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Bank Technology Based Product on Economic Growth in Nigeria (2009 – 2018)

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Abstract: *This study examines the impact of bank technology-based product on economic growth in Nigeria over the period of 2009 – 2018 in a quarterly basis. Secondary data were collected from the CBN statistical Bulletin and the Nigerian Bureau of Statistics to establish the relationship between the dependent variable (Real GDP) and the independent variables (Automated Teller Machines, Point-of-Sale, Internet Banking and Mobile Banking). The research adopted the Vector Error Correction Model (VECM) and the results of the analysis show that bank technology-based product has significantly impacted on the economic growth of Nigeria. The VECM result shows that R2 is 0.5897, which shows that the model explains about 58.97% of the total variations in Economic growth as explained by the independent variables during the period of the study, while 41.03% is explained by variables not included in the model. The study recommends that banks should expand and improve on their electronic services in a planned and well-articulated strategy for the long run, to have more positive impact on economic growth.*

Keyword: *Banking, economic growth, ICT, electronic payment*

CHAPTER ONE

1.0 Introduction

1.1 Background of the Study

Technology, in the 21st century has become widespread and its effect inevitable. An outstanding development in the industry is the adaption of information and communication technologies (ICT) in rendering banking goods and services. Example of bank ICT- based products include automated teller machine (ATMs) transactions, point of sale (POS) system, mobile banking system and

internet banking system, among others, which forms the bases of technology base product in banking system in Nigeria.

Technology base product in banking system has been described as the 3rd of the great ages of payment, the first ages funds transfer was through payment by cash (notes and coins) and the second ages of fund transfer was through paper based payments (for instance, cheques). It is not only beneficial to financial institutions because it can speed up processing of transactions, decrease cost, and help to draw and retain customers, but also to customers, as they can save time and money and maybe more convenient than usual ways of banking.

Electronic banking started far back in the 1980s; the revolution took place throughout the 20th century and flourished even more in the 21st century with the development in the internet, the trend shifting towards use of internet as a medium, to electronically perform the transactions for both customers and banks. Since then, an inspiring number of innovative electronic banking systems have been developed and tested commercially.

According to john Csiszar (2019), new technology in banking is already transforming the financial sector in the western world Nigeria inclusive, and the traditional banking landscape is gradually been replace by the new technology with a safety features, such as advanced cryptography and biometrics, will help to protect against banks scams, and remote applications will make it easier than ever to do your banking without visiting a branch but if you do, the experience is likely to be much more customer friendly.

Banking sectors in most developed countries have pioneered the area of electronic banking services and have been actively involved in its constant improvement. The aim was to try to meet the ever-changing needs and lifestyles of modern clients. The Nigeria banking sector, central part of the Nigeria economy, has been witnessing extraordinary growth, especially about electronic services (Fakhoury &Aubert, 2015).

Technology base product gives a greater opportunity to financial sector to have significant cost advantages, increasing in profitability and facilitate lower risk than traditional banking products. In addition, studies shows that if there is an enough customer demand the technology base product of the bank there will be the return of investment on this field in short time. (Akhisar et al, 2015).

Empirical studies made on various countries, reveals that electronic banking services improve the performance of banks. However, the expected results are

not seen in some less developed and developing countries because of infrastructure investment could not do enough and customers prefer traditional branch-based banking.

The significance of ICTs in economic growth and development resulted from the fast growth of these technologies and their market in the nineties. The world's developed and developing countries started immensely to harness ICT for economic growth and sustainable development (Hodrab et al., 2016).

Recently, ICT is believed to foster sustainable long-term growth as a production technology through carefully designed ICT systems (Alani, 2012). The principal function of ICT is in enabling humans, governments, and organizations to transform information into knowledge as a strong driver in evolving lasting change in the economy and society (Kim, 2013; Lyon, 2013).

A survey carried out by the International Telecommunication Union (ITU, 2016) states that Nigeria has high population density, and the sector of wires and wireless communication is considered as the main sector that creates job positions especially the mobile phone sector. Furthermore, in September 2018, a survey carried out by the Nigerian Communication Commission (NCC) revealed that the contribution of the Telecoms Industry to GDP was rated 7.7% in 2012 as against 10.43% in the second quarter of 2018 (NCC, 2018). This shows a relatively contribution of the telecoms industry to GDP resulting to economic growth. Furthermore, the Executive Vice Chairman of NCC, Prof Umar Dambatta of Nigeria revealed that the ICT sector contributed N500 billion to the Nigerian economy in 2014 and created about 2.5 million jobs in 10 years and attracted $30 billion foreign investment between 2003 to 2014 (Vanguard, 2016). The revolution of ICT in developing countries is expanding and spreading giving the hope for these countries to achieve technological advances that contribute to advancing and developing their economies (Zwass, 2003). Nigeria not being an exception has benefitted from ICT in the areas of banking, fight against terrorism, e-governance, and human resource development. Nigeria being a developing country needs radical change in governance and this can only be achieved by reengineering existing governance processes with the help of ICT. The uses of ICT can lead the nation to overall economic growth/development. Nigeria's ICT sector recorded a 10.32% growth in Q1 2023 as an indicator of the positive impact of ICT on the Nigerian economy. According to a report by Nairametrics1, the ICT sector contributed 17.47% to Nigeria's real GDP in Q1 2023, showing an increase from the previous year. The growth was driven largely by activities in the telecommunications sub-sector,

which contributed 14.13% to the real GDP1. A paper by Alani (2012) states that the principal function of ICT is in enabling humans, governments, and organizations to transform information into knowledge as a strong driver in evolving lasting change in the economy and society. This is evident in the remarkable growth rate of 41.84% that the ICT sector recorded in nominal terms in the first quarter of 2023.

The Nigerian Bureau of Statistics (NBS) reveals that the ICT sector accounted for 13.23% of Nigeria's total GDP, amounting to ₦3.1 trillion ($6.7 billion) in the first quarter of 2023. This marks a notable increase from the 10.55% ($6.2 billion) recorded in the first quarter of 2022

1.2 Statement of the problem

Firstly, the issue of continuous damaged system and unpredictable internet failure. This has negatively impacted banks' operation and affected their efficiency and profitability. Similarly, banks are often faced with system redundancy due to rapid technological changes resulting to undue costs hence causes lower profitability.

Again, the issue of insecurity and lack of privacy have imposed more problems to electronic banking system in banks and also the activities of hackers is another problem standing against the banks from getting the full benefits offered by electronic banking.

These could lead to financial and capital losses due to erroneous processing of transactions, data privacy and confidentiality, unauthorized access or infringement to financial institutions systems and transaction, which will in turn, cause them heavy losses on their profitability and overall performance of the system.

Also, the banks due receive complaints from customers as regards, malfunctioning Automated Teller Machines (ATMs), network downtime, online thievery, and fraud, non-availability of financial service, payment of hidden cost of electronic banking imposed by banks to their customers.

Electronic banking was employed by banks to advance their service rendered, reduced queues in the banking hall, increase customers withdraw cash 24/7, improve international payment, track personal banking transaction, demand for online statement, or even make deposit to a third-party accounting all that

there are obstacle working against both banks and their customers in Nigeria from enjoying electronic banking benefit.

Hence, this research work tends to look at the problems and profound likely solutions of bank technology-based products issues viza-viz Nigerian economic growth.

1.3 Objective of the study

The general objective of this study is to examine the impact of bank technology-based product on Nigerian economic growth. The specific objectives therefore include:

1. To determine the effect of automated teller machine (ATMs) on the Nigerian economic growth.
2. To examine the effect of point of sales (POS) on the Nigerian economic growth.
3. To investigate the effect of mobile banking system on the Nigerian economic growth.
4. To determine the effect of internet banking on the Nigerian economic growth.

1.4 Research Questions

To achieve the objectives mentioned above, the following research questions have been identified and considered adequate for this research work and shall aid in carry out this assignment.

1. To What extent does bank technology-based product have impact on Nigerian economic growth?
2. To what extent does Automated Teller Machine (ATM) have impact on Nigerian economic growth?
3. Does point of sales (POS) have any impact on Nigerian economic growth?
4. To what extent does mobile banking have impacts on Nigerian economic growth?
5. Does internet banking have any impact on Nigerian economic growth?

1.5 Research Hypothesis

The research hypothesis for this work is stated as follows.

Hypothesis 1

Ho_1: There is no significant relationship between bank technologies-based product and Nigerian economic growth.

Hypothesis 2

Ho_2: There is no significant relationship between automated teller machine (ATMs) and Nigerian economic growth.

Hypothesis 3

Ho_3: There is no significant relationship between point of sales (POS) and Nigerian economic growth.

Hypothesis 4

Ho_4: There is no significant relationship between mobile banking system and Nigerian economic growth.

Hypothesis 5

Ho_5: There is no significant relationship between internet banking and Nigerian economic growth.

1.6 Significance of the Study

The importance of bank technology-based product has been increased in the recent years with the increase of the customers in the banking sector and its role in the development of the economic sector in Nigeria. The awareness of customers in banking industries about qualities of electronic banking services has been increased. The excellent service quality increases the productivity, market share, return on investment, and economic growth. Nowadays electronic banking system has gained more importance through the services rendered that aid economic growth. In recent years the banks are racing for providing the highest technology infrastructure, these lead to wide use of electronic banking services through wide spread of internet websites for fulfilling the requirements of the customers. Despite the differences of the services offered in respect of

prices and types of offering electronic services, majorities of the banks use electronic banking services for buying, selling, and exchanging services through the electronic websites which known as an electronic commerce.

This study will be relevant to banking industries in Nigeria and outside Nigeria who wishes to improve their performance through the uses of technology-based products and return impact on the economic growth of their respectively country. Academically, the study also adds to the existing body of knowledge available to students and other researchers that world want to embark on similar or related research.

1.7 Scope and Limitation of the Study

This research is intended to reveal the impact of bank technology-based products on the Nigerian economic growth. The research covers the period from 2009-2019, analyzing the relationship between bank technology-based products and the Nigerian economic growth. It also aims at pointing out the problems facing the banks in using technology-based products (ICT devices) in rendering effective service to their customers and proffer possible solutions to the identified problems.

This research work was constrained by some factors which included.

1. Financial constraints: with help of family members and well-wishers I was able to overcome challenges pose by finance.
2. Time constraints: time was my major constraints in carrying out this research work in the sense that enough time was not allocated to this research but with God grace I was able achieve success with the little time allocated to it.
3. Inability to get up-to-date data for the research: getting up to date data for electronic banking advice for this study was a problem but at end I was able to achieve success in carry out the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Literature

2.1.1 Concept of Technology Based Products

The technological revolution produced modern technical instruments which have been used to assist and improve electronic banking services.Technological innovations is driven by today's banking industry to large extent that the industry shares the common characteristics of high-technology industry, most notably; market uncertainty, technology uncertainty and competitive volatility. Impact of information technology revolution upon banking has been widely discussed. Banking industry has formed suitable grounds to apply technological innovation because banking activities are easily digitized and automated (Bradley and Steward 2002; Daniel 1997).

Roger (2016) opined that ICT is a synergy between computers and communication devices and forms an important part of the modern world. Thus, the most significant shortcomings in the banking industry today is a wide spread failure on the part of senior management in banks to grasp the improvement of technology and incorporate it into their strategic plans.

Binugo and Aregbeshola (2014) assert that recent advances in the technological world giving birth to the emergence of information and communication technology (ICT) have led to remarkable changes in the ways businesses are run in contemporary times. This development is underscored by contemporary advancements engineered by the knowledge economy. It is also important to state that modern banking in Nigeria is driven by the outputs from robust local and global research and development. It is to establish the prevailing trend in the adoption of ICTs in the operations of Nigerian commercial banks.

Furzaneh (2012) in their research say that customers are encouraged to utilize ICT banking as priority. Increasing the customer's arousal by ICT advertisements to use ICT banking creates a positive attitude toward the bank's brand, which in-turn is the key factors in ICT banking effectiveness. It assists the customer to validate their account numbers and receive instruction on when and how to receive their cheque books, credit, and debit cards.

Ukah (2013) Nigerian banking industry has highly become ICT-based and is reaping the benefits of a technological revolution as evidenced by its application in most of its operations. Many commercial banks are making huge investments in technology to maintain and upgrade their infrastructure, in order not only to provide new electronic information-based service, but also to take timely advantage of new off-the-shelf electronic services such as online retail banking which is making it possible for very small institutions to take advantage of new technologies at quite reasonable costs. These developments may ultimately change the competitive landscape in the financial services market.

2.1.2 Electronic Banking System

Electronic banking is a banking advice that allows clients to do many banking transactions, either financial or non-financial through a bank's websites. The technological revolution produced modern technical instruments which have been used to assist and improve electronic banking services. The electronic services represent the forms of self-services, so that the client can do what he needs himself. In this regard the electronic banking services should be designed on the basis of the needs, wants, expectations, and experiences of the clients according to the following standards, firstly the electronic services should have the easiness to use so that the customer can perform the tasks easily, secondly the speed of electronic services should be high, and finally the electronic services should have the credibility, and there should be compatibility between these services and other technical services.

According to encyclopedia.com electronic banking is defined as a form of banking in which funds are transferred through an exchange of electronic signals rather than through an exchange of cash, cheque, or other types of paper documents. Transfers of funds occur between financial institutions such as banks and credit unions. They also occur between financial institutions and commercial institutions such as stores. Whenever someone withdraws cash from an automated teller machine (ATM) or pays for groceries using a debit card (which draws the amount owed to the store from a savings or checking account), the funds are transferred via electronic banking. Electronic banking relies on intricate computer systems that communicate using telephone lines. These computer systems record transfers and ownership of funds, and they control the methods customers and commercial institutions use to access funds. A common method of access (or identification) is by access code, such as

a personal identification number (PIN) that one might use to withdraw cash from an ATM machine.

Okechi and Oruan (2013), defined electronic Banking System as an innovative service delivery mode that offers diversified financial services like cash withdrawal, funds transfer, cash deposits, payment of utility and credit card bills, cheque book requests, and other financial enquiries. Daniel (1999) defines electronic banking as the process of delivery of banks information and services by banks to customers via different delivery platforms that can be used with different terminal devices such as personal computers and mobile phone with browser or desktop software, telephone, or digital television. Electronic banking describes more on the uses of information and communication technology and electronic means by a bank to conduct transactions and interact with stakeholders (Abid & Noreen, 2006).

Electronic banking implies provision of banking products and services through electronic delivery channels. Electronic banking has been around for quite some time in the form of automatic teller machines (ATMs) and telephone transactions. In more recent times, it has been transformed by the internet –a new delivery channel that has facilitated banking transactions for both customers and banks (Nitsure, 2003).

Robinson, (2000), noted that the supply of electronic banking services enables banks to establish and extend their relationship with the customers. There are other numerous advantages to banks offered by EBS such as customer's loyalty, market segmentations, innovation of new products and services, more effective marketing, and communication at lower costs/fees (Tuchila, 2000).

Electronic payment strategies have been adapted in Nigeria advancing by the increase in the share volume and worth of transactions accomplished through the ATM, POS, and Mobile phones, etc. For instance, the volume of transactions executed with the ATM was put at N548.60 million in 2009 and this increased to N74.9 trillion in 2016 (Adegbesan, 2017). Thus, it is not doubtful concerning the penetration of electronic payment approaches in Nigeria (Jenevive & Anyanwaokoro, 2017). In Nigeria major cities and financial hubs, E-banking services are increasingly gaining ground as the customers received them as panacea to the problems of poor-quality services peculiar to the Nation's banking system. However, what is unknown is the level to which e-banking services have reduced the stress or problems associated with banking and enhanced customers' satisfaction (Taiwo & Agwu, 2017). Emergent literature

has identified that electronic banking in Nigeria is costly, occasioned by epileptic internet services, increase in the size of cash deposits, and increased exposure to fraudulent activities (Afolabi, 2009; Taiwo & Agwu, 2017).

2.1.3 Brief History of Electronic Banking

For decades financial institutions have used powerful computer networks to automate millions of daily transactions. In the 1950s the Bank of America was one of the first institutions to develop the idea that electronic computers could take over the banking tasks of handling checks and balancing accounts, which was, at that time, extremely labor-intensive. Other institutions gradually joined the effort and progressed away from using paper checks and toward all-electronic banking. Data-processing machines, robotic document sorting, and the invention of optical character recognition (a computer application that translates handwritten or typewritten words into text that can be machine-edited) were a few of the developments which allowed this evolution.

The first electronic banking machines were able to keep records of deposits and withdrawals from each client, make account balance information available instantaneously, monitor overdrafts, stop payments, and hold funds. The machines responsible for this work today are as exact and reliable as the banking industry requires them to be. Electronic banking laid the groundwork for speed and convenience in individual and commercial (business) banking. The spread of personal computer use has added another layer of convenience and speed to the process. Electronic banking allows customers of most banks to do their banking at any hour of the day, regardless of the bank's operating hours. If customers choose to do such things as transfer funds or pay bills, they can usually do so from anywhere Internet access is available.

Online banking typically offers bank statements, electronic bill payment, funds transfers between a customer's checking and savings accounts (or to another customer's account), loan applications and transactions, and purchasing or sales of investments, all of which allow customers to maintain their accounts without making a trip to the bank itself. When funds are transferred between accounts by electronic means, it is called an electronic funds transfer (EFT). The Electronic Fund Transfer Act, passed by the federal government in 1978, established that an electronic funds transfer is any financial transaction that originates from a telephone, electronic terminal, computer, or magnetic tape (storage tape of the sort used in video or audio cassettes).

A wire transfer is the electronic transfer of funds across a network controlled and maintained by hundreds of banks around the world. Usually wire transfers are reserved for moving large sums of money. Wire transfers allow people in different geographic locations to transfer money easily. The wire transfer payment system called Fedwire (Federal Reserve Wire Network) links the offices of the Federal Reserve (the central bank of the U.S. government), the U.S. Treasury (the department of the federal government that manages the country's revenue), and other government agencies and institutions.

One of the largest companies that provide electronic money services is Western Union. The company started out in 1851 as a transmitter of telegraphs, messages sent through wires as coded electronic pulses. As the telegraph became an obsolete form of communicating information in the mid-twentieth century, Western Union redefined itself as a provider of electronic financial transactions. Now named Western Union Financial Services, Inc., the company specializes in electronic money transfers and business communications services.

Another prominent provider of electronic financial transactions is PayPal, a service founded in 1999. It is used to process payments when people buy or sell things on the Internet. The service first gained popularity among people who used the auction website eBay. Most of the sellers on the site were not professional merchants and so were not equipped to accept credit cards; PayPal enabled them to receive electronic payments while also giving buyers an alternative to mailing paper checks or money orders. In 2002 eBay acquired PayPal.

2.1.4 Origin of Electronic Banking in Nigeria

Conventional banking system started in Nigeria in 1952. Since then, the industry has witnessed a lot of regulatory and institutional advances. The industry was being controlled by at most five out of the 89 banks in existence before the commencement of the ongoing banking industry reformation in the country. Multiple branch systems is also one of the notable features of Nigerian banks, with a total of 89 banks accounting for about 3017 bank branches nationwide as at 2004. As well, the industry is faced with heavy challenges, including the overbearing impact of fraud and corruption, erosion in public confidence, a poor capital base, persistent cases of distress and failure, poor asset quality, and so on. Part of the moves to resolve these lingering problems include the banking reform initiated by the Central Bank of Nigeria in June

2004, which is largely targeted at reducing the number of banks in the country and making the emerging banks much stronger and reliable. In the bid to catch up with global developments and improve the quality of their service delivery, Nigerian banks have no doubt invested much on technology; and have widely adopted electronic and telecommunication networks for delivering a wide range of value-added products and services. They have in the last few years transformed from manual to automated systems. Unlike before when ledger-cards were used, today banking has been connected to computer networks, thereby facilitating the practice of inter-bank/inter-branch banking transactions. Developments at home, such as the introduction of mobile telephone in 2001 and improved access to personal computers and Internet service facilities have also added to the growth of electronic banking in the country. However, whereas local banks most commonly practice real time online intranet banking, the integration of customers into the process is far from been realized. Many of the reasons are attributed to the high prevalence of Internet fraud and lack of an adequate regulatory framework to protect the banks from the volatility of risks associated with Internet banking, especially at the levels of communication and transaction. In the main, Nigeria is globally regarded as the headquarters of Advance Fee Fraud which is perpetrated mostly via the Internet. Electronic banking is not one technology, but an attempt to merge several different technologies. Each of these evolved in different ways, but in recent years different groups and industries have recognized the importance of working together. Bankers now see a kind of revolution going on in their business in part because we have taken a quantum leap in the use of technologies in the last several years.

2.1.5 Recent Trends in Electronic Banking

As online banking has become more sophisticated, banks have been formed that operate exclusively as electronic banks and have no physical storefront for customers to use. Without the costs of purchasing and maintaining physical "bricks-and-mortar" structures like traditional banks do, online banks are able to offer higher interest rates on savings accounts (interest payments are fees that customers collect for keeping their money in the bank). Customers at online banks can use the internet to conduct all the standard banking transactions (including paying bills online, viewing images of cancelled checks, and transferring money to accounts at other banks and brokerages).

Many of these customers have their employer automatically deposit their paychecks into their bank accounts electronically (a method called direct

deposit, which is also very commonly used by clients of traditional banks). Some employers, however, do not offer direct deposit. If a customer of an online bank receives a paper check, he or she cannot walk into their bank and cash it. He or she must mail the check to their bank or deposit it in an ATM that accepts deposits for their bank. Some customers view this inconvenience as a drawback of using an online bank.

2.1.6 Types of Banking Innovations

Fisher (1998), technology when applied in today's banking environment falls into three specific categories: customer independent (a technology that involves a customer conducting and completing a transaction with a bank entirely independent of any human contact with the institution e.g. ATMs, phone banking and Internet banking); customer assisted (a bank employee will use customer-assisted technology as a resource to complete a transaction e.g. call centre's customer service officers will use a Customer Relationship Management (CRM) System to understand a customer's profile and provide instant responses to customers' queries on the banking transactions and up-to-date billings (Gutek & Welsh, 1999)); and customer transparent Customer technology which represents the real core of bank operations and customers never see it but expect it.

Electronic banking consists of the followings; automated teller machine (ATM), mobile transfers, point of sale (POS), and internet banking.

2.1.6.1 Automated Teller Machine (ATM)

In Nigeria, ATM was conventionally introduced as an electronic delivery channel in 1989 and was first installed by National Cash Registers (NCR) for the defunct Societe Generale Bank of Nigeria (SGBN) in the same year. Since its introduction, many Nigerian banks have installed ATM in response to the changing nature of modern banking operations. Until 2003, a small number of banks operated their own propriety ATM fleets. The main shared ATM network in Nigeria, Inter Switch, began operations in 2003 with 5 ATMs from United Bank for Africa (UBA) and First Bank of Nigeria(FBN) (Tope: 2010) .

Automated Teller Machine (ATM) is a machine where cash withdrawal can be made over the machine without going into the banking hall. It also sells recharge cards and transfer funds; it can be accessed 24 hours/7 days with account balance enquiry (Fenuga, 2010).

2.1.6.2 Internet Banking

Internet banking allows customers of a financial institution to conduct financial transactions on a secure website operated by the institution, which can be a retail or virtual bank, credit union or society. It may include of any transactions related to online usage. Banks increasingly operate websites through which customers are able not only to inquire about account balances, interest, and exchange rates but also to conduct a range of transactions. Unfortunately, data on Internet banking are scarce, and differences in definitions make cross-country comparisons difficult (Timothy, 2012)

2.1.6.3 Point of Sale (POS)

Point of sale (POS) also sometimes referred to as point of purchase (POP) or checkout is the location where a transaction occurs. A 'checkout' refers to a POS terminal or more generally to the hardware and software used for checkouts, the equivalent of an electronic cash register. A POS terminal manages the selling process by a salesperson accessible interface. The same system allows the creation and printing of the receipt. Because of the expense involved with a POS system, the eBay guide recommends that if annual revenue exceeds the threshold of $700,000, investment in a POS system will be advantageous. POS systems record sales for business and tax purposes. Illegal software dubbed 'zappers' is increasingly used on them to falsify these records with a view to evading the payment of taxes (Olorunsegun, 2010).

2.1.6.4 Mobile Banking

Mobile banking (also known as M-banking) is a term used for performing balance checks, account transactions, payments, credit applications and other banking transactions through a mobile device such as a mobile phone or

Personal Digital Assistant (PDA). The earliest mobile banking services were offered over SMS, a service known as SMS banking. Mobile banking is used in many parts of the world with little or no infrastructure, especially remote and rural areas. This aspect of mobile commerce is also popular in countries where most of their population is un-banked. In most of these places, banks can only be found in big cities, and customers must travel hundreds of miles to the nearest bank. The scope of offered services may include facilities to conduct bank and stock market transactions, to administer accounts and to access customized information (Tiwari and Buse, 2007).

2.1.7 Benefits of Electronic Banking Services

Electronic banking provides benefits for the bank and for the customers using it (Suganthi, 2010).

i. Electronic Banking has reduced the cost of doing business and made organizations more profitable.

ii. E-base Banks are offering more than banking services; they are offering services on the bank website.

iii. Electronic Banking eliminates geographical and time differences/constraint.

iv. Electronic banking may be more cost effective for banks, which can then lower the fees for the customers.

2.1.8 Branch Networking

Networking of branches is the computerization and inter-connecting of geographically scattered stand-alone bank branches, into one unified system in the form of a Wide Area Network (WAN)or Enterprise Network (EN); for the creating and sharing of consolidated customer information/records (Abor, 2005).It offers quicker rate of inter-branch transactions as the consequence of distance and time are eliminated. Hence, there is more productivity per time. Also, with the several networked branches serving the customer populace as one system, there is simulated division of labour among bank branches with its associated positive impact on productivity among the branches. Furthermore, as it curtails customer travel distance to bank branches it offers more time for customers' productive activities.

2.1.9 The Problems and Solutions Associated with the Development of Technology in Banking System In Nigeria

The development of an efficient monetary transfer system in Nigeria has been hampered by so many factors. These problems are infrastructural deficiency such as erratic power supply and communication link. In this case government should endeavour to provide stable and efficient power supply and telecommunication system.

Another problem is inadequate skilled managers and requisite tools on end users and client systems, here efforts should be done in provision of

infrastructure and skilled manpower, another problem is the large accumulation of cash in the country so the government should compel legislation that would charge the dominance of cash usage to electronic payments. Also, there is high charge or cost for the e-payment terminals (ATMs) so the banking legislation should set out standard charges for e-payment services.

Another problem is non-provision of adequate security for fraud prevention, banks should endeavour to provide stand-by-camera in every ATMs machine for confirming identify of operators account and employ a good computer wizard in dictating and preventing frauds committed by computer hackers.

Another problem is lack of government support for the improvement of e-banking, there should be an involvement of C.B.N in public awareness campaign and escalating infrastructural challenges to the relevant government agencies and encourages Nigerians to trust and migrate to e-payments.

Lastly one of the major problems is low level of awareness computer appreciation and literacy among the public and over dependence on cash for all types of transaction. Awareness should be created to the public through media such as, television, billboard, radio etc on the trust and benefits derived from the usage of e-payment and also continuous promotion of cashless society via payments system reform programmes.

2.1.10 Disadvantages Of Technology In Banking System In Nigeria

2.1.10.1 Power Failure and Communication Link:

Constant electric failure leads to deficiencies in infrastructures such as ATMs computers etc which slows down the rate of electronic transactions and causes a bridge in the communication lines as customers may not be able to easily communicate with their banks.

2.1.10.2 Lack of Computer Back Up:

Due to the fact that all customers' information is stored online, banks find it difficult to function effectively when there is power outage. Banks should try as much as possible to keep a manual backup (ledger) of customers' data and information to ensure there is no interruption in the flow of work during power outage.

2.1.10.3 Lack of Adequate Investment Capital:

Funds that can be used to buy new information technologies and for modernizing existing systems is generally in short supply. While there are a number of modern banking applications in use, there is also integrated banking system, Nigeria has continued to experience innovations in terms of product development specifically, there has been tremendous improvement in the speed in which funds are transferred within and outside the domestic economy (international money transfer).

2.1.10.4 Reduces Employment in The Country:

Electronic banking in the country today has reduced the rate of employments in the country whereby most works that should be done by human are done by machines thereby lead to minimum rate of employment and high rate of unemployment in the country.

2.1.10.5 High Charges on Machines:

The rate of commission or charges imposed by banks is too high thereby discouraging customers from using the electronic machine for exchange of transactions example of such charges are cheques on withdraw ATMs and online transfer from one bank branch to another.

2.1.10.6 Low Public Acceptance:

Customers and public do not have trust in the machine in the sense that fraudulent personals use the system in carryout fraudulent activities, even today banks uses the machine in looting customers money from their accounts. Some customer complains that sometimes when they go for withdraw with their ATM the machine will seize the card while their account will still be debited with un withdraw sum in course of ratification of this problem, the customer might be discouraged because it will take a longer time or end up unsolved.

2.1.10.7 Insecurities in Banks:

Most electronic machines today are not secure thereby making it easier for fraudulent personnel to carry out their fraudulent activities without been caught. Due to insecurity, banks cannot prevent stop or dictate any fraudulent

activity. Computer hackers also use the system in stealing data or information by breaking of codes.

2.1.10.8 Encourages Excessive Withdrawal:

Un-operational days like Saturdays when banks are not in operation customers can go and withdraw with their ATM cards, especially when there is a function like weeding ceremonies, customers with little or no money can rush to a nearby ATM machine to withdraw money for excessive spending, customers complained about this in an interview conducted by banks.

2.1.11 Positive Impact of Technology in Banking System In Nigeria

2.1.11.1Speedup Settlement of Transaction:

Electronic banking speedup settlement of transaction either national or international level where the bank stands as paying bank to the customers for settlement of transaction or debt and collection bank for the collection of payment on transaction made.

2.1.11.2 Reduce the Rate at Which Customers Visit Banks:

The introduction of this system has bridged the gap between the customer and his bank, where the customer can easily go any branch bank close to him and withdraw money from the ATM using his electronic card. This saves time, energy and reduces stress for the customer. Also, customers can make or carryout transaction while at home with the use of telephone.

2.1.11.3 Move into a Cashless Society:

The introduction of the electronic machine has reduced the use of raw cash thereby moving the country into a cashless economy. As stipulated by Anyanwaokoro M. (1997), that the settlement of financial obligations is now done by the use of electronic gadgets such as computer, facsimile and telex, instead of currency notes and coins. He went on to say that individuals can pay their bills by using credit cards or even pressing some buttons that transfer money from one account to another. The perfection of this system is what he described as a move into cashless society.

2.1.11.4 Reduction of Theft:

The use of electronic payment system has reduced the rate of theft/stealing in the society. The federal government reported to daily champion on Tuesday, April 21 (2009) that due to endemic corruption in official transaction and incessant robbery attacks on bullion van and bank vaults which made the federal government to direct immediate automation of government fiscal operations through a system known as electronic payment (e-payment).

2.1.11.5 Clearance of Good:

Payment system in the custom areas help in ensuring easy facilitation of clearance of goods by importers, also the money accrue to the government would be paid up electronically thereby making the gathering of revenue very easy and checking of any fraudulent moves as reported by Mumdu H. daily sun, Friday May 21, 2010.

2.1.12 Economic Growth

Mladen (2015), Economic growth includes changes in material production and during a relative short period of time, usually one year. In economic theory, under the concept of economic growth implies an annual increase of material production expressed in value, the rate of growth of GDP or national income. Growth can be achieved, for it does not achieve the developmental course of the economy. So economic development amounts involve not only an increase in material production, but also all the other socioeconomic processes and changes caused by the influence of economic and beyond economic factors.
Economic growth and development is not just a concept, it is also an activity and a professional practice. Defining economic growth and development is a prerequisite to move discussion towards objective policy discussion and robust measurement.

Economic growth has a strong theoretical grounding and is easily quantified as an increase in aggregate output. Growth occurs when output increases. Output can increase either when we add more inputs or use technology or innovation to enhance the efficiency with which we transform inputs into outputs. In part because of this straightforwardness, economic growth, with its emphasis on increases in population, employment or total output dominates the debate, even though increases in any or all of these could be associated with both improvements and/or declines in prosperity and quality of life. Economic growth is, in a limited sense, an increase of the national income per capita, and

it involves the analysis, especially in quantitative terms, of this process, with a focus on the functional relations between the endogenous variables; in a wider sense, it involves the increase of the GDP, GNP and NI, therefore of the national wealth, including the production capacity, expressed in both absolute and relative size, per capita, encompassing also the structural modifications of economy.

Most of the theoreticians think of the economic development as a process that generates economic and social, quantitative and, particularly, qualitative changes, which causes the national economy to increase its real national product cumulatively and durably. Hence, economic development occurs when individual agents can develop the capacities that allow them to actively engage and contribute to the economy. In the aggregate, this should lower transaction costs and increase social mobility. Rather than being reduced to a static factor in a production process, individuals become the agents of change in the process of economic development: they have the freedom to realize their potential. The greater the number of individuals able to participate in the economy and the society, the greater the opportunity for new ideas to circulate and be put into action. Economic development is measured by rising real per capita income, Gini coefficients and other measures of the distribution of income and wealth as well as indicators of quality of life, that range from life expectancy to crime statistics to environmental quality. From this standpoint, economic development differs from growth in terms of a focus on a broader set of metrics.

This conceptualization sharpens the contrast between growth and development. Indeed, examples abound of national economies that have experienced significant increases in economic output, due to either population growth or large-scale resource extraction, with little broad-based improvement in individuals' quality of life and ability to realize human potential. There are numerous countries in sub-Saharan Africa, Central and South American and Oceania that provide examples of growth without development (Acemoglu et al. 2002; De Soto, 2000; Moyo, 2009). With insufficient support for economic development, longer-term outcomes that lead to broad-based improvements in quality of life and widespread prosperity remain inaccessible. The lack of economic development erodes capacities and penalizes future economic growth. Of course, economic growth provides slack resources that may either be appropriated by rent-seeking elites or invested in economic development to provide the basis for future economic growth. When long-run prosperity rests not on resource extraction but on the ongoing production of ideas, investments

in economic development become even more essential as a precursor to growth.

Economists conclude that the development of high-quality institutions is the major factor behind economic growth (Rodrik *et al*., 2002). Institutions operate with specific rules and procedures that lower transaction costs and inspire confidence by certifying the range of potential outcomes.

Economic development seeks to achieve long-term sustainable development in a nation's standard of living, adjusted for purchasing power parity." The term sustainable, as defined by Tatyana Soubbotina at the World Bank (2004:9 – 10), could "be otherwise called equitable and balanced, meaning that, in order for development to continue indefinitely, it should balance the interests of different groups of people in three major interrelated areas–economic, social, and environmental." But in defining standard of living, Porter unfortunately conflates economic growth with economic development: "Standard of living is determined by the productivity of a nation's economy, which is measured by the value of the goods and services (products) produced per unit of the nation's human, capital, and physical resources." When economic development is confused with economic growth, then private sector constructs are often adopted uncritically as means by which public investments ought to be evaluated.

Equitable and sustainable economic development fosters economic growth that at the same time renews and improves the capacities and conditions that make growth possible. While industrial activity certainly benefits from location, the resulting profits are often not distributed back to residents or reinvested in those same places that provided the advantage to firms and industries.

It is also worth pointing out that between economic growth and economic development there are similarities and differences. Similarities refer to the fact that:

(i) Growth and development are continuous processes, with stimulating effects in economy.

(ii) Both processes involve the allotment and utilization of resources and the increase of efficiency.

(iii) The finality of growth and development is the improvement of the standard and quality of life.

(iv) Growth and development are cause and result of the general trend, influencing its rhythm and ensuring passages from one level to the other.

The differences between economic growth and development refer to the fact that, while economic growth concerns the quantitative side of economic activity (the increase of results, of quantities, of sizes), development has a larger scope, including qualitative changes that take place in economy and society. In fact, development is a qualitatively higher step of macro-economic evolution. We often refer to growth theories when we speak about the developed countries and to the theories of development when we approach the economic problems that are specific to the developing or less developed countries.

2.2 THEORICAL FRAMEWORK

2.2.1 Theory of Innovation Diffusion

This study is anchored on innovation diffusion theory postulated by Roger in 1983, he argues that individuals' intention to adopt a technology as a modality to perform a traditional activity. The critical factors that determine the adoption of an innovation at the general level are the following: relative advantage, compatibility, complexity, trainability, and observability. Many banks have found it advantageous to adopt ICT in their operation to improve their efficiency. This is achieved through development of websites and mobile applications that suit the customer needs. Customers are therefore able to access their accounts anywhere if they are connected to the internet. This theory is concerned with the way a new technological idea, artifact or technique, or a new use of an old one, migrates from creation to use. According to IDT, technological innovation is communicated through channels, over time, among the members of a social system.

The stages through which a technological innovation passes are knowledge (exposure to its existence, and understanding of its functions); persuasion (the forming of a favourable attitude to it); decision (commitment to its adoption); implementation (putting it to use); and confirmation (reinforcement based on positive outcomes from it) (Arnaboldi & Claeys, 2008). In the same way internet banking has been enhanced due to cyber threats and fraud. Early users generally are more highly educated, have higher social status, are more open to both mass media and interpersonal channels of communication, and have more contact with change agents. Mass media channels are relatively more important at the knowledge stage, whereas interpersonal channels are relatively more important at the persuasion stage. Innovation decisions may be optional (where the person or organization has a real opportunity to adopt or reject the

idea), collective (where a decision is reached by consensus among the members of a system), or authority-based (where a decision is imposed by another person or organization which possesses requisite power, status or technical expertise). Barnes and Corbitt (2013) advises that managers need to understand the capabilities of any technology and the benefits that ensue from its use in considering what technology to use with their operations, as well as understand associated costs and limitations of operating that technology. He advises the general issues to consider as the volume and variety of output that the technology can achieve the fit with existing technology used with the organization and the level of maturity of the technology. Internet banking heavily relies on the ICT since it is carried out on the internet. Customers can access their accounts remotely without having to physically visit the bank.

2.2.2 Technological Acceptance Model

This study is anchored on the technological acceptance model which was propounded by Fred Davis in 1993. The theory of technological acceptance explains how individuals accept new technology and it leads to growth in an economy. In essence, it shows how a user of a proposed technology welcomes and adapts to a new technology. He stated that two beliefs determine the complete acceptance of a technology. These beliefs are perceived usefulness and perceived ease of use. Perceived Usefulness is a factor that affects user's acceptance because it is based on how capable the new technology will help improve job performance. The technology must be capable of producing an advantageous result and must also be able to generate a positive performance. As for perceived Ease of Use, Fred Davis defined it as how easy it is for users to make use of new technology. It means that the ability to employ the new technology should be effortless. Prior to the implementation of the cashless policy, Nigeria was a huge cash-based economy. To increase the effect of the policy on citizens, the people have to believe that the policy will be easy to use and also result in positive performance thereby, leading to economic growth. E-Banking products must also be re-engineered to make electronic payment effortless which will stir the country toward a cashless economy (Nwankwo and Eze, 2013).

2.3 Empirical Review

Several researchers have investigated the relationship between bank technology-based products and Nigerian economic growth. This has generated both positive and negative arguments in the literature. Some of these research

conducted from different part of the world including Nigeria are reviewed below:

Ukwuoma (2019), examine the effect of ICT on Economic Growth in Nigeria: Economic drivers of most developed and developing nations are believed to be anchored on their population growth, GDP per capita, inflation rate and most importantly ICT. This study examines these drivers for the Nigerian economy using secondary data obtained from World Bank and subjecting the data to Regression. Data gathered ranged from 2008 to 2018 and SPSS used for analysis using Regression as the test tool. The result reflects that increased inflation, population and GDP per capita have negative effects on the number of Internet Users thereby affecting the economic growth of the country. The study proffers recommendations that the Federal Government of Nigeria can adopt to enhance ICT in Nigeria for its economic growth which include enhanced funding and the development of an ICT master plan for the Nigerian State.

Hammoud, Bizri and Ibrahim (2018), investigate the Impact of E-Banking Service Quality on Customer Satisfaction: Evidence from the Lebanese Banking Sector. The study adopted primary data, which was gotten from survey instrument, which was distributed among bank clients in the Lebanese banking sector. The data were statistically analyzed using structural equation modeling with SPSS and Amos (20). The study revealed that reliability, efficiency, and ease of use; responsiveness and communication; and security and privacy all have a significant impact on customer satisfaction, with reliability being the dimension with the strongest impact. E-Banking has become one of the essential banking services that can, if properly implemented, increase customer satisfaction, and give banks a competitive advantage. Knowing the relative importance of service quality dimensions can help the banking industry focus on what satisfies customers the most.

Awoyemi and Awoyemi (2017), examine the role of information technology on Nigerian economy. This was done using ordinary least square estimation technique. The study found that investment in the telecommunication sector and improved level of communication and information technology significantly influences economic growth in Nigeria. Adequacy of information technology infrastructures such as computer and internet devices as well as high level of internet usage will achieve rapid economic growth and development if the resources are channeled efficiently. Therefore, this study suggests an improvement in the supply of information and communication infrastructures.

Akhisar Batu and Tunay (2015), examine the effect of innovations on bank performance: The case of electronic banking service. The study adopts a panel data analysis of a 23 developed and developing countries, years under study covers the period of 2005 – 2013. The study reviewed that profitability of developed and developing countries affected from the ratio of the number of branches to the number of ATMs is highly significance and electronic banking service is significant. It also revealed that some variables were found to contrast with the expected negative relationship because of diversity in the level of development of the countries, the socio-cultural structure and electronic banking infrastructure.

OKORO (2014) evaluated the impact of selected e-payment instruments on the intermediation efficiency of the Nigerian economy from 2006 to 2011. The following findings were made: that there is significant relationship between ATM, POS, Internet service values and the intermediation efficiency of the Nigerian economy. However, the study also reviles that there is no significant relationship between Mobile service value and intermediation efficiency of the Nigerian economy within the period under study. The implication of these finding is that the ATM, POS and Internet services are the major instruments used by the customers of the deposit money banks in Nigeria, may be as a result of the level of awareness created by the banks in Nigeria. On the other hand, the insignificant contribution of the Mobile service value to intermediation efficiency may be because of the user's ignorance or the banks' insufficient effort in selling the product effectively. Furthermore, the result implies that the higher the usage of the selected e-payment instruments in Nigeria the better the intermediation efficiency of the Nigerian economy. Therefore, this study recommends that the banks should put more effort in advertising these products in Nigeria.

Aliyu, Tasmin and Lame (2013), examine the Impact of Electronic Banking on Customer Service Delivery in the Malaysian Banking Industry: Using Kano's Model. The study adopted Structural Equation Modelling as a tool and instrument for data analysis. The study revealed that the mutual relationship that exists between electronic banking, behavioral factors, and customer service delivery in the banking industry. It could be established through the findings of this study that based on the extensive review of existing literatures, the expected and likely outcome as well as the research gaps identified in the research could also provide some direction for future research.

Oluwagbemi, O., Abah, J., & Achimugu, P., (2011), examine the effect of information technology in Nigeria banking industry. The paper further reveals that the deployment of IT facilities in the Nigerian Banking industry has brought about fundamental changes in the content and quality of banking business in the country. This analysis and clarification of how Nigerian Banks have used IT to reengineer their operations is detailed through literature review and observation. Three categories of variables that relate to the use and implementation of information technology devices were considered in this paper. These include the nature and degree of adoption of innovative technologies; degree of utilization of the identified technologies; and the impact of the adoption of IT devices on the bank operations.

2.4 Summary of Literature Review

Author(s)	Year	Place	Topic	Methodology	Findings
Ukwuoma	**2019**	**Nigeria**	Effect of ICT on Economic Growth in Nigeria.	SPSS used for analysis using Regression as the test tool.	The result reflects that increased inflation, population, and GDP per capita have negative effects on the number of Internet Users thereby affecting the economic growth of the country.
Hammoud, Bizri and Ibrahim	2018	Lebanese	The Impact of E-Banking Service Quality on Customer Satisfaction: Evidence from the Lebanese	Structural equation modeling with SPSS	The study revealed that reliability, efficiency, and ease of use; responsiveness and communication; and security and privacy all have a significant impact on customer

			Banking Sector.	and Amos (20).	satisfaction, with reliability being the dimension with the strongest impact.
Awoyemi and Awoyemi		Nigeria	The role of information technology on Nigerian economy.	Ordinary least square estimation technique.	The study found that investment in the telecommunication sector and improved level of communication and information technology significantly influences economic growth in Nigeria.
Akhisar Batu and Tunay	2017	Developed and developing countries.	The effect of innovations on bank performance: The case of electronic banking service.	Panel data analysis.	The study reviewed that profitability of developed and developing countries affected from the ratio of the number of branch to the number of ATMs is highly significance and electronic banking service is significant.

Okoro	2015	Nigeria	The impact of selected e-payment instruments on the intermediation efficiency of the Nigerian economy from 2006 to 2011.	Ordinary least square estimation technique.	The following findings were made that there is significant relationship between ATM, POS, Internet service values and the intermediation efficiency of the Nigerian economy.
Aliyu, Tasmin and Lame		Malaysia	The Impact of Electronic Banking on Customer Service Delivery in the Malaysian Banking Industry: Using Kano's Model.	Structural Equation Modelling.	The study revealed that the mutual relationship that exists between electronic banking, behavioral factors, and customer service delivery in the banking industry.
Oluwagbemi, Abah, & Achimugu,	2014	Nigeria	The effect of information technology in Nigeria banking industry.		The paper further reveals that the deployment of IT facilities in the Nigerian Banking industry has brought about fundamental changes in the content and quality of banking business in the country.

	2013 2011			Ordinary least square estimation technique.	

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This study is designed to examine the impact of bank base technology product on Economic Growth of Nigeria. In this chapter, the methodology adopted in the collection, analysis, and interpretation of the data for the study would be discussed. This is to give a lucid description of the research plans and necessary tests needed for the actualization of the objective of the study.

3.2 Research Design

This study is an empirical analysis of bank base technology product and Economic Growth of Nigeria. The data, measures and methods employed work together with a view to address the central research questions. The multiple regression models were used for empirical analysis of data and testing of our research hypothesis.

3.3 Data

The quarterly series data for this study was collected from the Statistical Bulletin and the Central Bank of Nigeria Annual Report and Statement of Accounts for the period 2009Q1-2018Q4. The choice of the period is based on the period when e-banking became a common practice in the banking sector.

3.4 Research Instruments

The instruments employed in this research are determined in line with the nature and objectives of the research. This analysis employed Econometric Module using least square techniques involving the construction and Estimation of multiple regression models to ascertain the impact of bank base technology product on Economic Growth of Nigeria. Also the construction of model showing the coefficient of determination to explain the changes in the level of bank base technology product variables, which for the purpose of this study, includes; Mobile Banking, Internet banking, Automated Teller Machines and Point-of-Sale transactions, that may affect Economic Growth in Nigeria, as well as tests of significance, using the T- test to evaluate the individual significance of the regressors and F-test to estimate the joint significance at a 95% confidence interval. The analysis was done using E-views 11.0 software.

3.5 Method of Data Analysis

In this study, the following tests shall be conducted:
Unit root test
Co-integration test
Vector Error Correction Mechanism
Wald test

a) Unit Root Test: It is used to test for the stationarity of the time series data to avoid spurious regression results. Augmented Dickey fuller will be used in the process.
b) Co-integration Test: It is used to test for the long run relationship between the variables. And a protracted run relationship is found on these variables during which we are going to study. Johansen Co-Integration Approach will be undertaken by the researcher during the analysis.
c) Vector Error Correction Mechanism (VECM): The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The bigger the constant of the parameter, the upper the speed of adjustment of the model from the short-term to the long-term equilibrium.

3.6 Model Specification

Regression model using ordinary least square technique (OLS) is an essential econometric technique as it can be used in a wide range of applications to examine the various variables used. This study has adopted a growth model which specifies that growth is a function of mobile banking, internet banking, ATM and POS.

RGDP = F (IB, MB, ATM, POS)

Where:

RGDP = Real Gross Domestic Product 38

IB = Internet Banking

MB = Mobile Banking

ATM = Automated Teller Machine

POS = Point-Of-Sale

In clear terms, the econometric model is specified below:

RGDP = b_0 + b_1ATM + b_2POS + b_3IB + b_4MB + Ut

logRGDP = b_0 +log b_1ATM + logb_2POS +log b_3IB + logb_4MB + Ut

Where:

RGDP = Real Gross Domestic Product

B_0 = Regression Constant

B_1, b_2, b_3, b_4 = Regression parameters

U = error term

3.7 Method of Evaluation

a) Sign and Magnitude of Parameter

These are the suggestions about the signs of the parameters and to check whether they are in line with economic theory. As regards to the magnitude of parameters, the B's represents marginal magnitudes of economic theory.

b) Coefficient of Determination (R2)

The coefficient of multiple determinations explains the proportion of the variation in Y (Real Gross Domestic Product) that is explained by the explanatory variables.

Jointly it has a mathematical value that lies between 0 and 1 (i.e. 0<R2<1), thus the higher the value of R2, the greater the percentage of the variation of dependent variable that can be explained or caused by the independent variables.

$$\frac{R^2 = b_1 \Sigma x_1 y + b_2 \Sigma x_1 y}{\Sigma y^2}$$

c) Students T- test

This is a useful statistical test for sample less than thirty (30). In this study, the researcher used T-test to examine the statistical significance of the parameter estimates. Using OLS technique, the test of significance of the parameter estimates is the standard error test. The standard error is computed as the square root of the variance of the estimates.

Decision rule:

If t-calculated > t-tabulated, we reject the null hypothesis {H0} and accept the alternative hypothesis {H1}, and if otherwise, we accept the null hypothesis {H0} and reject the alternative hypothesis {H1}.

Level of significance = α at 5%

Degree of freedom: n-k

Where n: sample size.

K: Number of parameters.

d) F-test

This test is the test on the explained variable. It can also be said that F-test examines the joint significance of the explanatory variables.

Decision rule:

We reject null hypothesis and accept the alternative if the F-Ratio is greater than the F-tabulated; (Fcal >Ftab) at 5% level of significance by concluding that our estimate (s) are statistically significant, otherwise, we accept H0.

e) Durbin – Watson test

This helps to test the validity of the assumption of non-auto correlated disturbances.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1 Introduction

The focus of this chapter is on the presentation, estimation, and analysis of the data to address the issues relating to bank base technology product and economic growth in Nigeria.

Econometric analysis is usually done to evaluate the level of relationship that exists between the economic variables involved in the research. To that effect, this chapter evaluates the impact of bank base technology product on the Nigerian economic growth.

Quarterly time-series data covering a period of ten years were used in this study to estimate the model function. Data were sourced from the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) statistical bulletins. The statistical packages used for the analysis were Excel and E-views and results are presented in tables.

4.2 Data Presentation

Table 4.1 presents the data for Automated Teller Machines (ATM), Point-of-Sale (POS), Mobile Banking (MB), Internet Banking (IB) and Real Gross Domestic Product (RGDP) from 2009Q1 to 2018Q4.

Table 4.1

Year	RGDP N'B	ATM N'M	POS N'M	IB N'M	MB N'M
2009Q1	5571.42	137.72	3.51	4.38	0.06
2009Q2	5977.29	145.57	2.75	5.19	0.11
2009Q3	6718.23	126.12	2.48	52.27	0.52
2009Q4	6969.12	139.19	2.29	22.31	0.58
2010Q1	12790.38	62.59	2.77	3.37	0.87
2010Q2	13141.5	80.72	2.67	4.26	1.37
2010Q3	14516.59	114.9	2.8	9.94	1.84
2010Q4	15020.88	141.5	4.48	7.48	2.57
2011Q1	14686.11	333.51	6.28	24.13	3.32
2011Q2	15229.8	364.67	6.45	22.01	3.72
2011Q3	16368.91	387.48	8.64	6.36	5.01
2011Q4	17428.53	476.08	9.65	7.11	6.93
2012Q1	16675.1	454.79	1.87	6.37	1.08
2012Q2	17968.3	483.24	8.74	6.93	4.93
2012Q3	18735.3	499.71	14.75	7.54	7.26
2012Q4	19220.92	546.91	22.65	10.72	18.24
2013Q1	18522.19	611.25	26.28	11.37	22.88
2013Q2	20149.67	675.09	30.94	9.36	28.92
2013Q3	20703.82	729.23	43.14	12.29	33.92
2013Q4	21634.28	813.36	60.65	14.28	57.08
2014Q1	20381.9	784.05	67.46	16.6	66.35
2014Q2	21957.45	852.36	70.25	14.14	74.16
2014Q3	23232.82	1027.92	78	18.94	86.49
2014Q4	24564.82	1015.55	96.34	24.37	119.48
2015Q1	16203.8	937.96	96.31	22.76	91.62
2015Q2	16623.05	962.43	104.57	17.05	100.44
2015Q3	18208.48	1011.48	112.42	22.39	109.31
2015Q4	18745.36	1058.38	135.2	29.38	141
2016Q1	22435.46	1069.99	144.75	31.69	135.24
2016Q2	23737.3	1134.49	163.71	26.27	168.28
2016Q3	26871.01	1246.8	189.95	30.76	223.06
2016Q4	29531.65	1536.85	260.58	43.63	230.31
2017Q1	26228.85	1502.05	285.98	46.57	260.59
2017Q2	27266.39	1544.23	324.13	37.09	295.24
2017Q3	29756.01	1558.76	364.55	45.58	239.36
2017Q4	31647.99	1832.55	435.15	55.35	306.82
2018Q1	28682.95	1568.95	474.73	60.74	329.12
2018Q2	30955.3	1603.17	543.63	53.26	410.57
2018Q3	33781.03	1591.01	650.41	69.07	498.08
2018Q4	35667.63	1716.96	714.35	221.53	592.94

Source: CBN Statistical Bulletin and National Bureau of Statistics, (2018).

Table 4.2

Year	LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
2009Q1	3.745966	2.138997	0.545307	0.641474	-1.22185
2009Q2	3.776504	2.163072	0.439333	0.715167	-0.95861
2009Q3	3.827255	2.100784	0.394452	1.718253	-0.284
2009Q4	3.843178	2.143608	0.359835	1.3485	-0.23657
2010Q1	4.106883	1.796505	0.44248	0.52763	-0.06048
2010Q2	4.118645	1.906981	0.426511	0.62941	0.136721
2010Q3	4.161865	2.06032	0.447158	0.997386	0.264818
2010Q4	4.176695	2.150756	0.651278	0.873902	0.409933
2011Q1	4.166907	2.523109	0.79796	1.382557	0.521138
2011Q2	4.182694	2.5619	0.80956	1.34262	0.570543
2011Q3	4.21402	2.588249	0.936514	0.803457	0.699838
2011Q4	4.241261	2.67768	0.984527	0.85187	0.840733
2012Q1	4.222068	2.657811	0.271842	0.804139	0.033424
2012Q2	4.254507	2.684163	0.941511	0.840733	0.692847
2012Q3	4.272661	2.698718	1.168792	0.877371	0.860937
2012Q4	4.283774	2.737916	1.355068	1.030195	1.261025
2013Q1	4.267692	2.786219	1.419625	1.05576	1.359456
2013Q2	4.304268	2.829362	1.49052	0.971276	1.461198
2013Q3	4.31605	2.862865	1.63488	1.089552	1.530456
2013Q4	4.335142	2.910283	1.782831	1.154728	1.756484
2014Q1	4.309245	2.894344	1.829046	1.220108	1.821841
2014Q2	4.341582	2.930623	1.846646	1.150449	1.87017
2014Q3	4.366102	3.011959	1.892095	1.27738	1.936966
2014Q4	4.390314	3.006701	1.983807	1.386856	2.077295
2015Q1	4.209617	2.972184	1.983671	1.357172	1.96199
2015Q2	4.220711	2.983369	2.019407	1.231724	2.001907
2015Q3	4.260274	3.004957	2.050844	1.350054	2.03866
2015Q4	4.272894	3.024642	2.130977	1.468052	2.149219
2016Q1	4.350935	3.02938	2.160619	1.500922	2.131105
2016Q2	4.375431	3.054801	2.214075	1.41946	2.226033
2016Q3	4.429284	3.095797	2.278639	1.487986	2.348422
2016Q4	4.470288	3.186631	2.415941	1.639785	2.362313
2017Q1	4.418779	3.176684	2.456336	1.668106	2.415958
2017Q2	4.435628	3.188712	2.510719	1.569257	2.470175
2017Q3	4.473575	3.192779	2.561757	1.658774	2.379052
2017Q4	4.500346	3.263056	2.638639	1.743118	2.486884
2018Q1	4.457624	3.195609	2.676447	1.783475	2.517354
2018Q2	4.490735	3.20498	2.735303	1.726401	2.613387
2018Q3	4.528673	3.201673	2.813187	1.839289	2.697299
2018Q4	4.552274	3.23476	2.853911	2.345433	2.773011

Source: Excel software

4.3 DATA PRESENTATION AND ANALYSIS

The data presented above was analyzed using multiple regressions with the aid of E-view because of the volume of data and to ensure accuracy in computation. The attempt to study the relationship between bank base technology product and economic growth in Nigeria led the researcher to subject the data collected to Unit Root test, Johansen Cointegration test and Vector Error Correction Model. The variables considered in this research work are: Real Gross Domestic Product (RGDP) which is the dependent variable, and the independent variables are Automated Teller Machine (ATM), Point of Sales (POS), Internet Banking (IB) and Mobile Banking (MB). The empirical results are presented below as generated from the analysis:

Table 4.3: UNIT ROOT TEST RESULT

Variable	ADF value	5% critical value	Order of Integration	Remarks
RGDP	-6.264535	-2.941145	I(1)	Stationary
ATM	-5.980892	-2.941145	I(1)	Stationary
POS	-8.029253	-2.941145	I(1)	Stationary
IB	-6.120782	-2.941145	I(1)	Stationary
MB	-7.638829	-2.941145	I(1)	Stationary

Source: Student's Computation (See Appendix)

The unit root result in Table 4.3 above indicates that none of the variables (RGDP, ATM, POS, IB, and MB) is stationary at level, but they became stationary upon first differencing as their ADF values (6.264535, 5.980892, 8.029253, 6.120782 and 7.638829) became greater than the values of the 5% critical value (2.941145, 2.941145, 2.941145, 2.941145 and 2.941145). Since they all became stationary after the first differencing, we proceed to conduct cointegration test and short-run speed of adjustment from long-run disequilibrium.

Table 4.4: JOHANSEN COINTEGRATION TEST RESULT

Hypothesized No. of CE	Eigen value	Trace statistics	0.05 critical value	Prob.
None*	0.898420	165.5834	69.81889	0.0000
At most 1*	0.760420	85.54156	47.85613	0.0000
At most 2*	0.509201	35.53119	29.79707	0.0098
At most 3*	0.259551	10.62095	15.49471	0.2359
At most 4*	0.002944	0.103209	3.841466	0.7480

Source: Student's computation (See Appendix)

From equation 4.4 above, the results of the cointegration indicated that the trace statistics is greater than the critical value at 5 percent level of significance in two of the equations. This shows that there is a cointegrating relationship among the variables used to model the relationship between Economic growth and electronic banking in Nigeria for the period under study. The p-values (0.0000, 0.0000 and 0.0098) which are less than 0.05 significant values confirm that. Hence, we reject the null hypothesis which states that there is no cointegrating relationship among the variables. The test result shows the existence of a long-run relationship in two cointegrating equations at 5% significance level.

At most 3- prob. (0.2359) which is greater than the critical value at 5%, we cannot reject the null hypothesis, means that there are at most three (3) cointegrated relationships in the model or there is three error terms exist on the model. All variables have long-run associationship, so we can run VECM.

Table 4.5: VECM (Least Squares (Gauss-Newton / Marquardt steps) RESULT

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.259649	0.113807	-2.281476	0.0313
C(2)	0.028463	0.172926	0.164596	0.8706
C(3)	0.248396	0.119226	2.083398	0.0476
C(4)	-0.062588	0.099215	-0.630833	0.5339
C(5)	-0.106763	0.046634	-2.289394	0.0308
C(6)	0.017082	0.082613	0.206774	0.8379
C(7)	0.058177	0.168807	0.344634	0.7333
C(8)	-0.037923	0.127008	-0.298584	0.7677
C(9)	-0.190947	0.088870	-2.148614	0.0415
C(10)	0.007192	0.051718	0.139059	0.8905
C(11)	0.158507	0.081634	1.941666	0.0635
C(12)	0.012198	0.011287	1.080689	0.2902

R-squared	0.589745	Mean dependent var	0.019595
Adjusted R-squared	0.409233	S.D. dependent var	0.058343
S.E. of regression	0.044843	Akaike info criterion	-3.114675
Sum squared resid	0.050273	Schwarz criterion	-2.592215
Log likelihood	69.62148	Hannan-Quinn criter.	-2.930483
F-statistic	3.267067	Durbin-Watson stat	2.108610
Prob(F-statistic)	0.006853		

Given the fact that there is presence of a cointegrating vector among the variables as shown by the cointegration tests, VECM is conducted to check the

speed of adjustment from short-run dynamics to their long-run static disposition:

ΔRGDPt-1 = -0.259649ECTt-1 + 0.028463RGDPt-1 + 0.058177RGDPt-2 + 0.248396ATMt-1 – 0.037923ATMt-2 – 0.106763IBt-1 = 0.007192IBt-2 + 0.017082MBt-1 + 0.158507MBt-2 – 0.062588POSt-1 – 0.190947POSt-2 + 0.012198

From the table 4.5 above, ECM(-1) was consistent by assuming a negative value. This suggests that the ECM could correct any deviation from the long run equilibrium relationship between RGDP and the explanatory variables. The coefficient indicates a speedy adjustment of 26.964% per annum. This implies that following short-run disequilibrium, 25.964% of the adjustment to the long-run takes place within one year. The result in table 4.4 above shows that R2 is 0.5897, which shows that the model explains about 58.97% of the total variations in Economic growth as explained by the independent variables during the period of the study, while 41.03% is explained by variables not included in the model.

The result also shows the F-statistics = 3.267067, which is used to test the model of the study to ascertain if there exist significant relationship between the parameters. The probability of the F-statistics value is 0.006853. This shows that a significant relationship exists between bank base technology product and economic growth. This is evidenced by the probability value which is less than the 0.05 level of significance.

At 2.11; the Durbin-Watson statistics suggest absence of serial autocorrelation.

4.4 TEST OF HYPOTHESES

Hypothesis 1

H0: There is no significant relationship between Point-of-Sale and economic growth.

The T-statistics is used to test for the individual statistical significance of the parameter estimates. From the Regression result, the prob. (T-statistics) Value > 0.05, i.e. 0.5339 > 0.05, therefore we accept H0 and reject the alternative and conclude that there is no significant relationship between POS and economic growth.

Hypothesis 2

H0: There is no significant relationship between Internet Banking (IB) and economic growth (RGDP).

Here the probability of the T-statistics, 0.0308, which is less than the 0.05 significance level, proves that there exists a significant relationship between Internet Banking and economic growth. Therefore, we reject the null hypothesis and accept the alternative and conclude that there is a significant relationship between IB and RGDP.

Hypothesis 3

H0: There is no significant relationship between Automated Teller Machine (ATM) and economic growth (RGDP).

The probability of the ATM T-statistic, 0.0476, which is less than the acceptable significant level of 0.05, proves that a significant relationship exists between ATM and RGDP. Therefore, we reject the null and accept the alternative and conclude that there is a significant relationship between ATM and RGDP.

Hypothesis 4

H0: There is no significant relationship between Mobile Banking (MB) and Economic Growth (RGDP).

The probability of the MB T-statistic, 0.8379 which is greater than the significant level of 0.05, shows there is no significant relationship between MB and RGDP. So we accept the null hypothesis and reject the alternative and confirm no significant relationship exists between MB and RGDP.

4.5 DISCUSSION OF MAJOR FINDINGS

RGDP = 0.012198 + 0.248396ATM – 0.106763IB + 0.017082MB – 0.0625588POS

The equation above shows the estimated regression equation used to analyze the impact of Electronic Banking on Economic growth in Nigeria. The equation shows that ATMs and MB were found to have a positive impact on economic growth while POS and WB showed a negative impact. ATM, which has a statistical significance relationship with RGDP has a coefficient value of 0.248396. This implies that a unit change in ATM will increase Economic growth by 24.8396% if other factors are kept constant. IB which also has a significant relationship with RGDP has a negative coefficient value of -0.106763. This implies that an inverse relationship exists between the variables. A unit increase or decrease in IB would lead to 10.68% decrease or increase in RGDP.

No significant relationship exists between POS, MB and RGDP. This could be because of many factors.

Nigerians fear making use of POS in their day-to-day transactions. This is because most times it takes longer time to reverse money wrongly debited from customer's account during POS transactions. Sometimes the money is not

reversed at all except with a persistent disturbance from the customer, which makes him to spend more money in going to the bank branches or even money on airtime as he calls the bank's customer service line to have his money reversed.

The charge on POS transactions is also a discouraging factor to the customers as the extra charges are unplanned expenses which eat into their income. When the income of customers keeps being debited as bank charges, they can't count them as money spent on consumables and thus the GDP is affected as the customers have less money to spend.

Another discouraging factor is that POS is easily used to perpetrate different forms of fraud. This is because it portable and very easy to navigate. It does not have second order security measures like internet banking that requires an OTP before a transaction can be completed.

The use of Mobile Banking has not been generally accepted by Nigerians as it comes with a whole lot of challenges too. It has an unfriendly user interface where customers who do not have clear knowledge of how to operate phones find it difficult to make transactions using mobile banking.

Because it uses mobile networks, the unstable network provided by network providers in Nigeria makes it unreliable as customers do not trust it to always deliver. This has led to its poor usage and thus led to its insignificant impact in the economic growth of Nigeria.

The R- square which was 58.97% and depicts goodness of fit as it shows that the explanatory could explain about 58.97% of the fluctuation in the economic growth. ECM(-1) was consistent by assuming a negative value. This suggests that the ECM could correct any deviation from the long run equilibrium relationship between RGDP and the explanatory variables. The coefficient indicates a speedy adjustment of 26.964% per annum. The result of the study further showed that there is a long-run relationship between e-banking and economic growth in Nigeria.

This agrees with the findings of Ogbeide, Nwamaka and Ishiuwu (2016) who investigated the impact of electronic banking on Nigerian economic growth.

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

From the analysis in this work, real GDP could be regarded as a term used to describe economic growth, which is one of the macroeconomic objectives. The following summary is made in respect to the findings from the previous chapter.

From the above it is seen that a positive relationship exists between Automated Teller Machine, Mobile Banking, Point-of-Sale, and real Gross Domestic Product while Internet Banking exhibits a negative relationship with real Gross Domestic Product.

• The result of the T-test shows that only Automated Teller Machine (ATM) is statistically significant.

• The overall test of significance i.e. F-test that Electronic Banking has a positive impact on economic growth in Nigeria between 2009Q1 and 2018Q4. These findings clearly demonstrates that the researcher has not only answered the research questions but also achieved the research objectives set out in chapter one.

5.2 CONCLUSION

The result derived from the estimated model showed that bank base technology product has a significant relationship with Nigeria's economic growth, while the variables, except Automated Teller Machine (ATM), individually shows that the explanatory variables have no significant relationship with Nigeria's economic growth for the period under consideration. This study has examined Bank base technology product in relation to economic growth. In the view of this research, the conclusion is that Bank Base Technology Product exerts positive effects upon Nigeria's economic growth.

5.3 RECOMMENDATIONS

Based on the analysis carried out during this research work and the conclusion drawn from it, the following recommendations are made regarding the growth of the Nigerian economy.

• The government should enforce the use of Bank base technology product. This is because when there is ease of transaction, capital flows smoothly between the deficit spending unit and the surplus spending units in the economy.

• More work should be done to encourage the use of MB and POS, which at the time of this research has no significant impact on RGDP.

• The cashless policy should be enforced more to make the public generally uncomfortable with moving physical cash around.

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Appendix

Null Hypothesis: LOGRGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.508949	0.1211
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGRGDP)
Method: Least Squares
Date: 02/13/20 Time: 11:30
Sample (adjusted): 2009Q2 2018Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGRGDP(-1)	-0.112926	0.045009	-2.508949	0.0166
C	0.501683	0.191908	2.614187	0.0129

R-squared	0.145394	Mean dependent var	0.020675
Adjusted R-squared	0.122297	S.D. dependent var	0.057029
S.E. of regression	0.053428	Akaike info criterion	-2.971050
Sum squared resid	0.105618	Schwarz criterion	-2.885739
Log likelihood	59.93547	Hannan-Quinn criter.	-2.940441
F-statistic	6.294826	Durbin-Watson stat	2.180289
Prob(F-statistic)	0.016618		

Null Hypothesis: D(LOGRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.264535	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGRGDP,2)
Method: Least Squares
Date: 02/13/20 Time: 11:32
Sample (adjusted): 2009Q3 2018Q4

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGRGDP(-1))	-1.042750	0.166453	-6.264535	0.0000
C	0.021296	0.010092	2.110045	0.0419

R-squared	0.521559	Mean dependent var	-0.000183
Adjusted R-squared	0.508269	S.D. dependent var	0.083444
S.E. of regression	0.058514	Akaike info criterion	-2.787899
Sum squared resid	0.123261	Schwarz criterion	-2.701710
Log likelihood	54.97008	Hannan-Quinn criter.	-2.757234
F-statistic	39.24440	Durbin-Watson stat	1.994195
Prob(F-statistic)	0.000000		

Null Hypothesis: LOGATM has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.095317	0.7081
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGATM)
Method: Least Squares
Date: 02/13/20 Time: 11:34
Sample (adjusted): 2009Q2 2018Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGATM(-1)	-0.040010	0.036528	-1.095317	0.2805
C	0.138480	0.101874	1.359323	0.1823

R-squared	0.031407	Mean dependent var	0.028096
Adjusted R-squared	0.005228	S.D. dependent var	0.093338
S.E. of regression	0.093094	Akaike info criterion	-1.860502
Sum squared resid	0.320657	Schwarz criterion	-1.775191
Log likelihood	38.27979	Hannan-Quinn criter.	-1.829893
F-statistic	1.199720	Durbin-Watson stat	1.977686
Prob(F-statistic)	0.280457		

Null Hypothesis: D(LOGATM) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.980892	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGATM,2)
Method: Least Squares
Date: 02/13/20 Time: 11:35
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGATM(-1))	-0.996824	0.166668	-5.980892	0.0000
C	0.028114	0.016239	1.731222	0.0920

R-squared	0.498405	Mean dependent var	0.000237
Adjusted R-squared	0.484472	S.D. dependent var	0.133555
S.E. of regression	0.095893	Akaike info criterion	-1.799978
Sum squared resid	0.331035	Schwarz criterion	-1.713789
Log likelihood	36.19958	Hannan-Quinn criter.	-1.769312
F-statistic	35.77107	Durbin-Watson stat	1.978141
Prob(F-statistic)	0.000001		

Null Hypothesis: LOGPOS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.333275	0.9105
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGPOS)
Method: Least Squares
Date: 02/13/20 Time: 11:37
Sample (adjusted): 2009Q2 2018Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGPOS(-1)	-0.011575	0.034731	-0.333275	0.7408
C	0.077151	0.060724	1.270516	0.2118

R-squared	0.002993	Mean dependent var	0.059195
Adjusted R-squared	-0.023953	S.D. dependent var	0.172884
S.E. of regression	0.174942	Akaike info criterion	-0.598799
Sum squared resid	1.132380	Schwarz criterion	-0.513488
Log likelihood	13.67658	Hannan-Quinn criter.	-0.568190
F-statistic	0.111073	Durbin-Watson stat	2.495888
Prob(F-statistic)	0.740808		

Null Hypothesis: D(LOGPOS) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.029253	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGPOS,2)
Method: Least Squares
Date: 02/13/20 Time: 11:39
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGPOS(-1))	-1.271067	0.158305	-8.029253	0.0000
C	0.079719	0.028949	2.753759	0.0092

R-squared	0.641680	Mean dependent var	0.003860
Adjusted R-squared	0.631727	S.D. dependent var	0.277964
S.E. of regression	0.168684	Akaike info criterion	-0.670386
Sum squared resid	1.024352	Schwarz criterion	-0.584197
Log likelihood	14.73732	Hannan-Quinn criter.	-0.639720
F-statistic	64.46891	Durbin-Watson stat	2.128887
Prob(F-statistic)	0.000000		

Null Hypothesis: LOGIB has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.639273	0.9890
Test critical values:	1% level	-3.621023	
	5% level	-2.943427	
	10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGIB)
Method: Least Squares
Date: 02/13/20 Time: 11:41
Sample (adjusted): 2009Q4 2018Q4
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGIB(-1)	0.070092	0.109643	0.639273	0.5271
D(LOGIB(-1))	-0.150131	0.131942	-1.137855	0.2634
D(LOGIB(-2))	-0.549973	0.127785	-4.303897	0.0001
C	-0.050976	0.139121	-0.366413	0.7164

R-squared	0.379422	Mean dependent var	0.016951
Adjusted R-squared	0.323006	S.D. dependent var	0.234839
S.E. of regression	0.193224	Akaike info criterion	-0.348123
Sum squared resid	1.232077	Schwarz criterion	-0.173970
Log likelihood	10.44028	Hannan-Quinn criter.	-0.286726
F-statistic	6.725405	Durbin-Watson stat	1.548593
Prob(F-statistic)	0.001150		

Null Hypothesis: D(LOGIB) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.120782	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGIB,2)
Method: Least Squares
Date: 02/13/20 Time: 11:42
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGIB(-1))	-1.058723	0.172972	-6.120782	0.0000
C	0.044753	0.046544	0.961517	0.3427

R-squared	0.509964	Mean dependent var	0.011380
Adjusted R-squared	0.496352	S.D. dependent var	0.401505
S.E. of regression	0.284941	Akaike info criterion	0.378124

Sum squared resid	2.922882	Schwarz criterion	0.464313
Log likelihood	-5.184358	Hannan-Quinn criter.	0.408789
F-statistic	37.46397	Durbin-Watson stat	1.684147
Prob(F-statistic)	0.000000		

Null Hypothesis: LOGMB has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.796935	0.0682
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGMB)
Method: Least Squares
Date: 02/13/20 Time: 11:43
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGMB(-1)	-0.092017	0.032899	-2.796935	0.0083
D(LOGMB(-1))	-0.309632	0.150332	-2.059654	0.0469
C	0.259360	0.060465	4.289419	0.0001

R-squared	0.226375	Mean dependent var	0.098200
Adjusted R-squared	0.182168	S.D. dependent var	0.216414
S.E. of regression	0.195712	Akaike info criterion	-0.348693
Sum squared resid	1.340605	Schwarz criterion	-0.219410
Log likelihood	9.625175	Hannan-Quinn criter.	-0.302695
F-statistic	5.120785	Durbin-Watson stat	1.878288
Prob(F-statistic)	0.011202		

Null Hypothesis: D(LOGMB) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.638829	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGMB,2)
Method: Least Squares
Date: 02/13/20 Time: 11:45
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGMB(-1))	-1.229517	0.160956	-7.638829	0.0000
C	0.121872	0.038400	3.173725	0.0031

R-squared	0.618449	Mean dependent var	-0.004935
Adjusted R-squared	0.607850	S.D. dependent var	0.340861
S.E. of regression	0.213453	Akaike info criterion	-0.199601
Sum squared resid	1.640243	Schwarz criterion	-0.113413
Log likelihood	5.792424	Hannan-Quinn criter.	-0.168936
F-statistic	58.35171	Durbin-Watson stat	1.869217
Prob(F-statistic)	0.000000		

Date: 02/13/20 Time: 11:47
Sample (adjusted): 2010Q2 2018Q4
Included observations: 35 after adjustments
Trend assumption: Linear deterministic trend
Series: LOGRGDP LOGATM LOGPOS LOGIB LOGMB
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.898420	165.5834	69.81889	0.0000
At most 1 *	0.760420	85.54156	47.85613	0.0000
At most 2 *	0.509201	35.53119	29.79707	0.0098
At most 3	0.259557	10.62095	15.49471	0.2359
At most 4	0.002944	0.103209	3.841466	0.7480

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.898420	80.04180	33.87687	0.0000
At most 1 *	0.760420	50.01037	27.58434	0.0000
At most 2 *	0.509201	24.91024	21.13162	0.0140
At most 3	0.259557	10.51775	14.26460	0.1801
At most 4	0.002944	0.103209	3.841466	0.7480

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
-16.80669	22.98520	21.16026	-6.471415	-17.92802
62.27114	-16.43941	-49.29415	18.93507	32.64859
-11.45280	14.39134	15.45227	-6.699227	-16.57943
14.48081	-17.68421	29.38784	-18.02249	-16.07377
-9.264393	-4.242567	32.50814	-29.16878	-15.40855

Unrestricted Adjustment Coefficients (alpha):

D(LOGRGDP)	-0.006790	-0.012912	0.011614	0.007002	0.001223
D(LOGATM)	-0.019885	0.001201	-0.002351	0.006845	0.000924
D(LOGPOS)	0.002828	0.044952	0.060058	0.005686	0.000815
D(LOGIB)	0.034068	0.036205	-0.023643	0.023314	0.002312
D(LOGMB)	-0.007359	0.041991	0.073175	0.018986	-0.000148

1 Cointegrating Equation(s): Log likelihood 327.3411

Normalized cointegrating coefficients (standard error in parentheses)

LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
1.000000	-1.367622	-1.259038	0.385050	1.066719
	(0.14001)	(0.27184)	(0.19297)	(0.16331)

Adjustment coefficients (standard error in parentheses)

D(LOGRGDP)	0.114122
	(0.16053)
D(LOGATM)	0.334206
	(0.10713)
D(LOGPOS)	-0.047531
	(0.46827)
D(LOGIB)	-0.572576
	(0.38615)
D(LOGMB)	0.123679
	(0.55618)

2 Cointegrating Equation(s): Log likelihood 352.3463

Normalized cointegrating coefficients (standard error in parentheses)

LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
1.000000	0.000000	-0.679791	0.284704	0.394545
		(0.15118)	(0.10272)	(0.09804)
0.000000	1.000000	0.423543	-0.073372	-0.491491
		(0.24737)	(0.16807)	(0.16041)

Adjustment coefficients (standard error in parentheses)

D(LOGRGDP)	-0.689920	0.056190
	(0.57115)	(0.25024)
D(LOGATM)	0.409017	-0.476818
	(0.41058)	(0.17989)

D(LOGPOS)	2.751680	-0.673979
	(1.60714)	(0.70414)
D(LOGIB)	1.681980	0.187871
	(1.33291)	(0.58399)
D(LOGMB)	2.738490	-0.859449
	(1.99792)	(0.87535)

3 Cointegrating Equation(s): Log likelihood 364.8014

Normalized cointegrating coefficients (standard error in parentheses)

LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
1.000000	0.000000	0.000000	-0.746024	-1.763073
			(1.28522)	(0.61638)
0.000000	1.000000	0.000000	0.568822	0.852811
			(0.81491)	(0.39082)
0.000000	0.000000	1.000000	-1.516244	-3.173944
			(1.89366)	(0.90818)

Adjustment coefficients (standard error in parentheses)

D(LOGRGDP)	-0.822931	0.223328	0.672260
	(0.54034)	(0.26158)	(0.46047)
D(LOGATM)	0.435944	-0.510653	-0.516329
	(0.41481)	(0.20081)	(0.35349)
D(LOGPOS)	2.063850	0.190334	-1.227997
	(1.21396)	(0.58768)	(1.03452)
D(LOGIB)	1.952753	-0.152377	-1.429154
	(1.28380)	(0.62149)	(1.09404)
D(LOGMB)	1.900432	0.193637	-1.094895
	(1.53296)	(0.74211)	(1.30637)

4 Cointegrating Equation(s): Log likelihood 370.0603

Normalized cointegrating coefficients (standard error in parentheses)

LOGRGDP	LOGATM	LOGPOS	LOGIB	LOGMB
1.000000	0.000000	0.000000	0.000000	0.091229
				(0.05034)
0.000000	1.000000	0.000000	0.000000	-0.561042
				(0.09340)
0.000000	0.000000	1.000000	0.000000	0.594801
				(0.33955)
0.000000	0.000000	0.000000	1.000000	2.485579
				(0.66570)

Adjustment coefficients (standard error in parentheses)

D(LOGRGDP)	-0.721544	0.099512	0.878020	-0.404535
	(0.53783)	(0.29108)	(0.50575)	(0.22247)
D(LOGATM)	0.535070	-0.631708	-0.315158	0.043814
	(0.40528)	(0.21934)	(0.38110)	(0.16764)
D(LOGPOS)	2.146193	0.089775	-1.060887	0.328044
	(1.23875)	(0.67043)	(1.16487)	(0.51239)
D(LOGIB)	2.290354	-0.564662	-0.744013	0.203297
	(1.24117)	(0.67174)	(1.16714)	(0.51339)
D(LOGMB)	2.175361	-0.142112	-0.536943	0.010333
	(1.52970)	(0.82790)	(1.43846)	(0.63274)

Vector Error Correction Estimates
Date: 02/13/20 Time: 13:03
Sample (adjusted): 2009Q4 2018Q4
Included observations: 37 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOGRGDP(-1)	1.000000
LOGATM(-1)	-0.260689 (0.11015) [-2.36675]
LOGPOS(-1)	-0.589933 (0.32753) [-1.80113]
LOGIB(-1)	0.078960 (0.18877) [0.41830]
LOGMB(-1)	0.412324 (0.21612) [1.90786]
C	-3.314956

Error Correction:	D(LOGRGDP)	D(LOGATM)	D(LOGPOS)	D(LOGIB)	D(LOGMB)
CointEq1	-0.259649 (0.11381) [-2.28148]	0.508108 (0.21310) [2.38434]	1.011679 (0.36756) [2.75241]	0.970002 (0.44567) [2.17648]	0.759431 (0.48375) [1.56989]
D(LOGRGDP(-1))	0.028463 (0.17293) [0.16460]	-0.197469 (0.32380) [-0.60985]	0.368388 (0.55849) [0.65961]	0.498735 (0.67718) [0.73648]	0.707395 (0.73503) [0.96240]
D(LOGRGDP(-2))	0.058177 (0.16881) [0.34463]	-0.047549 (0.31609) [-0.15043]	-0.033226 (0.54519) [-0.06094]	-0.340995 (0.66105) [-0.51583]	0.378626 (0.71753) [0.52768]
D(LOGATM(-1))	0.248396 (0.11923) [2.08340]	-0.248170 (0.22325) [-1.11163]	-0.765427 (0.38506) [-1.98780]	-0.593416 (0.46690) [-1.27098]	-0.887126 (0.50678) [-1.75051]
D(LOGATM(-2))	-0.037923 (0.12701) [-0.29858]	0.146904 (0.23782) [0.61771]	-0.945295 (0.41020) [-2.30450]	-1.174847 (0.49737) [-2.36212]	-0.927205 (0.53986) [-1.71750]
D(LOGPOS(-1))	-0.062588 (0.09921) [-0.63083]	0.046819 (0.18578) [0.25202]	0.114203 (0.32043) [0.35640]	0.616802 (0.38853) [1.58753]	0.188743 (0.42172) [0.44756]
D(LOGPOS(-2))	-0.190947 (0.08887)	0.056737 (0.16641)	0.166737 (0.28702)	0.649441 (0.34802)	0.258811 (0.37775)

	[-2.14861]	[0.34095]	[0.58092]	[1.86611]	[0.68514]
D(LOGIB(-1))	-0.106763	0.045793	0.343531	0.242702	0.298324
	(0.04663)	(0.08732)	(0.15061)	(0.18262)	(0.19822)
	[-2.28939]	[0.52442]	[2.28090]	[1.32900]	[1.50501]
D(LOGIB(-2))	0.007192	-0.100033	0.591579	-0.058936	0.555154
	(0.05172)	(0.09684)	(0.16703)	(0.20253)	(0.21983)
	[0.13906]	[-1.03296]	[3.54167]	[-0.29100]	[2.52535]
D(LOGMB(-1))	0.017082	0.037975	-0.497728	-0.525869	-0.502949
	(0.08261)	(0.15469)	(0.26681)	(0.32351)	(0.35115)
	[0.20677]	[0.24549]	[-1.86546]	[-1.62549]	[-1.43229]
D(LOGMB(-2))	0.158507	-0.026904	-0.351151	-0.516941	-0.262078
	(0.08163)	(0.15286)	(0.26365)	(0.31968)	(0.34699)
	[1.94167]	[-0.17600]	[-1.33187]	[-1.61704]	[-0.75528]
C	0.012198	0.032570	0.148970	0.086067	0.136326
	(0.01129)	(0.02113)	(0.03645)	(0.04420)	(0.04798)
	[1.08069]	[1.54104]	[4.08655]	[1.94717]	[2.84150]
R-squared	0.589745	0.453654	0.521413	0.611680	0.347322
Adj. R-squared	0.409233	0.213262	0.310834	0.440819	0.060144
Sum sq. resids	0.050273	0.176267	0.524392	0.770959	0.908306
S.E. equation	0.044843	0.083968	0.144830	0.175609	0.190610
F-statistic	3.267067	1.887144	2.476098	3.579990	1.209429
Log likelihood	69.62148	46.41277	26.24331	19.11348	16.08048
Akaike AIC	-3.114675	-1.860150	-0.769909	-0.384512	-0.220567
Schwarz SC	-2.592215	-1.337690	-0.247449	0.137947	0.301893
Mean dependent	0.019595	0.030648	0.066472	0.016951	0.082622
S.D. dependent	0.058343	0.094667	0.174460	0.234839	0.196614

Determinant resid covariance (dof adj.)	1.11E-11
Determinant resid covariance	1.56E-12
Log likelihood	240.4068
Akaike information criterion	-9.481448
Schwarz criterion	-6.651457
Number of coefficients	65

Dependent Variable: D(LOGRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/13/20 Time: 15:43
Sample (adjusted): 2009Q4 2018Q4
Included observations: 37 after adjustments
D(LOGRGDP) = C(1)*(LOGRGDP(-1) - 0.260688744271*LOGATM(-1) - 0.589932877604*LOGPOS(-1) + 0.0789604887501*LOGIB(-1) + 0.412323718955*LOGMB(-1) - 3.31495621729) + C(2)*D(LOGRGDP(-1)) + C(3)*D(LOGATM(-1)) + C(4)*D(LOGPOS(-1)) + C(5)*D(LOGIB(-1)) + C(6)*D(LOGMB(-1)) + C(7)*D(LOGRGDP(-2)) + C(8)*D(LOGATM(-2)) + C(9)*D(LOGPOS(-2)) + C(10)*D(LOGIB(-2)) + C(11)*D(LOGMB(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.

C(1)	-0.259649	0.113807	-2.281476	0.0313
C(2)	0.028463	0.172926	0.164596	0.8706
C(3)	0.248396	0.119226	2.083398	0.0476
C(4)	-0.062588	0.099215	-0.630833	0.5339
C(5)	-0.106763	0.046634	-2.289394	0.0308
C(6)	0.017082	0.082613	0.206774	0.8379
C(7)	0.058177	0.168807	0.344634	0.7333
C(8)	-0.037923	0.127008	-0.298584	0.7677
C(9)	-0.190947	0.088870	-2.148614	0.0415
C(10)	0.007192	0.051718	0.139059	0.8905
C(11)	0.158507	0.081634	1.941666	0.0635
C(12)	0.012198	0.011287	1.080689	0.2902

R-squared	0.589745	Mean dependent var	0.019595
Adjusted R-squared	0.409233	S.D. dependent var	0.058343
S.E. of regression	0.044843	Akaike info criterion	-3.114675
Sum squared resid	0.050273	Schwarz criterion	-2.592215
Log likelihood	69.62148	Hannan-Quinn criter.	-2.930483
F-statistic	3.267067	Durbin-Watson stat	2.108610
Prob(F-statistic)	0.006853		