, however, there has been a unique issue associated with the price controls by the regulator (the Central Bank). Observers argued that the price control could be the reason why the spread of agents in the country was not extant. This was attributed to the fact that mobile money operators might not have been motivated to incur high costs and that the risks of investing in remote areas and charging the same regulated (low) fees could have resulted in little or no gain. The dilemma was, however, the possibility of fees and charges becoming unaffordable for the poor, that is if the bank and non-bank operators were given the latitude to charge fees they deemed appropriate.

Licensed non-bank mobile money operators are required to maintain a non-interest earning pool account at the Deposit Money Banks (DMBs) (CBN, 2015). Funds kept in that account are ring-fenced from operational use by the operators. Also, the account can not be used to obtain or service loans of any kind by operators. Funds in the pool account are deposit-insured by the Nigeria Deposit Insurance Corporation (NDIC). Thus, bankruptcy of the bank would not preclude the safety of some portion of the depositor funds.⁸ This approach is known as pass-through deposit insurance. It involves insuring deposits and deposit-like funds kept in custodial accounts at licensed banks, thus mobile money wallets that are traditionally seen as stored-values and not deposits, are guaranteed against the failure of the bank, not the service (mobile money) operator. Juan, Timothy, Claire, and Dave (2016) have noted that, in spite of the benefits of the pass-through deposit insurance scheme, challenges are often faced by non-bank firms providing services like mobile money. Such challenges include the rigours of

⁸This type of deposit insurance does not cover every amount standing as account balance, rather only certain levels of the balances are guaranteed.

providing real-time information on the identities of customers opening wallets through agents as well as constantly fluctuating balances of stored-value accounts. This could lead to high operational costs that may be undesirably passed to customers or where this is not possible, suffered squarely by the operators. It may also raise the risk of errors in providing reliable information to regulators and other stakeholders, especially where appropriate technology for data management is not utilised.

2.2.1 Stakeholders in the Nigerian ecosystem

The mobile money system is a value chain involving several actors who contribute to making the system work. The following players are found in the Nigerian ecosystem:

- a. **Banks:** Commercial banks in Nigeria participate as mobile money service providers hiring and managing agents for the operation. The banks also provide safe custody to the mobile money pool accounts. The pool accounts are the store where the aggregate funds in mobile money wallets from each operator are kept.
- b. **Non-Bank Operators:** These are non-bank, non-MNO corporates that are licensed by the Central Bank to operate the mobile money business. They hire, brand, and manage agents under their names. The companies under this category are required to have and maintain a minimum capital of N2bn (two billion Naira). Companies in this category are also allowed, just like the banks, to appoint ‘super agents’ as their partners in the business.
- c. **The Nigeria Inter-Bank Settlement Systems (NIBSS):** This is a company jointly owned by the Central Bank and the commercial banks. It was designated as the Nigeria Central Switch in addition to its other roles in the provisioning of shared infrastructure for the payments industry. As the Central Switch, it connects all the mobile money operators and banks for the purpose of interoperability as well as facilitating transaction settlements.
- d. **The Central Bank of Nigeria:** serves as the regulator of the payment system in the country. It licenses and conducts oversight on mobile money operators and other payment service providers as part of its mandate to promote a sound and stable financial system in Nigeria.
- e. **The Nigeria Deposit Insurance Corporation:** is a government agency providing deposit insurance for the banking sector. It extended its coverage to mobile money pool

accounts under the pass-through deposit insurance scheme. This was done to enhance confidence and encourage the adoption of mobile money in the country.

- f. **Super Agents:** These are companies licensed by the Central Bank to participate in the mobile money value chain. Super Agents act as middlemen between the principal (a fully pledged mobile money operator) and the sub-agents. They recruit and manage the sub-agents on behalf of their principals; they also provide liquidity support to agents under their authority. The minimum capital of N50m (50 million Naira) is required for licensing.
- g. **Sub-Agents and Merchants:** Sub-agents are the lowest level in the value chain. They operate from shops and kiosks and earn a commission per transaction. A network of sub-agents is key for the success of mobile money. The merchants sell products and provide services and accept their payments through mobile money wallet. Merchants who accept mobile money for payments are important stakeholders who facilitate the growth in the adoption of the system. The sub-Agents and merchants do not require licence from the Central Bank.
- h. **Mobile Network Operators and Value-Added Service Providers:** These are the players from the telecommunications sector who, collectively, provide the telecommunications infrastructure that facilitates transmission of mobile money transactions in Nigeria. MNOs are currently not permitted to obtain a mobile money licence in Nigeria partly because of the fact that they have been initially licensed to conduct telecommunications business, not financial services. Their Telco licence, furthermore, prohibits their engagement in financial services. If they are eventually permitted to partake in the financial services sector, issues such as how to avoid regulatory arbitrage ought to be carefully addressed. Nevertheless, there is increasing enthusiasm by the MNOs to partake in mobile money services.

2.2.2 Models of Mobile Money

Broadly speaking, three models of Mobile Money exist, the Bank-led, the Telco-led (also called MNO-led), and the hybrid or collaborative model (Donovan, 2012). Various jurisdictions have adopted different models while some have adopted a mix of both, called a hybrid-model. Countries like Nigeria, Egypt, Ethiopia, and South Africa have adopted the Bank-led model (Babcock, 2015), while Kenya, Uganda, and Tanzania have the Telco-led model. Ghana started

as Bank-led but later moved towards the Hybrid-model by allowing the Telco's to create a special purpose vehicles (SPVs) and participate. This move birthed significant growth in penetration of the service in Ghana, within a short period. Similarly, in Pakistan, the acquisition of majority stakes by Telenor, an MNO, into Tameer Micro Finance Bank could be interpreted as a fusion of both models leading to a hybrid model.

CBN (2015) defines the bank-led model as a bank, either alone or as a consortium of banks that seeks to deliver banking services, leveraging on the mobile payments system. The non-bank-led model, contrastingly, is a corporate organisation duly licensed by the Central Bank of Nigeria (CBN) to deliver mobile money services to customers.⁹ The Lead Initiator was described as a corporate organisation other than a deposit money bank or a telecommunication company. The bank-led model is usually carried out by existing, licensed banks in the country, as a product or line of service. In the non-bank-led model, corporate entities, usually financial technology companies (FinTechs), obtain licences from the Central Bank to partake in the business. Telecommunications companies (TELCOs) are however not allowed to engage in financial services in Nigeria.¹⁰

As of December 2016, the Central Bank of Nigeria had licensed 22 mobile money companies, 13 of which were non-bank-led while the remainder were bank-led (BPSD, 2016). The companies were mostly concentrated in Lagos, the commercial capital of Nigeria, with representation in most states of the federation.

In terms of growth in transactions, mobile payments have maintained a rising trajectory in recent years. Figure 1 shows that, since 2012, the volume of transactions, just like values represented, have constantly risen per year. By the end of 2016, the volume has stood at 47 million transactions and its value, at N756.89 billion (USD 2.4 bn). Despite this seemingly positive growth trend, there are still enormous unexplored growth opportunities considering the size of Nigeria's population and vastness of its land.

⁹The definition is based on the Nigerian context.

¹⁰The telecommunications regulator, Nigerian Communications Commission, prohibits licensed Telco operators from participating in financial services like mobile money.

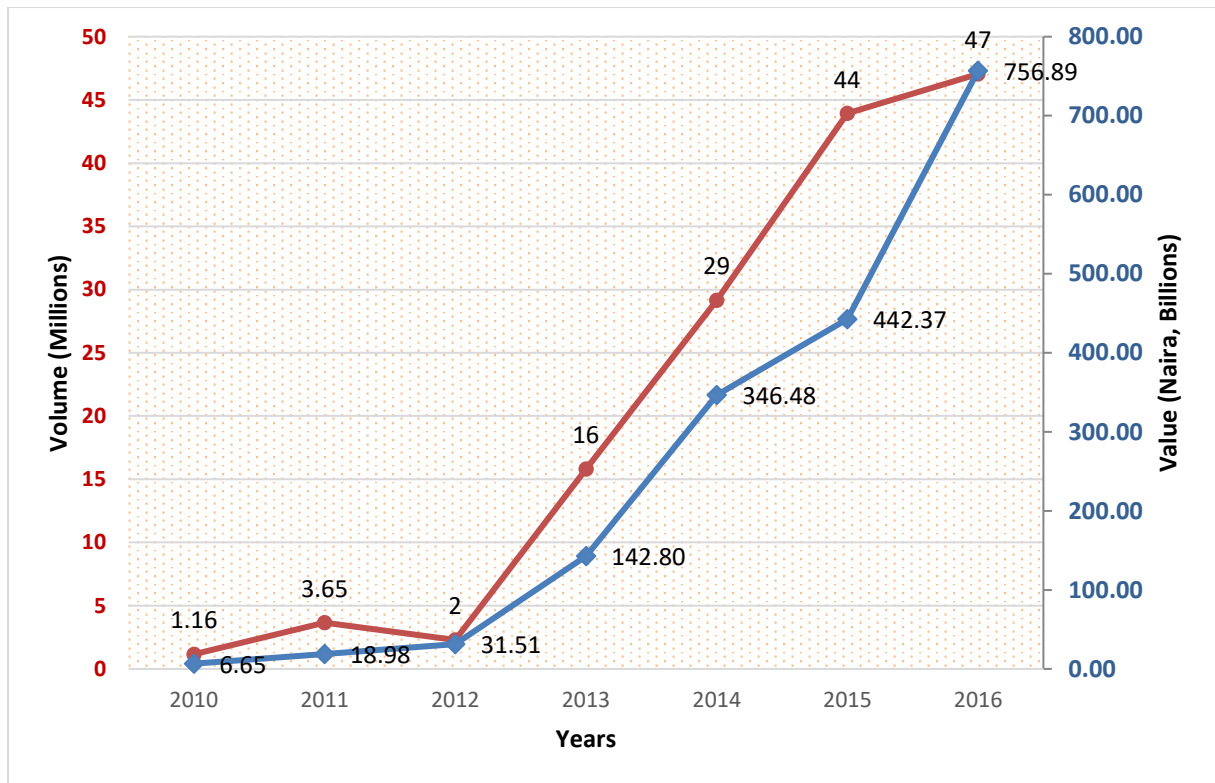


Figure 1: 7-Year Trend of Mobile Payment Transactions in Nigeria

Source: Central Bank of Nigeria (2018)

2.2.3 Agent Networks

The Mobile Money Operators (MMOs) heavily rely on agent networks for cash-in and cash-out (CICO) function which remains key to the success of every mobile money platform. This, does not overlook the role that channels like the USSD and Mobile Applications play in reaching and helping customers transfer to or from their mobile money wallets. The agents are normally located in major cities and also in remote villages where more often than not, internet services and bank branches are scarce or unavailable. Consequently, the role of agents in promoting mobile money adoption cannot be over emphasised because they provide the reach and support to mobile money users in remote communities that conventional banks and internet technology do not.

According to GSMA (2016), between 2011 and 2016, the number of agents has increased five-fold in sub-Saharan Africa, with Kenya showing the most promising success. The rapid growth in the number of agents might be the reason behind the increase in mobile money transactions in this period. It may also reflect the employment and entrepreneurial opportunities provided by this new method of payment.

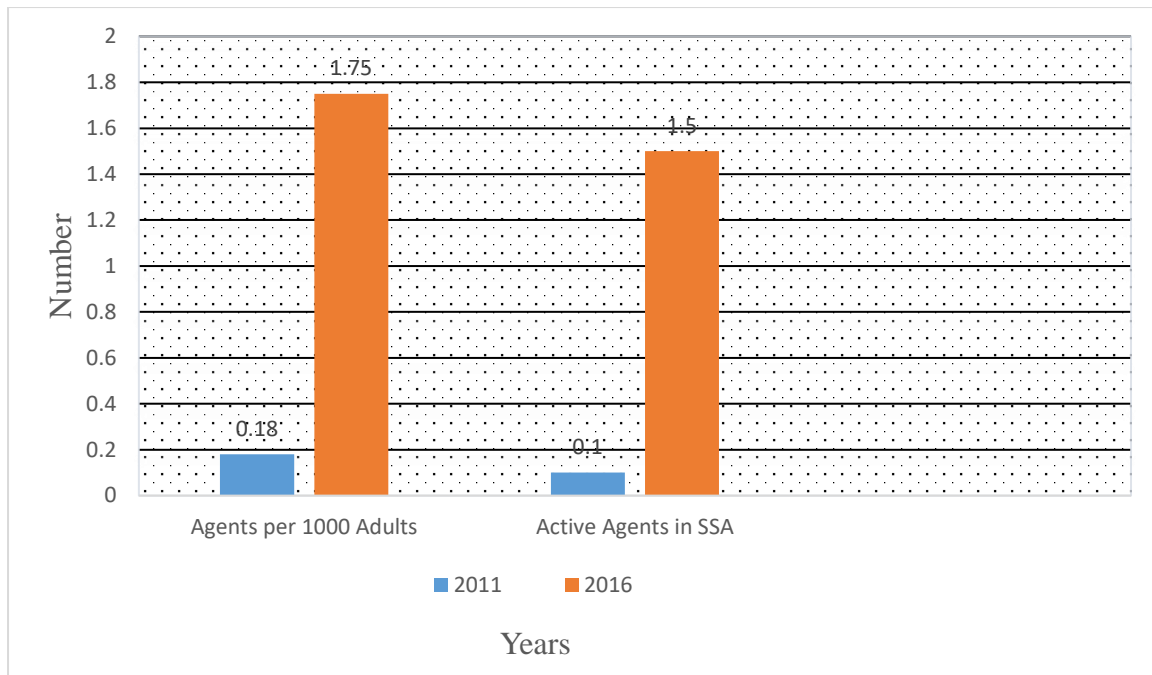


Figure 2: Trend in Agent Reach in sub-Saharan Africa

Source: GSMA (2016)

As shown in Figure 2, there have been 0.18 agents per 1000 population in sub-Saharan Africa since 2011, which has grown exponentially to 1.75/1000 population five years later. Similarly, in terms of volume, there were 100,000 active agents in 2011 and 1.5m by the year 2016. This exponential growth is an affirmation that mobile money adoption in sub-Saharan Africa has outpaced growth in other parts of the world (GSMA, 2016).

Building and incentivising networks that serve as the cash-in, cash-out points of contact, as well as customers' primary interface with the brand, is difficult and costly (Donovan, 2012). This relates to the cost of training an agent, managing the agent to ensure that AML/CFT risks do not crystallise, branding an agent location and local advertisement costs, etc. In Nigeria, the non-exclusivity of agents has been a concern,¹¹ meaning that any mobile money operator could use/hire any other agent for mobile money transactional purposes irrespective of whether the agent has already been hired and set up by a predecessor. This often discourages first-time agent hiring, as operators may wait for their competitors to bear the initial costs of set-up while they subsequently utilise the agent and their installed facilities. This challenge could be

¹¹Agents are expected to be non-exclusive by regulation, with the expectation that such would prevent an operator hiring agents in a restrictive manner.

ameliorated if initial agent-hirers are compensated with some additional income for each transaction made through their agent as a result of competitor's utilisation of an agent set-up by them.

According to Maurer, Nelms, and Rea (2013), agents face problems in four areas, namely: profitability, proximity, liquidity, and trust. In terms of profitability, stakeholders including regulators, must not underestimate the motivation of agents to see value in the agency business. Without agents' enthusiasm, the overall objectives underpinning the success of mobile money may be entirely lost.

The issue of proximity relates to the accessibility of agents to customers and other agents within a network. It encourages higher transaction turnover; however, the principal must be aware of the dangers of growing too fast and saturating the market, which may have further consequences on the profitability of both the agents and the principal. Therefore, the point is to extend the bridges to other territories by getting new agents, not by building bridges on other bridges (Maurer et al., 2013).

With respect to profitability, in their capacity as "human ATMs", agents must strive to keep a good balance between physical stocks of cash and e-floats at all times. Failure to do so may result in customer dissatisfaction, a loss of confidence in the agent, or even the entire system. Mobile money operators are concerned about the regulatory and reputational risks they assume when they contract agents though they continue to take the necessary steps to protect themselves against fraud, liquidity mis-management, and reputational damages—all of which may arise because of agent misbehaviour.

In terms of trust, agents need integrity and reliability. This could partly be achieved through training that includes ensuring that agents keep consistent hours and that they treat mobile money clients with the utmost respect they deserve. Where assistants exist, agents must confirm that their assistants can offer the same level of service in their absence by reliably accommodating customer cash-in/cash-out demands and that assistants have the ability to conduct customer due diligence adequately. Customers must have trust that their transactions will be fulfilled in a timely manner, they will not be defrauded, and their money is safe when "in the mobile money system" (Maurer et al., 2013). In Nigeria, the brand and reputation of the mobile money operator plays an important role. Banks and non-bank MMOs with established brands do support reliance and trust on their agents primarily through their known

brands and ability to quickly resolve issues when they occur.

2.2.4 Interoperability

Interoperability refers to the ability of different schemes to open their systems to receive information from one another with a common understanding. A payment system that is interoperable allows two or more proprietary platforms to exchange information and carry out transactions in a seamless manner. It promotes competition and provides convenience and cost reductions to its users. Interoperability requires technical, regulatory, and legal cooperation from the members. In sub-Saharan Africa, cross border mobile payment interoperability would have the potential to support the success of the Continental Free Trade Area (CFTA) when fully implemented.

2.2.5 Services offered through mobile money

Mobile money services primarily involve cash-in/cash-out transactions, airtime purchases and peer-to-peer money (P2P) transfers. Other services, such as bill payments, are also common. Recent developments in some markets have also witnessed savings and investment wallets, and cross-border remittances. The process of converting physical cash into electronic money (e-money) into a customer's mobile wallet is simply referred to as "cash-in" while the process of turning e-money into physical cash is referred to as "cash-out". A human agent must experience the market dynamics to estimate, with reasonable accuracy, the levels of liquidity required to serve customers for both cash-in and cash-out transaction requests. The absence of good liquidity management is a concern and a possible cause for customer disloyalty to the service. Donovan (2012) stressed the role of good liquidity management to win customer loyalty and ultimate success of the scheme.

In terms of person-to-government payments (P2G), a few prevalent categories have been identified by Frydrych, Scharwatt, and Vonthron (2015). These include tax collections, school fee payments, licences, official documentation fee payments, and health payments while payments for fines were less-commonly done. P2G payments using mobile money are less common in Nigeria but this might be attributed to the lack of penetration of the service and the low levels of mobile money service awareness in the country.

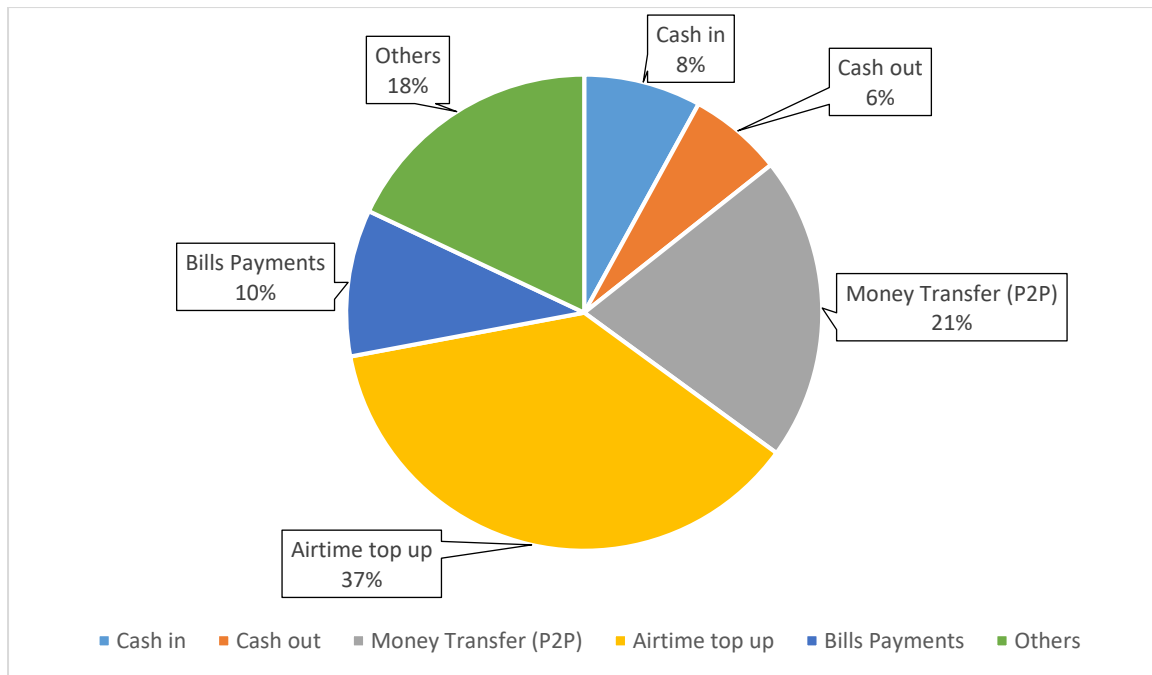


Figure 3a: Classification of Mobile Money Transactions in Nigeria by Volume, 2016

Source: BPSD (2016)

The highest use of mobile money in Nigeria, from the perspective of transaction volume, was airtime top up, with 17.4m (37%) transactions in 2016. This was followed by P2P money transfers with 9.7m transactions representing 21% of the total transactions. Bill payments, cash in, cash out and Others formed the remaining balance of 42%. The reason for the high volume of airtime transactions might be related to its low value and its tendency to be required on a recurrent basis.

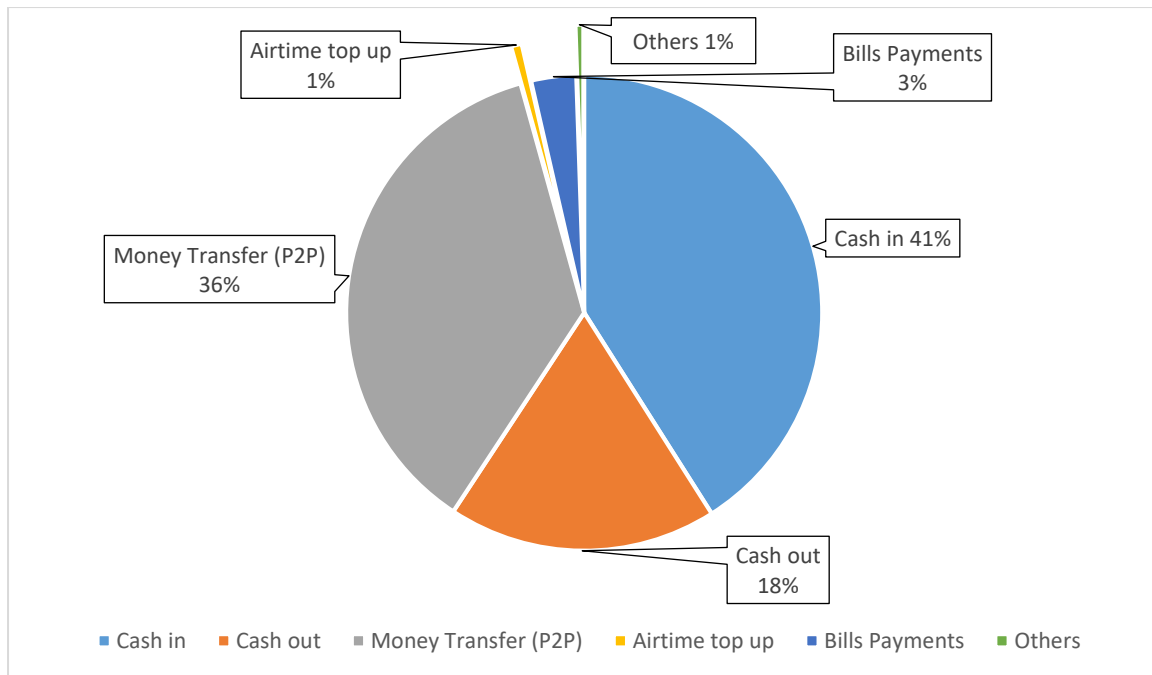


Figure 3b: Classification of Mobile Money Transactions in Nigeria by Value, 2016

Source: BPSD (2016)

Viewing the transaction classification from the perspective of “value”, cash-in, with N310bn represented 41% of the total transaction values. This could be attributed to the relatively high value nature of cash-in transactions compared to low value transactions, such as airtime purchases. Typically, an airtime purchase by most Nigerians can be as low as N50 while cash-in transactions of N500 or even N1,000 are considered extremely low. This indicates a 10 - to 20 - fold difference between a cash-in transaction and an airtime purchase. P2P transfers, with N275bn worth of transactions, made up 36% of the total mobile money transactions in 2016, while cash-out was 18%, payment of bills was 3%, airtime top up was 1% and Others with (1%) formed the remainder.

2.2.6 Use Case of Mobile Money

Mobile money can solve many financial challenges in developing countries by virtue of its ability to unlock access to wide range of financial services. Aside P2P payments, other forms of payments such as P2B, B2P and, more importantly, P2G, are growing. P2G payments are unique in that they assist in revenue generation to the government thereby solving fiscal policy challenges while also, indirectly affecting the population through the provisioning of public infrastructure by the government using the funds safely generated through mobile P2G channels.

The following table provides an overview of some P2G opportunities offered by mobile payments in some developing countries.

| Tax Collections | School Fees |
|--|---|
| <ul style="list-style-type: none"> • How: Mobile money enables a larger portion of the population to pay taxes with ease. • Type: Income tax, property tax, and value-added tax. • Used in: Cameroon, Guyana, Kenya, Mauritius, Philippines, Rwanda, Tanzania and Uganda. | <ul style="list-style-type: none"> • How: Citizens use mobile money wallets to pay for education and related fees. • Type: School tuition fees, registration/enrolment fees, examination entry fees. • Used in: Bangladesh, Cameroon, Côte d'Ivoire, Ghana, Kenya, Liberia, Rwanda, Tanzania and Uganda. |
| Licence and Official Documentation Fees | Health Payments |
| <ul style="list-style-type: none"> • How: Citizens pay for various types of licences to the government revenue authorities in a timely manner using their wallets. • Type: driving licences, vehicle licences, gun licences, etc • Used in: Guyana, Kenya, and Pakistan. | <ul style="list-style-type: none"> • How: Payments for hospital expenditures, drug costs and other health-related costs done through mobile money wallets. • Type: Health insurance premiums. • Used in: Kenya. |

Table 1: Overview of Payment Opportunities offered by Mobile Money

Source: Frydrych et al. (2015)

The areas of tax, education, and health shown above are particularly important for both the citizens and authorities. The digitisation of tax payments results in increased internally generated revenues through the expansion of tax nets and enhanced accountability on the part of collectors.

In terms of licensing fees, the use of mobile money will encourage registration. This has implications for the social well-being of the society since licensed drivers and vehicles are presumably subjected to necessary checks to meet the minimum standards for road worthiness. This will save costs associated with road accidents caused by unqualified drivers and environmental damages resulting from the high emission of carbon from vehicles (that otherwise, would have been disqualified). A citizen, attracted by the convenience of mobile payments, who subjects himself to the necessary checks for a gun licence, brings down the risk of guns getting into the hands of criminals, medically unfit individuals, and terrorists.

All citizens, including low income earners, would have an opportunity to access health

insurance by the digitisation of payments. This will not only promote family health but will reduce mortality rates and create opportunities for business growth in the insurance industry. Overall, it translates to a reduction in national health expenditure, more productive citizenry and a thriving insurance sector that encourages employment generation.

GSMA (2016) disclosed that mobile money contributed significantly to several industries in sub-Saharan Africa. In particular, GSMA (2016) highlighted the following case studies:

- **Water and Sanitation in Africa:** In 2013, the Water and Sewerage Corporation of Dar-es-Salaam increased its revenue by 38% through collections motivated by mobile money. Additionally, close to TZS1bn was collected every month. This achievement contributed to the increase in revenue generation by the government of Tanzania with positive implications on sanitation which improves the health of the population. Reliable revenue generation through mobile money services also provides access to good quality water that has far reaching effects on the development of the Tanzanian society. The cost efficiency benefits accruing to water service providers also extend to several other jurisdictions within sub-Saharan Africa. According to Hope, Foster, Krolikowski, and Cohen (2011), when mobile money was adopted for the payment of water services in Uganda, it was predicted that annual savings in operations and maintenance costs would exceed USD 420,000 a year emanating from cost savings from the closure of pay points that would no longer be required.

Similarly, as a result of the adoption of mobile-enabled payment options, Nkana Water and Sewerage Company in Zambia had annual savings of USD 23,000 just by closing down two (2) pre-adoption pay points and further increasing its monthly revenue by 33%. Hope et al. (2011) emphasised that these estimated savings were modest, however further savings might be achieved from a full automation of the billing management processes and a drop in the rate of accounting errors. It was also reported that the Nairobi City Water and Sewerage Company had high transaction volumes of more than USD 120,000 worth of water bill payments made through M-PESA every month while the Mobile Network Operators also benefited from revenues from growth in transaction volumes and enhanced customer loyalty.

- **Education in Cote d'Ivoire:** Through a radical public-private partnership which has digitized person-to-government (P2G) payments in Cote d'Ivoire, about 99.3% of a total of 1.7 million secondary school students paid their annual registration fees with

mobile money during 2015 and 2016 sessions. The benefits to the government ranged from ease and timeliness of collections, to opportunities for managing budgets more effectively and efficiently. To the mobile money providers, the benefits reported an increase in customer loyalty and the widening of the payments ecosystem. The situation in Cote d'Ivoire has additionally implied that, aside from the implementation of mobile service for payments related to education, it also contributed to secondary school students' financial literacy which benefited both the educational authorities/schools, the students, and the society at large.

- Agriculture in Africa: In Kenya and Tanzania, as of October 2014, 35,000 farmers had reportedly received support through a programme called Connected Farmer Alliance, sponsored by Vodafone and the US Agency for International Development (USAID). A similar mobile services utilising technology for short term loans to farmers has also grown in Nigeria. For example, some crowd funding platforms connect investors to farmers for funding and the eventual sharing of returns based on a formula that was pre-agreed through digital means.

Babcock (2015) reported that Ghana, Uganda, and Zambia portrayed commitment by their large commodity buyers financing the roll-out of digital finance in their respective value chains. In these jurisdictions, it was reported that large buyers of farm produce use mobile money to pay farmers, which introduced volume economics and an ecosystem of cash-in/cash-out (CICO). As this practice matures, it is expected to create new payment value chains for branchless banking, credits, savings, and micro-insurance which opens for an array of economic opportunities to those at the base of the pyramid.

- Energy in East Africa: Similar to the agricultural sector, the energy sector in East Africa has witnessed support from mobile financial services. People who lack access to energy may have access to mobile phones which enables them to participate in innovative offers that simplify access to off-grid energy.

M-Kopa, a Kenya based solar energy company sold over 500,000 solar kits in Kenya, Uganda, and Tanzania by 2017 using a rent-to-own model to provide affordable alternative energy to the people, leveraging mobile money. This achievement has come at a time when priorities for renewable and cleaner energy were at the top of most governments' global agenda. In particular, Goal Seven of the United Nations SDGs

relates to ensuring access to affordable and sustainable energy for all. Mobile money development therefore positively affects employment levels, health and safety, and business developments in the off-grid energy sector.

2.3 Theoretical Models

Theoretically, the first work that impacted the finance-growth studies in the field of economics was that of Bagehot (1873) as cited in Paavo (2017), who postulated that merchants in England could use a higher proportion of low-interest borrowed funds in their capital structure and make more profits by selling their commodities at much more competitive prices than other merchants (competitors) using entirely their own capital. This showed the role of financial intermediation and how banks could contribute to growth in trade.

Schumpeter (1911) also offered an early perspective on this debate by arguing that a well-developed financial system can facilitate technological innovation and economic growth through the provision of financial services. Today, it is obvious that even undeveloped financial systems are providing innovative financial services that are cost effective and capable of unlocking opportunities for the population.

Also, by the early twentieth century, Schumpeter (1934) had popularised the term “creative destruction” which was based on the argument that economic development could not take place on its own without an entrepreneur initiating innovative solutions to replace old technologies. This point could be well related to the role of Financial Technology (Fintech) companies in the present day, as they innovate solutions that ensure faster, cheaper, and more secure payments which appeal to their users so that old payment methods (like cheques and cash) are rapidly phased out with modern methods such as cards, Unstructured Supplementary Service Data (USSD), etc. Central to Schumpeter’s theory was the role of financial institutions that could create opportunities (financial and otherwise) that enabled the emergence of more efficient and cost-effective products and services leading to economic growth. Particularly, Schumpeter (1934) recognised the role of bank credits in economic growth.

The Neo-Classical Growth Theory was developed by the Harrod-Domar model of 1946 and extended by Solow (1956) and Swan (1956). Solow (1956) argued that economic growth is a factor of labour, capital, and technology. The theory explains that a temporary equilibrium can be achieved by varying the combination of those factors in an economy, thereby ignoring any

specific role that finance can have on economic growth. Overall, Solow (1956) maintained that only through technological innovations could economies develop.

The Neo-Classical theory was opposed by a body of theorists especially due to its failure to appreciate the role of financial intermediation in economic growth. The collection of these oppositions formed the Endogenous Growth Model, which holds that economic growth is determined by endogenous factors rather than external forces. This was further expatiated into those who consider economic growth to be significantly determined by investments in innovation, knowledge, and human capital and those who focus on externalities and positive spill-over effects that can lead to economic growth. Most importantly, the Endogenous Growth theorists appreciated the role of financial intermediation to economic growth (see Saint-Paul (1992) and King and Levine (1993)).

The Financial Repression Hypothesis was attributed to the works of McKinnon, and Shaw. They argued that, historically, most countries, especially developing ones, suppressed competition in their financial sectors through specific government interventions and regulations that have eventually led to low levels of growth. This was based on their belief that an uncompetitive financial sector leads to lower levels of savings and investments than a competitive market. McKinnon (1973) and Shaw (1974) argued that economies with efficient financial systems achieve growth and development through an efficient allocation of capital.

McKinnon (1973) and Shaw (1974) advanced the hypothesis of Schumpeter (1934) who argued that a well-developed financial system was capable of promoting innovation and economic growth through enabling financial services and resources to investment-ready entities. McKinnon (1973) and Shaw (1974), on the other hand, maintained that policies of financial repression adopted by poor countries in the 1970s were mostly associated with the misallocation of resources, interest ceilings, poor investments and inefficiencies. They argued that financial liberalisation to encourage savings and investments was strongly associated with the stimulation of economic growth. These arguments were later opposed by Philip Arestis, Nissanke, and Stein (2005), who believed that the views of McKinnon-Shaw were built on sketchy theoretical premises that led to several banking crises emanating from weak theoretical foundations.

Today, savings and investments are mostly facilitated through innovative Digital Financial Services (DFS), an offshoot of which is mobile money. Innovative solutions are developed by

FinTech firms that enhance user convenience, lower costs, and remove uncertainties in the way that savings, payments and investments were done in the past.¹² This has encouraged policy-makers to embark on promoting the adoption of DFS by wider segments of the population, especially those that are under-served. It is believed that a more inclusive economic growth would be attained when the wider population is financially included to access opportunities for savings, investments, insurance, pensions, and similar variables of financial inclusion.

In relation to the relationship between banks and economic growth, Boyd and Smith (1998) developed a framework in which equity and debt (credits) were shown to influence growth. The framework presented equity and debt as complements rather than substitutes, in financing investments for development which further validated the role of banks in providing an intermediation role in financial development and economic growth.

Four hypotheses—the supply-leading, demand-following, bi-directional, and no-causality—described the relationship between financial development and economic growth. The supply-leading hypothesis holds that financial market development leads to economic growth. Patrick (1966) emphasised the role of entrepreneurship at the creation of financial institutions and the provision of their services in advance of the demand for them. In a much later paper, Jung (1986) described the situation of supply-leading as depicting a financial mediation function where the resources from surplus spending units are channelled into financial markets for use by deficit spending units. This was in line with the an earlier description by Shaw (1974), particularly on the mediation role played by the financial market.

The second hypothesis, the demand-following, described financial development as a by-product of economic growth where an expanding economy stimulates the demand for financial services (Patrick, 1966). This means that, as the economy grows, financial services naturally follow suit. However, advocates of financial inclusion through Digital Financial Services disagree since they widely believe that a financial system must first develop for people to subscribe, save, access credit and invest which, in turn, could lead to economic growth.

¹² An example is the way mobile applications are now automating how Esusu/Adashi/Ajo/Stokfel/Roscas are managed.

Bi-directional causality pertains to the existence of a two-way relationship between finance and economic growth. Financial market development could lead to economic growth or economic growth occurs first, followed by financial development. Meanwhile, some proponents, such as Lucas (1988) and Ram (1999), believed that there was no causality between financial market development and economic growth.

2.4 Empirical Review of Mobile Money and Economic Growth

The debate on financial development and economic growth, in the field of development economics, has been a long one. Experts hold different, inconclusive views about the role of finance and economic growth. Although much literature and empirical studies about finance-economic growth exist, none specifically examined the relationship from the perspective of mobile money. Rather, several papers analysed the impact of variables such as stock market development, banking development, insurance market development and taxation on development, to mention but a few. This section reviews some of those empirical studies.

In a study by Pagano (1993), the supply-leading hypothesis was confirmed through evidence that financial intermediation, acting on savings and investments or on the social marginal productivity of investment, does affect economic growth. The study focused on financial aspects, labour, natural resources and products to assess relationship with economic growth. However, he admitted that little was known about how the development of different markets affects economic growth. This implies that more work to test the relationship from the perspective of different markets would be useful.

To further support the supply-leading hypothesis, an analysis of the effect of foreign direct investments (FDI) on economic growth was done on 66 countries, including Nigeria. The study, conducted by Hermes and Lensink (2003), found strong evidence of a positive relationship between FDI and economic growth but only when the financial systems in recipient countries were fully developed to absorb capacity. This implies that, where capacity for absorption was absent or weak, the relationship might not be positive. The study further detailed that most countries with developed financial systems from the sample showed a positive relationship between FDI and economic growth while those with weaker financial institutions revealed no relationship between the two variables examined. The study established therefore that, as a pre-condition for FDI to have any meaningful impact, a developed domestic financial system was necessary, indirectly, asserting the relevance of the

supply-leading hypothesis. These findings were affirmed in another study by Akinlo (2004) who found an insignificant relationship between FDI and economic growth in Nigeria which might relate to the nascent state of the development levels of Nigeria's financial system at the time of the research.

Employing a different approach by using panel unit root and cointegration tests, Christopoulos and Tsionas (2004) found out that long run causality moved from financial development to economic growth. The results also established that a short-term relationship was absent, thereby implying that policies aimed at improving financial markets would appear to have a delayed effect on economic growth at the first instance but would eventually result in positive effects in the long run.

In a more recent study testing the insurance market, Alhassan and Biekpe (2016) used between 17 and 21 years annual time-series data to test the causal relationship between insurance and economic growth in eight sub-Saharan African countries. The results indicated a long-term relationship between insurance market activities and economic growth for all the countries, except for Morocco and Gabon, which had bi-directional and mixed-causality relationships respectively. This showed that, even for Morocco and Gabon, the causality still existed but in a different form.

Employing a broader aspect of banking service as proxy for financial development, Furqani and Mulyany (2009) studied the long run relationship between Islamic banking and the economic growth of Malaysia using the Cointegration test and the Vector Error Correction Model (VECM). The researchers found a short-run evidence of fixed investment granger-causing Islamic banking to develop a long run bi-directional relationship between Islamic banking and fixed investment. Evidence supporting the "demand following" hypothesis was established where an increase in the Malaysian GDP resulted in the development of Islamic banking, but not the other way around. This conclusion is further supported by the findings of Galindo and Micco (2004), who ascertained that state-owned banks did not significantly contribute to the development of industries that relied on external finance or those with less satisfactory collaterals to pledge and obtain loans from banks for expansion.

A study by Arestis and Demetriades (1997) used both cross-country and time series regression by averaging the long term variables, then using them for cross-section regressions in order to understand relationships in the countries studied. The outcome found that there was abundant

evidence of reverse causality, i.e., real GDP, positively contributing to the banking system. These findings also confirm reverse-causality or a “demand-following” hypothesis, where GDP is reversely affecting financial development.

Investigating an international evidence on the causal relationship between financial development and economic growth, Jung (2013) used the annual data of 56 countries, of which 19 were industrial, to study the existence and characterisation of causality and its temporal behaviour. The results indicated support for bi-directional causality where both financial development and economic growth influenced one another. This was similar to findings from a study by Calderón and Liu (2003) on 109 industrial and developing countries to establish the direction of causality between finance and growth. The study tested data from 1960 to 1994 and found that the Granger Causality from financial development to economic growth and vice versa, co-existed.

Wood (1993) studied the relationship between financial development and economic growth using the broad money (ratio of M2/GDP) and GDP of Barbados as respective proxies. The author employed data from 1946 to 1990 but split the study into two in order to reflect the period when the Barbadian economy was heavily supported by its agricultural sector and the period when the economy was majorly financed by the manufacturing and services sectors. Both sample periods indicated a supply-leading pattern of causality, but also with considerable evidence of demand-following causality. These findings are in line with the bi-directional perspective, where the variables affect each other. The findings therefore found evidence that supported the research objectives and established justifications for the policy of establishing and promoting financial institutions in Barbados.

In a similar study, Greenwood (2009) observed that financial intermediation promotes growth through allowing a higher rate of return to be earned on capital, while growth, in turn, provides the means to implement costly financial structures. The study therefore concluded that the extent of financial intermediation and the rate of economic growth are endogenously determined. This is another validation of the bi-directional approach where both financial development and economic growth affect each other in either direction. This is also in line with the findings of Akinboade (1998), who studied the relationship between the financial development and economic growth of Botswana between 1972 and 1995, and found a bi-directional relationship.

In a study on financial development and economic growth in Nigeria, Ndako (2010) employed annual time series data from 1960 to 2005 to ascertain the link between finance and growth using the Multivariate Vector Autoregressive (VAR) technique. The empirical evidence obtained suggested a unidirectional relationship from financial development to economic growth, when bank credit to private sector was used, but bi-directional when domestic credit to private sector and bank deposit liabilities were used as proxies for financial development. This study supported the supply-leading hypothesis in the context of Nigeria.

In a later study, Ndako (2017) introduced the effect of investment in the studies of financial development and economic growth of Nigeria using standard Vector Autoregression (VAR) framework. The study, after accounting for structural breaks, established a long-term relationship between financial development, investment and growth. The conclusion based on these findings, which was similar to the position of King and Levine (1993), maintained that investment is a key channel that influences economic growth through financial development. It is therefore important to factor the effects of investment in studying finance-growth relationships.

In a similar research studying the impact of finance on investment and that of investment on the economic growth of Nigerian economy, Okorie (2014) found that total domestic investment of Nigeria in the long run had a positive impact on Nigeria's economic growth, but cautioned that the level of savings in Nigeria was not sufficient to match the investment opportunities in the short run. What was relevant from this study was that the supply-leading hypothesis had further been substantiated.

Marwa and Zhanje (2015) introduced a shift in understanding the theory of finance-growth nexus by integrating the role of development finance in the connection. The study argued that, while finance played a critical role in economic growth, using conventional methods might underestimate the role that finance played on economic development, especially in less-developed countries. Therefore, a model was developed which categorised standard finance enterprises into one group and development finance enterprises into another. This, according to Marwa and Zhanje (2015), would provide more accurate results.

In establishing the relationship between the Financial Development Index (FDI) and economic growth in the Indian context, Hye (2011) used Augmented Dickey-Fuller, Phillips Perron and Ng Perron unit root tests to determine the level of integration while an Auto-Regressive

Distributed Lag approach to cointegration and a rolling window approach to estimate the coefficient of each observation were used to obtain the long and short-run dynamics. Evidence from this study indicated that a long-run relationship was present among the economic growth, FDI, real interest rate, labour force and capital. FDI, however, was negatively associated with economic growth, and real interest rate also negatively determined the economic growth only in the long run. The study found evidence in both supply-leading and no-causality hypotheses of finance and growth.

On the other hand, results of a study conducted by Lucas (1988) belonged to the no-causality school of thought by finding no relationship between finance and growth. Should a no-causality situation occur in a context of mobile money payments/GDP, it would imply that each variable is independent of the other and increase or otherwise in one would have no influence whatsoever to the other. However, the link for causality or no-causality cannot be determined at this stage of the current research.

Similarly, Ram (1999), having studied 95 individual countries with the aim of finding the link between finance and growth, found negligible or weakly negative covariation between the growth of financial development and real GDP per capita. The study also found that the average individual-country correlation had a sharp contrast to the cross-country correlation between the same variables that indicates that the cross-country estimates, which have been used in most studies, might be spurious. Therefore, Ram (1999) concluded that there was no causal relationship between financial development and growth as suggested by previous studies, and argued that future research on the topic should lay more focus on individual country studies. However, even in an individual country study focusing on Nigeria, Akinlo (2004) established a negative relationship between financial development and economic growth using M2 and GDP as respective proxies.

Furthermore, Galindo and Micco (2003) took a rather different approach by attempting to study the link between state-owned banks and economic growth using data from 33 countries. The selection of state-owned banks, rather than privately-owned, was to test the belief that state intervention was very effective at channelling resources to productive areas. However, contrary to this long-held belief, the results of the empirical study found no evidence of state-owned banks contributing to growth rates of manufacturing industries. This was attributed to the fact that state-owned interventions were often influenced by political motives rather than economic

viability. The study also discovered that privately-owned banks were more efficient at channelling funds to sectors that would later exhibit growth. The Nigerian mobile money companies being studied are entirely privately-owned and therefore, likely to have these attributes.

Attempting to re-assess the finance-growth relationship, Harris (1997) studied the empirical relationship between stock markets and economic growth using current, rather than lagged investment, and adopting two stage least squares to circumvent possible endogeneity in current investment. The results indicated substantially weak evidence to support the existence of a relationship between stock market development and economic growth. This is consistent with the findings of Galindo and Micco (2003) who studied the role of state-owned banks in promoting growth of manufacturing industries.

To this end, it is clear that the debate between financial development and economic growth is inconclusive because various studies found various evidences, that confirmed at least one of the four major hypotheses. What is important is to continue to test the nexus using different variables and methodologies until reasonable comfort is achieved. The adoption of mobile money to serve as a variable to re-test the long-term debate is being utilised in this study.

2.5 Chapter Summary

This chapter gave an overview of mobile money in Nigeria, making a distinction between the bank-led and TELCO-led models. The trend of transactions in Nigeria was presented under Figure 1, showing a rising trajectory in both the volume and value over a 7-year period. The concept of agent networks was introduced, enumerating the roles that mobile payment agents have in providing the reach to communities where the mobile money services are most needed, thereby promoting financial inclusion.

The chapter also presented a conceptual framework where hypotheses (supply-leading, demand-following, bi-directional, and no-causality) around finance-growth debate were highlighted and discussed. In the same vein, empirical studies testing those theories were reviewed and a synthesis of different views was made. It was clear from the empirical studies reviewed that there had not been any study conducted to ascertain the nature of the relationship and causality pattern between mobile money aspect of financial markets and economic growth in the context of Nigeria. This study is therefore, the first of its kind to fill that gap and contribute original knowledge in that regard.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter presents the techniques adopted in evaluating the relationship between mobile money development and economic growth. It states the econometric methodology employed, data employed, data sources, period covered, the frequency of the data and the regression equation. In addition, the sampling method, sample size, and unit of analysis are stated. Also presented in this chapter are the justifications for variables employed, methods adopted in the analysis of the collected data, and the estimation technique adopted.

3.1 Research Design

A quantitative research method was adopted to study the link between the mobile money development and economic growth in Nigeria. Obadan (2012) describes quantitative research as a study, based on a social phenomenon that can be measured and expressed numerically. Some of the advantages of quantitative research include its usefulness for the analysis and explanation of causal dependencies among social phenomena, and it is fast and generally inexpensive. One of its shortcomings is the fact that it often requires complex statistical analysis and scientists do not always have the expertise of statisticians in such analysis (Obadan, 2012). This challenge was ameliorated by the researcher through capacity improvement in statistical analysis and in using the EViews statistical package, which was a very useful software that assisted in the time series econometric analyses of this research.

In terms of data measurement, it was determined that mobile money development and economic growth could be measured using data relating to the volume of transactions and real GDP respectively. Gross Fixed Capital Formation, representing investment, would be used as control. The data for mobile money (volume of transactions) would be extracted from a statistics database from the website of the Central Bank of Nigeria while macroeconomic variables would be sourced from the Nigerian National Bureau of Statistics' (NBS) website. Nigeria's quarterly Gross Fixed Capital Formation was also sourced from the website of Nigerian National Bureau of Statistics.

3.2 Sample Size and Data Period

A quarterly volume of mobile payments was used as proxy for mobile money development while the quarterly real GDP of Nigeria¹³ served as the proxy for economic growth. This approach is somewhat different from what had been traditionally used as proxy for financial development in various past studies. For example, Goldsmith (1969) recognised the use of the ratio of the value of financial intermediary assets to GDP, King and Levine (1993), and Levine (1997) used variables like the ratio of liquid liability to GDP, private sector credit to GDP and the level of stock market turnover. Also, Rajan and Zingales (1998, as cited in Zingales (2003)) used a measure as unique as “the quality of accounting standards” to represent financial development.

This study considers it important to assess the contentious relationship between finance and growth from a different perspective in order to avoid the risk of arriving at the same results by using similar variables that were used in past studies. This position was supported by the findings of a study by Adu, Marbuah, and Mensah (2013) where it was established that the growth effect of financial development on economic growth was sensitive to the choice of proxy used. It was argued that it was not uncommon to find a positive relationship using private sector credit as ratio to GDP, then to find a negative or not-growth-inducing relationship when broad money stock ratio to GDP is used. For instance, Ndako (2010a) established a unidirectional relationship between economic growth and financial development when bank credit to private sector was used as proxy for financial development. However, adopting liquid liabilities, a bi-directional relationship was found for the same country. The same study also found a bi-directional link between finance and growth in South Africa using the banking system while the results turned to a uni-directional link from economic growth to stock market when South African stock market variables were used. This re-affirms the fact that the choice of proxy in finance-growth studies has a significant effect on the nature of the relationship that could be found.

¹³ Nigeria is the unit of analysis, considering that aggregated data of its mobile money transactions was used in the study.

The period employed was from Q12010 to Q42016, taking into consideration the availability of both mobile payments¹⁴ data, quarterly Gross Fixed Capital Formation and the corresponding quarterly real GDP data. The mobile payments data, being a flow data available on monthly basis, was adjusted to quarterly, for consistency with the other variables.

3.3 Analytical Framework

A quantitative method of research was adopted which, as noted by Obadan (2012), employs deductive logic that allows the researcher to start with a hypothesis, then to employ data to confirm or refute the hypothesis. The advantage of a quantitative research design includes simplicity, objectivity and that it is inexpensive (Obadan, 2012). This is more so when compared with a qualitative research approach. Conversely, a quantitative research method often requires econometric analyses that are so extensive that not all researchers possess the requisite know-how; however, the availability of statistical software has reduced the impact of this challenge. To this end, this study utilised EViews software for its data analysis.

The Auto-Regressive Distributed Lags (ARDL) bounds approach to cointegration was employed on a quarterly time-series data from Q12010 to Q42016 to test the causal relationship between mobile money and economic growth in Nigeria. It had been established that using time series data to test finance-growth causal relationships was more fruitful than the cross-sectional method which has been more commonly used in recent studies (P Arestis & Demetriades, 1997). This informed the choice to use time series data for the study.

However, Asteriou and Hall (2007) observed that time series data might be more difficult to analyse than cross-sectional data since economic observations are usually dependent across time and are closely related to their recent histories. Therefore, careful steps were taken to specify an appropriate econometric model to counteract that concern in this study.

3.4 Model Specification

The model adopted for the research is specified as follows:

$$GDP_t = \beta_0 + \beta_1 mmpayment_t + \beta_2 fcapital_t + \varepsilon_t \dots\dots\dots (1)$$

¹⁴Mobile money was introduced in Nigeria around mid-2009 therefore full yearly data were only available as from 2010.

$$t. \varepsilon_{it} \sim i.i.d(0, \sigma_{\varepsilon}^2) \text{ and } \text{cov}(\varepsilon_y, \varepsilon_z) = 0$$

where GDP_t denoted gross domestic product in period t ; $mmpayment_t$ represented the volume of mobile money payment transactions in period t and $fcapital_t$ was gross fixed capital formation in period t .

3.4.1 Measurement of Variables

Gross Domestic Product (GDP)

Real Gross Domestic Product figures were taken on a quarterly basis, to represent the aggregate demand in Nigeria's economy. It was presented as the dependent variable in ascertaining the impact of mobile money development on economic growth. GDP is a popular proxy for economic growth in Finance-Growth studies. Its adoption had featured in several studies, such as Alhassan and Biekpe (2016), Okorie (2014), Ram (1999), Kiprop, Kalio, Kibet, and Kiprop (2015), Ndako (2010), and Ndako (2017), thus providing a solid justification for its use in this study.

Mobile Money Payments

The volume of mobile payment transactions was taken as proxy for mobile money development in Nigeria. The "volume" is a better indicator for the adoption or penetration of the channel for payments than "value" because a single non-recurrent high value transaction could influence a data set within a period, and therefore, might be less indicative of growth in mobile payment transactions. Mobile money offers opportunities for simplified payments and, in most instances, for savings, credit, and investments among others. However, there were no known studies in the past that adopted mobile payments as proxy for financial development. This study is the first of its kind in the context of Nigeria. The choice of volume of mobile money transactions as a proxy for financial development was made considering that there was no consensus by scholars on the best proxy for the measurement of financial development. Introducing a fresh proxy therefore will present an opportunity to revalidate if results that were consistent with past studies could be achieved, using the different proxy.

Investments

The Gross Fixed Capital Formation was employed as proxy for investments in Nigeria. The

data, obtained from the NBS, was used for control purposes in the adopted model. This implied that the variable would not experience the same conditions with the other variables used in the study.

According to Gill and Johnson (2010), a dependent variable is the phenomenon whose variation the researcher is trying to understand, while an independent variable is a phenomenon whose variation notionally explain the changes in the dependent variable. As described earlier, for this research, GDP served as the dependent variable, mobile money payments as independent variable, while investment served as a control.

3.5 Estimation technique

The least square method of estimating regression model and the ARDL bounds test were adopted to model the relevant variables. Diagnostics tests, such as Lagrangerian multiple autocorrelation test, Heteroscedascity test and Cholesky impulse response test, were carried out.

3.5.1 Unit root test

A time series data is often considered stationary, although this could not be reasonably assumed without a test to affirm that or reject it. Therefore, in this study, a unit root test was conducted to ascertain stationarity.

The first part in the identification process was to investigate the stationarity level to decide the integration order d . This was done with the Augmented Dickey-Fuller (ADF) tests and is described in the following section.

3.5.2 The ADF test

The Augmented Dickey-Fuller (ADF) test was used to test the null hypothesis of a unit root against the alternative of stationarity (i.e., no unit root) and was based on the following model of Banerjee, Dolado, Galbraith, and Hendry (1993):

$$\Delta y_t = \alpha + \beta_t + (\rho - 1)y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \dots\dots\dots(2)$$

where α is a constant, β the coefficient of a simple time trend, ρ is the parameter of interest, Δ is the first difference operator, δ_1 to δ_{p-1} are parameters of p , the lag order of the autoregressive process. The lagged differenced variables were included to account for possible serial

correlation that would otherwise appear in the error term ε_t , which was assumed to be approximately a white noise process (Banerjee et al., 1993).

What is tested is the null hypothesis of a unit root, that is, $\rho = 1$ against the alternative hypothesis of stationarity that is $|\rho| < 1$. The test statistic that is used is based on the t equivalent statistic by Dickey and Fuller (1979).

$$DF_{\tau} = \frac{\rho - 1}{SE(\rho)}$$

The estimated value of the test statistic is compared to the value of t critical value of the Dickey-Fuller test (Banerjee et al., 1993).

3.5.3 Cointegration and Long run estimates

If two or more time series are individually integrated but residuals of their linear combination have a lower order of integration, then the series are said to be cointegrated. This implies a long run equilibrium relationship that connects the individual variables, represented by some linear combination of them, by testing the residuals for stationarity (Engle & Granger, 1987). In other words, the existence of cointegration implies a long-term relationship. This was affirmed by Sultan (2010) who stated that the existence of cointegration will indicate the existence of a stable long term relationship among the variables, where the means and variances remain stable regardless of time. To test for cointegration among the variables in the long run, various cointegration tests were used, such as the Johansen (1988) method, and the two-step approach of Engle and Granger (1987). One of the advantages of the Johansen method was that it allowed for the estimation of multiple cointegrating vectors where they exist (Sultan, 2010). However, its application presupposed that the underlying regressors were all integrated of order one which may lead to erroneous inferences.

Pesaran, Shin, and Smith (2001) developed a new ARDL bounds testing approach for testing the existence of a cointegration relationship that is applicable irrespective of whether the underlying series are I(0) or I(1). The desirable properties of the ARDL bounds test is that it is used for small sample sizes and provides an alternative test for examining a long-run relationship regardless of whether the underlying variables have a unit root. Also, by applying the ARDL technique, unbiased estimates of the long-run model can be obtained.

In promoting the choice of cointegration test, Ahmed, Muzib, and Roy (2013) found that the ARDL bounds test can distinguish the dependent and independent variables producing an unbiased and efficient analysis, by avoiding serial correlation and endogeneity problems that may arise.

$$D(GDP_t) = \beta_{01} + \beta_{11}(GDP_{t-1}) + \beta_{21}(mpayment_{t-1}) + \beta_{31}(fcapital_{t-1}) + \sum_{i=0}^p \alpha_{1i} D(GDP_{t-1}) + \sum_{i=0}^q \alpha_{2i} D(mpayment_{t-1}) + \sum_{i=0}^q \alpha_{3i} D(fcapital_{t-1}) + \varepsilon_{1t} \dots \quad (3)$$

The null hypothesis tested whether a long-term relationship exists. A comparison between the estimated F-statistic (F-stat) and the lower and upper bounds critical values (CV) forms the basis for either confirming or rejecting the hypothesis. The critical values are estimated for 1%, 5% and 10% level of significance. The hypotheses are denoted as follows:

- H₀: no long-run relationship exists, i.e. F-stat < CV;
- H₁: long-run relationship exists, i.e. F-stat ≥ CV

3.5.4 Short run Error Correction model

The ECM (Error Correction Mechanism) version of modified ARDL is used to investigate the short run dynamic relationships. This will be done through the ECM applied through the Ordinary Least Square (OLS) method. Nkoro and Uko (2016) indicated that the ARDL framework allows for the determination of short run dynamics and long run relationships. This is achieved through integrating short run dynamics with long run equilibrium, thus resulting in an analysis of long run relationships between integrated variables and reparametrising the relationship between the variables into an error correction model (ECM). To obtain error correction estimates associated with the long-run equilibrium model, the studies adopted by Belloumi (2014), Nkoro and Uko (2016), and Alhassan and Fiador (2014) for error correction model type were all on the same path and is stated below:

$$D(GDP_t) = \beta_0 + \beta_1 D(GDP_{t-1}) + \beta_2 D(mpayment)_{t-1} + \beta_3 D(fcapital)_{t-1} + \delta ECT_{t-1} + \varepsilon_t \dots \dots \dots (4)$$

Where ECT_{t-1} is the error correction.

3.5.5 Causality Analysis

In addition to ascertaining whether a link exists between mobile money development and economic growth, it was also an objective of this research to establish the nature of causality

between the two variables.

According to Koop (2013), correlation between two or more variables does not imply causality but might be very suggestive of it. In other words, the thinking behind the methodology adopted in the context of this study, was that even if it was established that mobile money and economic growth were correlated, further tests would still be conducted to ascertain if causality existed.

Thus, the Granger Causality tests developed by Granger (1969) which is used on time series variables to test how past events could granger-cause current events, was employed. It was used to test the null hypothesis with the aim of ascertaining if causality existed between mobile money and economic growth.

Consequently, null and alternative hypotheses were tested accordingly, based on the dependent variable, GDP, and independent variable, MMPayment (Mobile Money Payments). Normally, a time series X is said to Granger-cause Y if it can be shown, usually through a series of t -tests and F -tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y . The granger causality model is given below:

$$GDP_t = \sum_{i=1}^n \alpha_i mpayment_{t-i} + \sum_{j=1}^n \beta_j GDP_{t-j} + \varepsilon_{1t} \dots \dots \dots (5)$$

$$mpayment_t = \sum_{i=1}^n \lambda_i mpayment_{t-i} + \sum_{j=1}^n \delta_j GDP_{t-j} + \varepsilon_{2t} \dots \dots \dots (6)$$

Therefore, in testing causality in this study Granger causality was adopted in testing hypotheses:

GDP causes Mobile money payments or Mobile money payments cause GDP;

GDP causes Fixed Capital Formation or Fixed Capital Formation causes GDP;

Mobile money payments cause Fixed Capital Formation or Fixed Capital Formation causes Mobile money payments;

The direction can be unidirectional (one way) or bi-directional (both ways).

CHAPTER FOUR: DISCUSSION OF FINDINGS

4.0 Introduction

This chapter focuses on the analysis of data, statistical techniques and the regression modelling strategy. The modelling strategy discussed in Chapter Three is referred to in the process of analysis and the subsequent result will be discussed and interpreted.

4.1 Descriptive Statistics

The mean of GDP is 19,788,472, with 0.15 coefficient skewness and standard deviation of 4,315,782, indicating less responsiveness to influences when compared with the standard deviation of mobile money payments which was higher. The mean of mobile payment is 5,109,252 and standard deviation of 4,831,242 with 0.495 coefficient skewness. The standard deviation of mobile payments was the highest among the variables indicating that the degree of variability in periodic change was high. The mean of fixed capital formation is 2,374,552 and standard deviation 2,685,157. All variables follow normal distribution with non-significant Jarque-Bera value.

Table 2: Statistics of the Variables

| Variables | GDP (Naira, millions) | MMPAYMENT (Number) | FCAPITAL (Naira, millions) |
|--------------|--------------------------|-----------------------|-------------------------------|
| Mean | 19,788,472 | 5,109,252 | 2,374,552 |
| Median | 20,050,397 | 4,205,193 | 2,355,061 |
| Maximum | 29,169,059 | 14,092,005 | 2,873,296 |
| Minimum | 12,583,478 | 170,458 | 1,909,818 |
| Std. Dev | 4,315,782 | 4,831,242 | 2,685,157 |
| Skewness | 0.155 | 0.495 | 0.257 |
| Kurtosis | 2.277 | 1.782 | 2.087 |
| Jarque-Bera | 0.722 | 2.872 | 1.279 |
| Prob. | 0.697 | 0.238 | 0.527 |
| Observations | 26 | 26 | 26 |

Furthermore, the Kurtosis of all the variables fell within the benchmark of 3 for standard normal distribution. Normally, the lower the value of Kurtosis, the flatter the peak when plotted. Mobile payments, having the lowest value amongst the variables in the table, will thus exhibit a flatter peak.

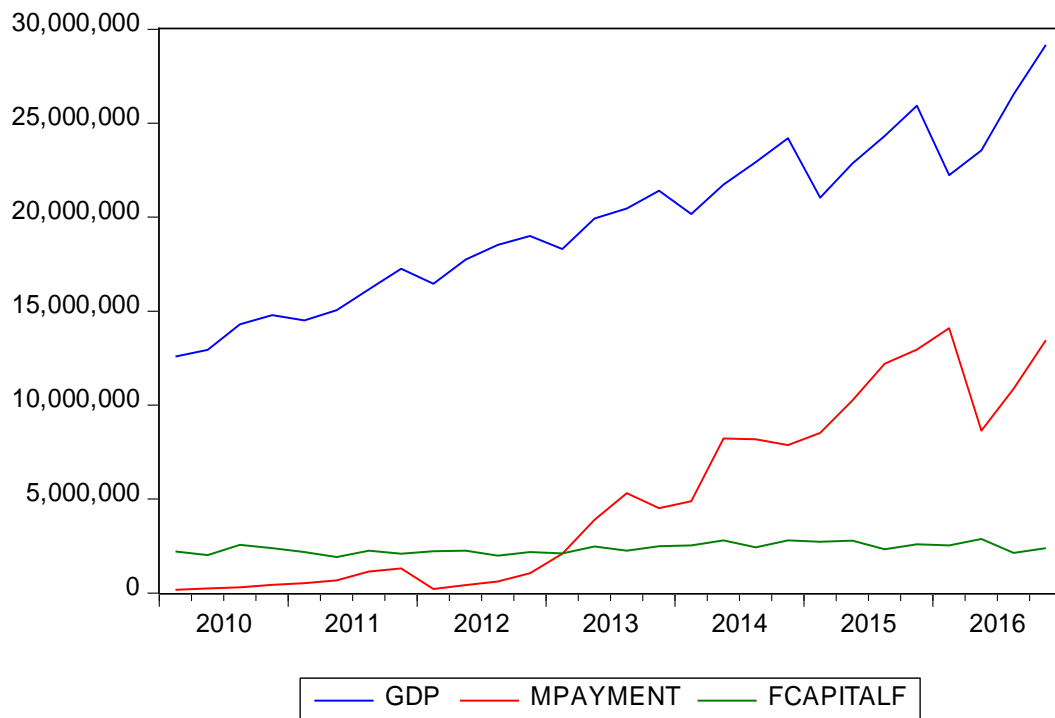


Figure 4: Time plot of mobile payments, GDP and gross fixed capital formation

The above graph depicts a steady increase in the economic growth (GDP) over the years with evidence of seasonal components. The use of mobile money payments began to move upward from the third quarter of 2012 which might be attributed to an increase in user awareness of the service in Nigeria, but later dropped in the second quarter of 2016 which may be as result of the economic recession faced by Nigeria around that period. There is an indication of an upward trend for the remaining parts of 2016. GFCF was affected by relatively minimal variations in the period under review.

4.2 Stationarity test

The seasonal pattern in the above graph revealed the evidence of non-stationarity in the data. Consequently, on the basis of graphical analysis and the Dickey-Fuller test, the conclusion is that, for the quarterly periods of 2010 to 2016, GDP, mobile money payments and fixed capital formation time series were nonstationary, i.e., they contained a unit root. Therefore, the data were differenced. After the first difference, the data were found to be stationary at 10%, 5%, and 1% using the Augmented Dickey-Fuller critical value.

Table 3: ADF tests

| | t-stat I(0) | t-stat I(1) | CV 10% | | CV5% | | CV1% | |
|-------------------------|-------------|-------------|--------|--------|-------|--------|--------|--------|
| | | | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| | | | -2.6 | -2.63 | -2.97 | -2.98 | -3.699 | -3.724 |
| MM payments | -0.338 | -4.76 | FTR | Reject | FTR | Reject | FTR | Reject |
| GDP | -2.25 | -19.44 | FTR | Reject | FTR | Reject | FTR | Reject |
| Fixed capital formation | -1.209 | -5.627 | FTR | Reject | FTR | Reject | FTR | Reject |

Note: CV = Critical Value at 6 lags; FTR – Fail to reject = unit root; Reject = no unit root.

4.2.1 ARDL Bounds Test

The ARDL bounds estimation tests the null hypothesis that no long-run relationship exists. From Table 4, it is observed that the estimated F-statistic is greater than the upper bounds critical values at conventional levels of significance at 1%, 5%, and 10%. This indicates the existence of a long run relationship between economic growth and mobile money.

Table 4: Bounds test result

| | f-statistic | CV 10% | | CV5% | | CV1% | |
|-------|-------------|--------|--------|--------|--------|--------|--------|
| | | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| model | 5.847 | Reject | Reject | Reject | Reject | Reject | Reject |

Note: CV = Critical Value at 6 lags; FTR – Fail to reject = no cointegration; Reject = cointegration

4.3 Regression Results

4.3.1 Long run estimates

The long-run estimates are shown in the table below. The mobile payment coefficient shows a positive relationship with GDP in the long run, i.e. with every million increase in mobile payment transactions resulting to an increase of 0.8 million Naira in GDP of Nigeria. The control variable, fixed capital formation seems not to have the similar significant impact on GDP in the long run.

Table 5: Long run coefficients

| variable | coefficient | Std.Error | t-statistic | prob. |
|------------|-------------|-----------|-------------|-----------|
| mm payment | 0.800878 | 0.095378 | 8.396871 | 0.000*** |
| fcapital | -0.296057 | 1.732124 | -0.17092 | 0.8657 |
| Constant | 16381364 | 3879027 | 4.22306 | 0.0003*** |

*Notes: *** denotes significance at 1%.*

4.3.2 Short run estimates and diagnostics

The result of the short run error correction terms was shown in Table 6. In the short run, a 1% increase in the volume of mobile payment reduces GDP by 0.03 million Naira. However, this seemed to have no impact in the short run. Fixed capital formation (investment) seemed to have a significantly positive relationship with GDP at 1% level of significance. The cointegration term, **CointEq(-1)**, is observed to be -0.177 and significant at 5%. This implies that about 17.7% of any movements into disequilibrium are corrected for within one period and suggests a slower speed of adjustment of disequilibrium correction in reaching long run equilibrium steady state position.

Table 6: Short run estimates and diagnostics

| | <i>Coefficients</i> | <i>t</i> | <i>p-value</i> |
|----------------|---------------------|----------|----------------|
| D(mm payment) | -0.03 | -0.19 | 0.85 |
| Fcapital | 2.15 | 3.49 | 0.003*** |
| cointEq(-1) | -0.177 | -2.6 | 0.02** |
| R ² | 0.51 | | |
| DW | 2.007 | | |

Notes: *** and ** denotes significance at 1% and 5% respectively.

4.4 Diagnostics

Residual serial correlation using Lagrange Multiplier (LM) test was not significant which implies that there was no serial correlation in the residuals of the model.

Table 7: Residual autocorrelation test

Breusch-Godfrey serial correlation LM Test: Null hypothesis: No serial correlation at up to 2 lags

| | | | |
|---------------|----------|--------------------|--------|
| F-statistic | 0.232752 | Prob.F(2,14) | 0.7954 |
| Obs*R-squared | 0.772327 | Prob.Chi-square(2) | 0.6797 |

4.5 CUSUM Tests

CUSUM tests were used to check if the parameters in the analysis were stable over time, among other basic tests performed in conjunction. The figure below is the plot for CUSUM tests where stability was indicated by the plot falling within the critical bands at the 5% level of significance. The results obtained indicated the absence of any instability of the coefficients.

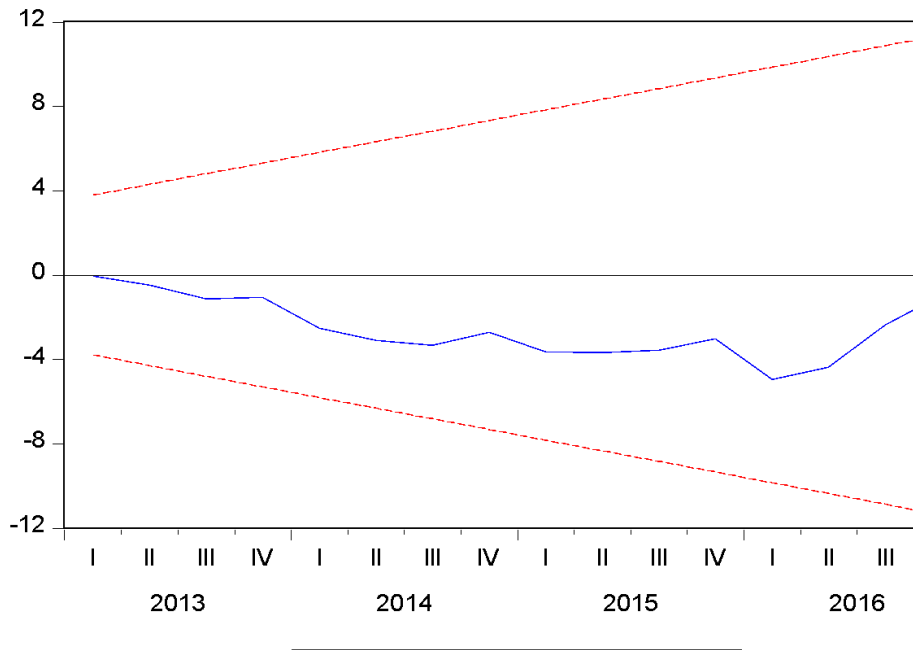


Figure 5: CUSUM Test

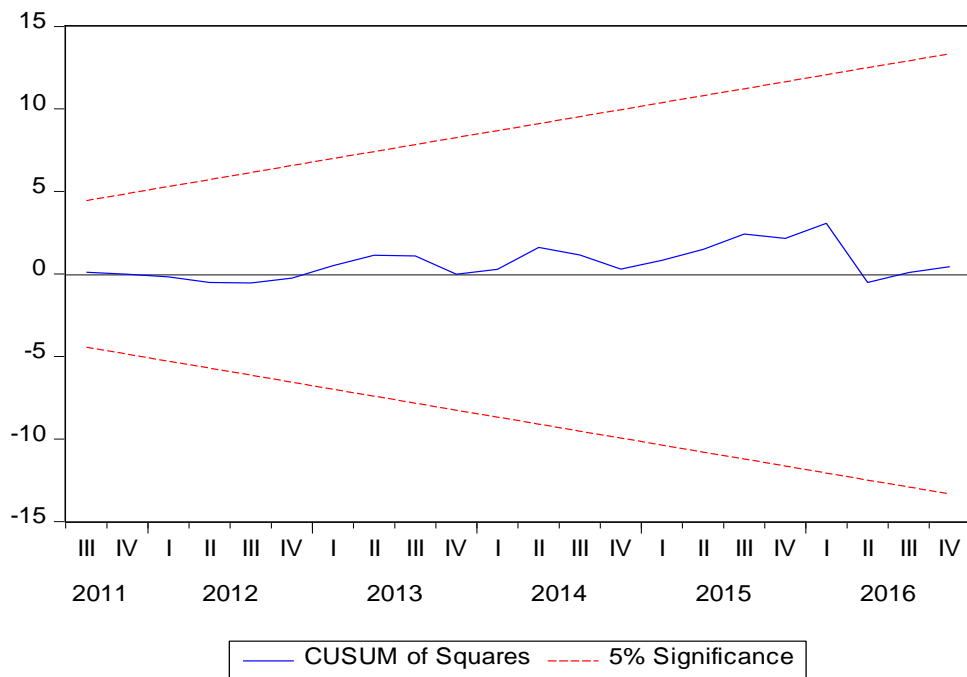


Figure 6: CUSUM OF SQUARES Test

4.6 Granger Causality Test

The Granger Causality Test, as developed by Granger (1969), showed that mobile payments and gross fixed capital formation do not cause GDP, conversely, GDP caused both mobile payment and fixed capital formation with ($p < 0.05$). The tests show a unilateral relationship in line with the demand-following hypothesis discussed under Chapter Two.

Table 8: Granger Causality Test Results

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|-----|-------------|----------|
| GDP does not Granger Cause MPAYMENT | 26 | 4.73023 | 0.0201** |
| MPAYMENT does not Granger Cause GDP | | 0.35006 | 0.7087 |
| FCAPITALF does not Granger Cause MPAYMENT | 26 | 0.63151 | 0.5416 |
| MPAYMENT does not Granger Cause FCAPITALF | | 1.91780 | 0.1718 |
| FCAPITALF does not Granger Cause GDP | 26 | 2.74993 | 0.0869* |
| GDP does not Granger Cause FCAPITALF | | 4.41621 | 0.0251** |

Notes: ** and * Denotes rejection of null hypothesis at 5% and 10% respectively.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter provides a summary and conclusion to this study. Based on the results obtained from the data analysis in Chapter Four, recommendations are made which would hopefully help further research and policy formulation in the future. Areas for future research that could add to the debate on the finance–growth nexus have been identified and suggested.

5.1 Summary of Key Findings

The study explored the link and nature of causality between mobile money, a component of financial markets, and economic growth - represented by GDP. This particular objective was partly inspired by four hypotheses in the field of economic development in respect of the finance–growth debate, as postulated by Patrick (1966), namely: supply-leading, demand-following, uni-directional and no-causality relationships.

Using the ARDL bounds tests techniques by Pesaran, Shin, and Smith (2001), ADF tests and causality tests developed by Granger (1969) and employing quarterly time series data of mobile money transactions and Nigeria's real GDP between Q12010 and Q42016, evidence of a long run relationship was established between mobile money and economic growth. The Granger Causality tests revealed that mobile money payments do not cause economic growth. Rather, economic growth showed a significant influence on (granger-caused) mobile money payments with probability results of less than 0.05. Thus, a unidirectional reverse-causality relationship from real GDP to mobile payments validating the demand-following hypothesis, was established. The findings, in the context of this study, signify that, if the real economy of Nigeria should continue growing, in the long run, the demand for mobile money services would naturally follow which will translate to the development of the service in the long run. As the demand for mobile money service grows, proliferation of mobile money agents would be expected, the volume of transactions would increase, and innovative mobile financial products would emerge. This will have far-reaching implications for employment generation, poverty alleviation and economic growth in Nigeria.

5.2 Recommendations

Following the results of this research, the following are recommendations for policy-makers, opinion formers and researchers:

- a. Considering that it has been established in this study that mobile money has a long-run relationship with economic growth, researchers with interest in the finance–growth debate should note these findings as further proof for the validity of the demand-following hypothesis.
- b. Based on the results of the causality tests, it is recommended that Nigeria, having reflected a uni-directional causality from GDP to mobile payments, should focus on policies that promote real economic growth in the economy. This would ultimately influence the mobile money market development especially having ascertained that, with each 0.8 million Naira increase in Nigeria’s GDP, a million increase in the volume of mobile money transaction occurred. However, a policy implication worth noting is that the effects of economic growth on mobile money development may have delayed effects considering that only a long-term relationship was established in this study.
- c. It is also recommended that further studies be conducted to ascertain growth-inducing sectors of the Nigerian economy for the focus of policy makers. Areas such as expansion in capacity in agriculture, trade, tourism and manufacturing sectors appear relevant, but could only be validated after further empirical studies have been conducted, to form a basis. If these segments grow, the economy will grow and demand for mobile money and related digital financial services would naturally follow.

5.3 Future Research Directions

As this work only studied the nature of the relationship between mobile money and economic growth in the context of Nigeria within a certain timeframe, it was constrained to extend its scope to certain important areas. Therefore, future studies may explore the following:

- a. Expand the scope of the study to sub-Saharan Africa and, if possible, using a more extended coverage period. A study affirming or rejecting the role of mobile money on economic growth will appropriately position policy makers and opinion formers to take the most relevant decisions that would bring about faster outcomes in terms of economic growth in sub-Saharan Africa.
- b. Explore the relationship between other electronic payment channels that are not necessarily mobile-based, such as ATM and Point of Sales (PoS) to economic growth considering that these channels are continuously becoming ubiquitous in day-to-day market offerings.

- c. A study introducing other variables into the equation, such as trade, technology and investments in mobile payments, will likely provide very useful information and interesting outcomes.
- d. Studying the factors/determinants of mobile money adoption in Nigeria and perhaps sub-Saharan Africa would be relevant and useful. This is in consideration of the fact that most countries in sub-Saharan Africa are at a stage of development that requires mobile money service to promote financial inclusion, and can in turn leverage their high mobile phone penetration to support mobile money adoption. It would therefore be important to ascertain the factors responsible for user and merchant adoption of the mobile money service in Nigeria.

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Appendix 1

List of Licensed Non-Bank Mobile Money Operators in Nigeria

1. Eartholeum
2. eTranzact
3. Fets Limited
4. MKudi Limited
5. Pagatech
6. Paycom
7. Cellulant
8. Teasy Mobile
9. VT Network
10. Zinternet
11. Hedonmark
12. Chams
13. Parkway

Appendix 2

List of Licensed Bank-led Mobile Money Operators in Nigeria

1. Ecobank
2. Fortis Mobile
3. GT Bank
4. Stanbic IBTC
5. Zenith Bank
6. Access Bank
7. Fidelity Bank
8. FBN Pridar Mobile
9. Sterling Bank