Effect of Formal Financial Sector on Financial Deepening in Nigeria

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Abstract
This study examined the effect of the formal financial sector on financial deepening in Nigeria for the period 2012Q1 to 2022Q3. The specific objectives of the study were to investigate the effect of deposit money bank development on financial deepening in Nigeria; to assess the effect of the insurance industry development on financial deepening in Nigeria; to determine the effect of stock market development on financial deepening in Nigeria. The study adopted an ex-post facto research design from the quarterly time series data generated from the Central Bank of Nigeria statistical bulletin on deposit money bank development, insurance industry development, stock market development, and financial deepening. The data were analysed using the Johansen co-integration test and Fully Modified Ordinary Least Squares estimation. The findings showed that both deposit money bank development and insurance industry development have significant effects on financial deepening in Nigeria, but stock market development has an insignificant effect on financial deepening in Nigeria. It was recommended that Nigerian deposit money banks should employ strategies that will develop the industry, especially investing in technology and Artificial Intelligence (AI), such that most of its banking products and activities will be carried out seamlessly in the comfort of the customers. Furthermore, National Insurance Commission should create a regulatory framework that encourages the establishment of new insurance companies, promote transparency and accountability in the industry, and ensure that insurers have adequate capitalization. Finally, the Nigerian Exchange Group need to do more in getting companies listed.

Keywords: Deposit Money Bank Development, Insurance Industry Development, Stock Market Development, Financial Deepening.

I. Introduction
The financial sector is essential to every economy because it combines services for value exchange, intermediation, risk transfer, and liquidity. The formal financial industry, which encompasses a wide range of businesses such as banks, investment firms, insurance firms, pension funds, and the Nigerian Exchange Group, is part of the financial sector. Additionally, local banks, cooperative societies, thrift and loan associations, and moneylenders are all part of the unregulated financial sector.

The formal sector is a collection of formal institutions created to raise the standard of living in the nation by offering more chances for savings through a variety of services and loans (Abdelzaher, 2019). Since the government heavily regulates their operations, they are also eligible for government subsidies, grants, and other forms of assistance from donor organizations. They engage in more intricate administrative processes in their daily operations as a result of their high levels of regulation, which also raises the cost of transactions. Savings that have been mobilized but not lent have additional investment prospects with formal financial institutions. According to this study, the formal financial institutions include deposit money banks, insurance firms, and the Nigerian Exchange Group, all active in raising capital and generating economic credit.

Since it first came under scrutiny, the formal financial sector has undergone several reforms to increase its stability and viability, hence promoting economic growth and development. The demutualization of the Nigerian Stock Exchange to the Nigerian Exchange Group, the Central Securities Clearing System (CSCS) within the stock market, the proposed recapitalization of insurance companies by NAICOM, and the introduction of Micro-insurance plans are a few of these reforms. The formal financial sector in Nigeria should be strengthened as a result of these reforms, and consumers of the financial system should feel more confident. The number of people in the financial system rises when the users of the system have confidence in it, which encourages more people to fall into the financial net. Financial deepening is thought to be occurring. The Nigerian government has made financial deepening one of its top priorities in the last ten years, with policy reforms being implemented to increase the depth of the financial system. The development of the e-naira, the currency redesign policy, and the national domestic card policy are more recent policies. The question here is, have these reforms led to financial deepening in Nigeria? This study examined the effect of the formal financial sector on financial deepening in Nigeria.

Most studies were carried out on individual formal financial institutions like Adewunmi (2020) evaluated the performance of Deposit Money Banks (DMBs) and financial deepening (1989 to 2018). The study employed Ordinary Least Square (OLS) regression analysis method. Kehinde et al. (2022) examined the link between financial deepening and the development of the stock market over the period of 1981 and 2019 using the bound test cointegration ARDL approach. Tiamiyu (2022) established the link between financial deepening and the stock market development between 1981 and 2019 using the bound test cointegration ARDL approach. Chepkiyeng (2017) evaluated the effect of financial deepening on the financial performance of financial institutions in Kenya using Ordinary Least Square (OLS) regression analysis. While Abdelzaher (2019) carried out a literature review comparative study between informal and formal finance.

The above studies did not consider the effect of the formal financial sector on financial deepening which is the focus of this study. Also, these studies did not proxy the formal financial sector with deposit money banks development, insurance industry development, and stock market development which are the proxies of the formal financial sector in this study. Furthermore, the estimation of the long-run estimates in a co-integrated panel with the OLS will

yield inconsistent and inefficient parameters. Therefore, this study used Fully Modified Ordinary Least Square (FMOLS) estimation to estimate the long-run relationship after checking for cointegration. FMOLS is a nonparametric approach that will account for the problem of endogeneity and serial correlation in the OLS estimator which are associated with time series data. This will make the study unique from the previous studies. These highlighted gaps in the literature necessitated this study; "Effect of Formal Financial Sector on Financial Deepening in Nigeria", with a focus on the period after the monetary policy of financial inclusion in 2012. Given the rising policies in support of financial inclusion (Currency redesign, Daily withdrawal limits, National domestic card) it becomes imperative to ask:

i. What is the effect of deposit money banks' development on financial deepening in Nigeria?
ii. How has the development of the insurance industry deepened the financial sector in Nigeria?
iii. What is the effect of the stock market development on financial deepening in Nigeria?

The study hypothesized that:

H_{01}: Deposit money bank development has no significant effect on financial deepening in Nigeria.

H_{02}: Insurance industry development has no significant effect on financial deepening in Nigeria.

H_{03}: Stock market development has no significant effect on financial deepening in Nigeria.

II. Literature Reviews
Conceptual Review
This study examined the effect of the formal financial sector on financial deepening in Nigeria. This section reviews the works of literature on the concept of the formal financial sector and the concept of financial deepening.

Figure 1: Conceptual Framework of the Study
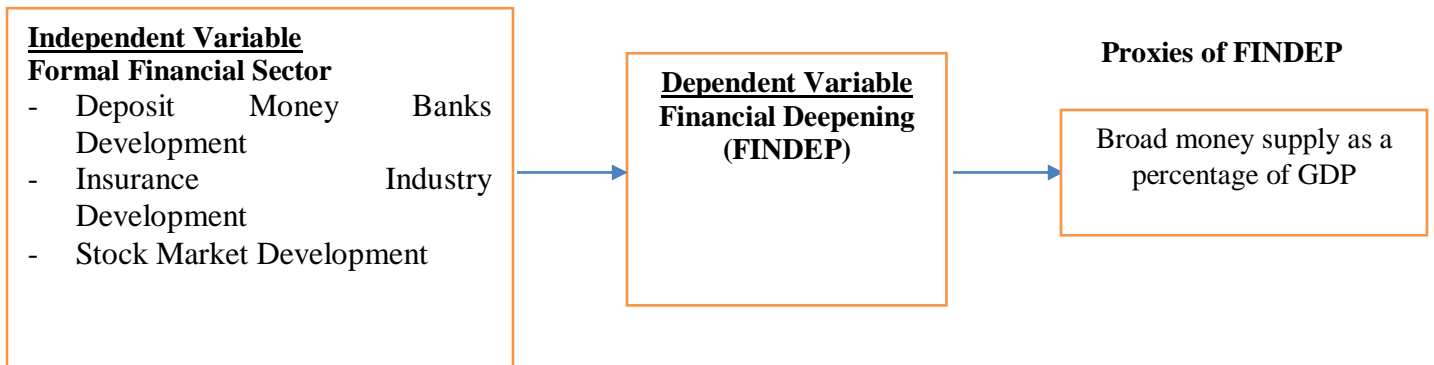
Source: Researcher 2023

Formal Financial Sector

The formal financial sector is a collection of formal institutions created to help the poor by giving them better opportunities to save money through a variety of services and loans (Abdelzaher, 2019). A statutory or legal authority has significant control over the formal financial system (Ghate, 2019). The formal financial sector consists of non-banking financial entities as well as financial organizations including Deposit Money Banks, Merchant Banks, Micro-Finance Banks, and others that are active in raising capital and generating credits in the economy.

In Nigeria, financial institutions such as Deposit Money Banks, insurance companies, Nigerian Exchange groups, and pension companies are all channels of the formal financial sector and they are agents of savings mobilization. This study dwells more on Deposit Money Banks development, insurance industry development, and stock market development as measures of the formal financial sector as their contributions to the economy are quite enormous.

Deposit Money Banks Development

The institutional transmission mechanism for monetary policy is provided by deposit money banks. They make Nigeria's payment system more functional and make it easier to achieve the objectives of monetary policy. The most effective automatic tool for achieving monetary policy and macroeconomic objectives is interest rates (Ngerebo & Lucky, 2016). Deposit money banks act as intermediaries by receiving deposits, utilising them to produce loans with a variety of maturities at fixed or variable rates, and profiting from the spread of interest rates by charging for the services they provide (Yusuff & Olaniran-Akinyele, 2019). The act of providing financial intermediation services to the economy is known as deposit money banking (households, firms and businesses, and government). It brings together individuals who have extra money and others who need it. It acts as a meeting place for those who lend and those who borrow money (Adewunmi, 2020). In a developing nation, the deposit money bank serves the following functions: Credit creation, the mobilization of savings for capital formation, industry financing, consumer activity financing, employment-generating activity financing, trade and agricultural financing, and international trade financing are all examples of how credit is created.

To encourage sustained economic performance and facilitate a thriving real sector, deposit money banks mobilize financial resources and direct them to profitable ventures (Chepkiyeng, 2017). They serve as the network of arteries that move money throughout the economy in addition to serving as a place to save money and lend it out when necessary, which is why they are frequently referred to as financial intermediaries. Consequently, its primary purpose is to transfer surplus funds from lenders to borrowers. Only banks in the Tier-1 (Notable among the banks are Zenith Bank Plc, Access Holdings Plc, FBNH Plc, UBA Plc, and GTCO Plc.) category hits N2.621 trillion market capitalization early in the financial year of 2022 (NGX, 2022).

Insurance Industry Development

The word "insurance" is a security that derives from the Latin word "sicurta," which signifies assurance (Chien-Chiang & Chi-Hung, 2015). People's perception of the need for security against threats is the cause of it. Insurance is the process by which a group of people who share a

risk unite and protect one another from potential harm. The goal of insurance is to disperse potential damages among group members and enable them to shoulder the cost of the damage, not to prevent potential damages from happening (Güvel & Güvel, 2022). An insurance provider is a business that gives protection and assumes the customer's risk. These are organizations that offer security in the event of a likely negative outcome.

The following tasks are carried out by insurance companies: raising long-term capital in the form of premiums through the provision of life or non-life protection to customers; fostering economic development through the investment of its premium and other income; and fostering the insurance industry by contributing a portion of its income to a fund in the Nigerian Re-insurance Corporation. As a fallout of the bank consolidation exercise undertaken by the CBN, the insurance sub-sector companies were also required to recapitalize, raising the minimum capital requirement to N2.00 billion, N3.00 billion, and N10.00 billion for life, non-life, and reinsurance business, respectively, to enable the sub-sector to meet the challenges of an increasingly global financial system (CBN, 2017). Furthermore, the insurance subsector has adopted the risk-based supervision approach to avert failure, in line with the developments in the banking subsector. The Nigeria insurance market size was N675 billion in 2021. The market is expected to grow at a compound annual growth rate of more than 9% from 2020 to 2025 (NAICOM, 2022).

Stock Market Development

The term "stock market development" describes a condition in which the financial system is fragmented, suggesting that there is no financial repression (Ang, 2017). It might also be described as the stock market's capacity to efficiently mobilize earnings and savings for investments and advancements (Nzotta & Okereke, 2019). Similarly, to this, Alrabadi (2016) characterizes the growth of the stock market as an increase in the availability of financial services with a larger preference catered to all societal levels. On the stock market, medium- and long-term securities are traded. The path of the national economy can be rather accurately predicted by stock market activity. It is anticipated that market performance that is efficient and effective would lead to robust economic growth.

In March 2021, the erstwhile Nigerian Stock Exchange was demutualized from a member-owned not-for-profit entity into a shareholder-owned, profit-making entity Nigerian Exchange Group Plc. In Nigeria, bonds, stocks, and other assets can be purchased and sold on the Nigerian Exchange Group (NGX Group), a trading platform. The Exchange offers facilities for capital events such as the payment of dividends and other incomes, as well as the issuing and redemption of securities and other financial instruments. Companies looking to use the financial markets to fuel their business expansion can get funding through the Exchange. Similar to this, NGX offers a variety of regulated securities to its pool of domestic, regional, and foreign investors to help them meet their investment goals. Through its wholly-owned companies, NGX Group offers a comprehensive range of services, including the listing and trading of securities, licensing, market data solutions, ancillary technologies, regulation, real estate, and more. The market capitalization averaged N16.880 trillion from June 2008 to July 2022, with 170 observations. The data reached an all-time high of N51.018 trillion in May 2022 (NGX, 2022).

Financial Deepening

Scholars experience financial depth differently. A rise in the availability of financial assets in the economy has been referred to as financial deepening (Hamilton & Godwin, 2016). Included in it is the whole or breadth of the financial assets accessible to the economy. The capacity of financial institutions to successfully mobilize savings for investments is another implication of financial deepening. Domestic savings growth provides the essential framework for the development of diversified financial claims. A higher ratio of the money supply to the GDP is typically a sign of financial deepening (Christian, 2016). Thus, financial development and deepening entail the creation and growth of institutions, tools, and growth mechanisms. Financial deepening, according to Osinsanwo (2015), is defined as a rise in financial services catered to all societal levels. Financial deepening is the expansion of the distribution of financial services by financial institutions to every member of society (Nnenna, 2019).

According to Kromtit and Tsenkwo (2018), financial deepening entails business expansion through organized marketplaces. To increase the effectiveness of intermediation and the effectiveness of economic policy, it is growing the number of financial institutions and integration of the informal market into the formal economic system. The strength of the financial system and the capability with which credits are issued in terms of lending and deposit rates are reflected in the degree of financial deepening. In light of the size of the sector's activity, the financial deepening theory outlines the financial system's beneficial influence on economic growth (Ohwofasa & Aiyedogbon, 2015). In other words, it is expected that an economy with more intermediary activity is making greater efforts to produce efficient allocations. Financial deepening is frequently defined in development studies as the expanded availability of financial services with a larger selection of services targeted toward the growth of all levels of society.

Empirical Review
Deposit Money Banks Development and Financial Deepening
Musa and Okologume (2020) determined the influence of Deposit Money Banks on the Nigerian Economy from 2009-2018. To facilitate the study, a simple model was specified using the variables; gross domestic product (GDP) as the dependent variable, deposit money banks credit (DMBC), lending rate (LR), and financial deepening (FD) as independent variables. The Central Bank Statistical Bulletin was used to gather the data for the variables, which were then subjected to ordinary least square (OLS) regression analysis. The outcome showed that the Nigerian economy is significantly and favourably impacted by the credit extended by deposit money institutions. The study therefore made several recommendations, including increasing efforts to make short-, medium-, and long-term loans available to productive investments like the manufacturing sector, agricultural sector, and SMEs as they are crucial to the growth and transformation of an economy like Nigeria's. This will result in increased employment and income for different economic agents as well as a productive economy. The time frame of 10 years (2009 to 2018) utilized in the study is too short to see the influence of a time series study; a time frame of at least 30 years would have been more appropriate. Also, the use of Ordinary Least Square regression was not suitable for the study, since the study was a time series data. Therefore, the cointegration model should have been appropriate.

Adewunmi (2020) evaluated the performance of Deposit Money Banks (DMBs) and financial deepening (1989 to 2018). To ascertain the long-term link between the dependent and independent variables, the study used the Ordinary Least Square (OLS) regression analysis method in addition to doing the Augmented Dickey and Fuller test for stationarity, Johansen co-integration, and Granger Causality test. Money supply and Gross Domestic Product, credit to the private sector and GDP, and deposit mobilization are the variables used. The Central Bank of Nigeria statistical bulletin was used to get time series data. Results showed that the relationship between the money supply and GDP does not significantly affect deposit mobilization. Additionally, it was shown that the performance of DMBs in Nigeria is significantly influenced by credit to the private sector and gross domestic product. Therefore, it was advised that government policy be focused on strategically expanding the money supply and fostering an effective capital market that will improve overall economic efficiency, mobilize savings, and foster a skilled entrepreneurial response in a variety of economic sectors. By analyzing the data with the cointegration model and Granger Causality test, the study was successful. However, since the study was based on time series data, Fully Modified Ordinary Least Square regression should have been appropriate as it will take care of the problem of endogeneity and serial correlation which is associated with time series data. Instead, Ordinary Least Square (OLS) regression was used to test hypotheses.

Olawumi et al. (2017) investigated the relationship between financial deepening and bank performance using financial deepening (M2/GDP), the ratio of credit to the private sector—GDP, and the ratio of deposit liabilities—GDP as variables of financial deepening while performance measure of interest is profitability. The descriptive research design was used in the study to examine the impact of financial depth on bank performance. The study's data came from secondary data sources. The data were analyzed using descriptive and empirical methods, and OLS regression was used to assess the models' agreement with expectations, statistical significance, and explanatory power. The results showed that every measure of financial deepening has a strong association and is statistically significant; this offers proof that financial deepening increased the profitability of the chosen commercial banks in Nigeria. The study found strong and statistically significant contributions from each financial deepening component on the performance of a subset of commercial banks. Since the investigation involved time series data, using ordinary least square regression was inappropriate. As a result, the cointegration model and fully modified ordinary least square regression, which will be taken into account in this study, should have been adequate. This will address the endogeneity and serial issues that time series data typically has.

Insurance Industry Development and Financial Deepening

Baruti (2020) analyzed the insurance system in Kosovo by determining and then analyzing its structure, the degree of concentration of insurance companies on the insurance market, their behaviour towards price, the number of participants, companies operating in this market, and types of products and services they provide. The statistical and qualitative data for the study analysis were acquired by looking at hypotheses about how insurance markets have developed in various nations. Additionally, the study employed secondary data from the Central Bank of Kosovo, insurance companies, and the Association of Insurance of Kosovo for the empirical

analysis. The study also carried out two questionnaires. The study first polled finance managers from every insurance company, and the second survey was of working people in general. In this way, the study aimed to comprehend the problem more fully. By identifying these variables, insurance companies will be able to create plans that satisfy consumer demand for voluntary insurance coverage while also enhancing the financial stability of Kosovo's economy. In the end, the study concluded that Kosovo's insurance industry is crucial to the further development of the financial system.

Kaya and Beşer (2020) investigated how and in what direction the insurance premium volume affects the economic growth of these 25 countries. Johansen Cointegration, Kao cointegration, panel FMOLS, Dumitrescu, and Hurlin (2012) Panel Granger Causality methods were used. Cointegration tests show that economic growth and insurance premium volume variables have long-term cointegration relationships. As stated in Panel FMOLS test results, a 1% increase in insurance premium volumes leads to a rise of 0.113% in economic growth. Following Dumitrescu and Hurlin's (2012) panel Granger causality analysis, there is unidirectional causality from insurance volumes.

Torbirai and Ogbulu (2014) studied the relationship between fund mobilization by insurance companies and gross fixed capital formation (GFCF) in Nigeria and specifically how the latter responds to stimuli emanating from the insurance companies. The estimation and analysis of a multivariate regression model with five predictor variables was used. According to the short-term findings, four explanatory variables—premiums from fire, accident, motor vehicle, and employee liability insurance policies—positively and insignificantly correlate with gross fixed capital formation, whereas the relationship between premiums from marine insurance policies and GFCF is both negative and insignificant. Long-term growth in gross fixed capital formation is favourably and strongly impacted by the money mobilization factors used by insurance companies. Furthermore, there is no proof of causation between the variables according to the Granger causality test. The use of multivariate regression suggests that there are multiple dependent variables in the study, although this is not the case because the only dependent variable in the analysis was gross fixed capital formation. As a result, the study applies the analysis technique incorrectly, which will have an impact on the study's findings and recommendations.

Stock Market Development and Financial Deepening
Attah-Botchwey et al. (2022) investigated the effect of financial deepening on stock market performance in selected Sub-Saharan African countries by determining the relationship that exists between financial deepening and stock market performance. From 2001 to 2019, the study took into account four Sub-Saharan African nations. The data were analyzed using Seemingly Unrelated Regression (SUR), a multiple regression analysis technique. SUR has the lowest standard errors of the calculated parameters used in the investigation. According to the study, each of the four nations' stock market performance was positively and statistically significantly impacted by broad money supply, a proxy for financial deepening. It was advised that all of the study's participating nations and other nations adopt measures designed to improve financial deepening by raising the broad money supply as a percentage of GDP. Investment in the

economy's productive sectors is made possible by the increase in the total amount of money in circulation.

Tiamiyu (2022) established the link between financial deepening and the stock market development between 1981 and 2019 using the bound test cointegration ARDL approach. The bound cointegration test showed that the variables under consideration were cointegrated. Financial development, domestic saving as a percentage of GDP, broad money diversification, and GDP are the key drivers of stock market development in the long run because they are all significant determinants in terms of signs, magnitude, and size. However, a significant unfavourable link between broad money diversification and stock market performance was observed from 1981 to 2019. Therefore, there is a long-term lack of financial diversification in the Nigerian financial industry. The stock market is negatively impacted by the financial development indicator, unlike in the long run, and it only becomes relevant after some lags. The study recommended that the Central Bank of Nigeria (CBN) should liberate interest rates to allow for more robust operations of financial sectors in Nigeria.

Theoretical Framework
Theory of Financial Deepening
This theory, which was first presented by Nnanna and Dogo (1998), demonstrates how the development of a money-related area leads to financial advancement and, ultimately, the growth of the economy. It is typically used to describe the state of an atomized monetary framework, which is a budgetary framework that is largely free from financial constraints (Nnanna & Dogo, 1998). The choice of an appropriate real financial strategy, particularly about real rates of profit and real stock of financing, results in financial deepening. Additionally, the shoddy budgeting framework is lacking in the way that the disbursement of cash is handled. The depth of finance is considered when progress is mediated through financial means.
Shaw (1973) contends that a variety of businesses, including account traders, industrial banks, and insurance brokers, can engage in successful business due to the developing financial landscape. Financial deepening alone promotes development by boosting the potency of speculation. This connection, which is allegedly tied to the advancement of finance-related development, supports favourable popularization (Friedman, 2018).

As first investigated by Levine (1997) and later by DemirgucKunt and Levine (2019), it has been suggested that a vibrant and well-functioning financial system results in a sizable pool of financial deepening. Hypothetically, Goldsmith's early work (1969) considered, among other things, the crucial role that could be played in financial improvement by retaining a monetary framework without control over the borrowing costs and amounts popular at the time. As the writing progressed, it became apparent that the financial framework, overall, performed four fundamental functions essential to financial improvement and development: gathering investment funds, allocating assets to profitable uses, encouraging exchanges and risk management, and applying corporate control. Given this possibility, a nation that promotes more obvious monetary advancements will have a higher rate of development, with the majority of the impact related to higher profitability rather than a higher overall risk ratio. As a result, the financial deepening in this study enhances the formal financial sector's financial performance.

This study adopts the theory of financial deepening which explains that money-related intermediation of development (such as deposit money banks, insurance companies, and the stock market) takes into account the depth of finance. Stressing that a dynamic and well-functioning deposit money banks, insurance industry, and stock market lead to a large pool of financial deepening.

III. Methodology
This study tailed the path of the positivism research philosophy as it adopts the deductive method of research focused on testing theory. This approach seeks facts and causes of social or business phenomena, with little regard to the subjective state of the individual. Considering the purpose of this study, the type of investigation, the extent of researcher involvement, the period over which data were collected, and the type of analysis, the *ex-post facto* research design was appropriate and was therefore adopted.

This study uses quarterly time series data covering the period 2012Q1 to 2022Q3. The variables of the study are deposit money banks development, insurance industry development, stock market development and financial deepening. Data for the study was obtained from the Central Bank of Nigeria Statistical Bulletin 2022.

Table 1: Measurement Table for Dependent and Independent Variables

Variables Specification	Proxied By	Description	Sources
Dependent Financial Deepening	FINDEX	Broad Money Supply (M2) GDP	Attah-Botchwey et al. (2022), Tiamiyu (2022), Olawumi et al. (2017), Adewunmi (2020)
Independent Formal Financial Sector	Deposit Money Banks Development (DMBD)	Credit to the Private sector GDP	Olawumi et al. (2017), Adewunmi (2020)
	Insurance Industry Development (IID)	Insurance Industry Total Assets GDP	Marco (2018)
	Stock Market Development (SMD)	Total Market Capitalization GDP	Attah-Botchwey et al. (2022), Tiamiyu (2022)

Source: *Researcher's Computation 2023.*

Descriptive statistics were used to explain the data. A stationarity test was conducted to test for the presence of unit roots in the time series data. In addition, the Johansen co-integration test was conducted to investigate the possible correlation among the variables of this study. A vector

autoregressive model was also used since there was no cointegration among the variables. The data obtained were further analyzed using Fully Modified Ordinary Least Squares (FMOLS) through Eviews 10 Statistical Package. The analysis process of this study follows the following steps:

The Phillips-Perron (PP) unit root test was employed to determine the order of integration of the variables to establish the stationarity level of the variables. The PP unit root test is conventionally said to have greater unit root detection ability when compared with the ADF unit root test. The PP test is thus preferred to the Augmented Dickey-Fuller (ADF) because it deals with a potential correlated error by employing a correction factor that estimates the long-run variance of the error process.

$$\Delta y_{t-1} = \alpha_0 + \lambda y_{t-1} + \ldots + \lambda y_{t-p} + \varepsilon_t$$

Cointegration

Johansen (1990) developed two likelihood ratio tests: The Trace Test and the Maximum Eigenvalue Test. The two procedures test for the presence of cointegrating vectors between deposit money banks development, insurance industry development, stock market development and financial deepening.

$$\Delta Y_t = \mu + \sum_{i=1}^{n-1} \Gamma i \Delta Y_{t-i} + \sum_{i=0}^{m-1} \gamma i \Delta X_{t-i} + \varepsilon_t$$

where Δ is the first difference operator, Y_t is a p x 1 vector of stochastic variables, X_t is the independent variable, l is a vector of constants, and ε_t is a vector of normally, independently, and identically distributed errors with zero means and constant variances and p is the number of variables.

Vector Autoregressive Model

Vector autoregressive (VAR) is a statistical model used to capture the relationship between multiple quantities as they change over time. VAR is a type of stochastic process model. VAR models are traditionally widely used in finance and econometrics because they offer a framework for accomplishing important modelling goals, including data description, forecasting, structural inference, and policy analysis (Stock & Watson, 2001). This type of analysis is used when there is a correlation between the time series values and their preceding and succeeding values.

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t$$

The variables of the form y_{t-i} indicate that the variable's value i periods earlier and are called the "ith lag" of y_t. The variable c is a k-vector of constants serving as the intercept of the model. A_i is a time-invariant $(k \times k)$-matrix and e_t is a k-vector of error terms.

Fully Modified Ordinary Least Squares

Fully Modified Ordinary Least Squares (FM-OLS) regression modifies least squares to account for serial correlation effects and for the endogeneity in the regressors that results from the existence of a cointegrating relationship. FM-OLS models are categories of multiple time series models that directly estimate the long-run effect of the independent variables (Deposit Money Banks development, insurance industry development, and stock market development) on the dependent variable (financial deepening) after correcting for the endogeneity problem in the time series.

The estimated coefficient of FM-OLS is given by:

$$\left(\int_0^1 dY_0\, \acute{Y}_x + \Delta_{0x}\right)\left(\int_0^1 Y_0\, \acute{Y}_x\right)^{-1}$$

$$= \left(\int_0^1 dY_{0.x}\, \acute{Y}_x\right)\left(\int_0^1 Y_0\, \acute{Y}_x\right)^{-1} + \Omega_{0x}\Omega_{xx}^{-1}\left(\int_0^1 dB_x\, \acute{B}_x\right)\left(\int_0^1 B_x\, \acute{B}_x\right)^{-1}$$

$$+ \Delta_{0x}\left(\int_0^1 B_x\, \acute{B}_x\right)^{-1} + u$$

Note that $_{0x}$ is the long-run variance of the equation, $\Omega_{0x}\Omega_{xx}^{-1}$ is the long-run regression coefficient, Y is the dependent variable and B is the independent variable.

The model is specified as follows:

FINDEX = f (DMBD, IID, SMD) ………………………………….... (1)

The econometric form of equation (1) is represented as:

$FINDEX_t = \alpha + \beta_1 DMBD_t + \beta_2 IID_t + \beta_3 SMD_t + \mu_t$ ……..………...…..... (2)

Where: FINDEX = Financial Deepening; DMBD = Deposit Money Banks Development; IID = Insurance Industry Development; SMD = Stock Market Development; α =Intercept or Constant; β = Slope of the regression line concerning the independent variables; μ=Error Term. The Cointegration model of the study is represented by:

$$\Delta FINDEX_t = \mu + \sum_{i=1}^{n-1}\Gamma i \Delta FINDEX_{t-i} + \sum_{i=0}^{m-1}\gamma_1 \Delta DMBD_{t-i} + \gamma_2 \Delta IID_{t-i} + \gamma_3 \Delta SMD_{t-i} + \varepsilon_t \dots\dots (3)$$

Where: FINDEX = Financial Deepening; DMBD = Deposit Money Banks Development; IID = Insurance Industry Development; SMD = Stock Market Development; ε = Error term; Δ = First difference operator; μ =Intercept or Constant; $_{t-i}$ = Time lagged; $\gamma_1 - \gamma_3$ = Coefficient of independent variables.

The Fully Modified Ordinary Least Squares model of the study is represented as:

$$\left(\int_0^1 dFINDEP_0\, FIN\acute{D}EP_x + \Delta_{0x}\right)\left(\int_0^1 FINDEP_0\, FIN\acute{D}EP_x\right)^{-1} =$$

$$\left(\int_0^1 dFINDEP_{0x}\, FIN\acute{D}EP_x\right)\left(\int_0^1 FINDEP_0\, FIN\acute{D}EP_x\right)^{-1} + \Omega_{0x}\Omega_{xx}^{-1} +$$

$$\Delta_{0x}\left(\int_0^1 DMBD_x\, DMB\acute{D}_x\right)^{-1} + \left(\int_0^1 IID_x\, II\acute{D}_x\right)^{-1} + \left(\int_0^1 SMD_x\, SM\acute{D}_x\right)^{-1} + u$$

……………..(4)

Where: FINDEP = Financial Deepening; DMB = Deposit Money Banks Development; IID = Insurance Industry Development; SMD = Stock Market Development; $_{0x}$ = Long run variance; $\Omega_{0x}\Omega_{xx}^{-1}$ = Long run regression coefficient.

Decision Rule:

If the p-value is < 5%, then the null hypothesis is rejected, otherwise the null hypothesis is accepted.

IV. Results and Discussion

Table 2: Descriptive Statistics

	FINDEX	DMBD	IID	SMD
Mean	73.92921	143.1340	5.868029	65.04349
Maximum	155.3083	303.3154	13.21249	161.6100
Minimum	33.66965	66.80971	1.038365	26.25000
Std. Dev.	40.10259	83.37503	4.208112	36.69791
Observations	43	43	43	43

Source: Eview Version 10 Output, 2023

Table 2 reveals that financial deepening has a mean of 73.92921, meaning that the Nigerian financial sector had an average quarterly depth of 73.9% for the period under consideration, while the deviation from the mean (standard deviation) was 40%. This means that financial deepening was normally distributed because the standard deviation value was lower than the mean value. The maximum financial deepening within the period of this study was 155.31%. This implies that the highest financial depth of the economy is not more than 155% within the 43 quarters. Table 2 also shows the minimum value to be 33.67%, meaning that financial deepening per quarter was not less than 34% for the period under review.

Deposit Money Banks Development had a mean of 143.13% while the deviation from the mean was 83.38%. This indicates that the deposit money banks' development was normally distributed since the standard deviation value was lower than the mean value. The maximum percentage within the period under consideration was 303.3154, implying that for the period under review, all deposit money banks in the Nigerian economy do not experience more than 303.3% development per quarter. While the minimum development experienced within the deposit money banks for the period under review was not less than 66.8% per quarter. From the table above deposit money banks seems to be developing faster than both the insurance industry and

the stock market, since they have the highest maximum percentage of 303 for the period under review.

Insurance Industry Development had a mean of 5.87%, while the deviation from the mean was 4.21%. This indicates that the insurance industry development was normally distributed since the standard deviation value was lower than the mean value. The maximum percentage within the period under consideration was 13.21249, implying that the highest level of development in the insurance industry per quarter under review was not more than 13.21%. While the minimum level of development in the insurance industry per quarter was not less than 1.04% for the period under review. The insurance industry has shown to be the least in terms of development when compared with deposit money banks and the stock market since they have the lowest minimum percentage of 1 for the period under review.

Finally, the stock market development had a mean of 65.04% while the deviation from the mean was 36.70%. This indicates that the stock market development was normally distributed since the standard deviation value was lower than the mean value. The maximum value within the period under consideration was 161.6100, implying that the development within the stock market for the quarter under review was not more than 161.61%. The minimum percentage of development of the Nigerian stock market per quarter for the period under review was 26.25%, indicating that stock market development did not go below 26%.

Table 3: Unit Root Test

Variables	Adj. T-Statistic	Prob. Values	Order of Integration
FINDEX	-10.93172	0.0000	*I(1)*
DMBD	-5.684561	0.0000	*I(1)*
IID	-6.989066	0.0000	*I(1)*
SMD	-6.545203	0.0000	*I(1)*

Source*: Researcher's Computation 2023.*

To examine the existence of stochastic non-stationarity in the series, the research establishes the order of integration of individual time series through the unit root tests. The test of the stationarity of the variables adopted was Phillips-Perron (PP) test. The variables tested were FINDEX, DMBD, IID, and SMD with results as presented in Table 3.

From Table 3, it can be seen that all the variables were found to be stationary at the first difference, that is, at order I(1). The PP test statistics were greater than their respective tabulated values and their p-values are all below the 0.05 significant level for this study. Since the variables were found stationary at first order I(1), the Johansen cointegration approach was applied to determine the long-run relationship among the variables.

Table 4: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.354368	33.07262	47.85613	0.5528
At most 1	0.212240	15.13408	29.79707	0.7713
At most 2	0.111376	5.353029	15.49471	0.7702
At most 3	0.012403	0.511701	3.841466	0.4744
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.354368	17.93854	27.58434	0.5003
At most 1	0.212240	9.781054	21.13162	0.7649
At most 2	0.111376	4.841328	14.26460	0.7617
At most 3	0.012403	0.511701	3.841466	0.4744

Source: Eview Version 10 Output, 2023

The Trace test of Johansen cointegration shows that there is no indication of cointegration at 0.05 significance level as shown in its Trace statistics of None, At most 1, At most 2, and At most 3 (33.07262, 15.13408, 5.353029, and 0.511701) are lower than their respective 0.05 Critical Values (47.85613, 29.79707, 15.49471, and 3.841466), while their p-values (0.5528, 0.7713, 0.7702, and 0.4744) are all above the 0.05 level of significance for this study. Also, the Maximum Eigenvalue test of Johansen cointegration shows that there is no indication of cointegration at a 0.05 significance level as the Max-Eigen statistics for None, At most 1, At most 2, and At most 3 (17.93854, 9.781054, 4.841328, and 0.511701) are lower than their respective 0.05 Critical Values (27.58434, 21.13162, 14.26460, and 3.841466), while their p-values (0.5003, 0.7649, 0.7617, and 0.4744) are all above the 0.05 level of significance for this study. Since there is no cointegration in the two criteria of the Johansen cointegration test, it implies that there is no long-run relationship between financial deepening and the three variables of the formal financial sector (Deposit money banks development, insurance industry development and stock market development) considered. Therefore, this suggests the use of the Vector Autoregressive model.

Table 5: Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DMBD	0.195340	0.073664	2.651770	0.0116
IID	4.499914	1.254256	3.587717	0.0009
SMD	0.142556	0.077011	1.851108	0.0719
C	10.79287	2.488780	4.336610	0.0001
R-squared	0.986705	Mean dependent var		74.84117
Adjusted R-squared	0.985655	S.D. dependent var		40.13488
S.E. of regression	4.806901	Sum squared resid		878.0391
Long-run variance	39.11532			

Source: Eview Version 10 Output, 2023

Deposit money bank development has a significant effect on financial deepening because the p-value is 0.0116 which is lower than the 5% significant level, indicating that an increase in deposit money bank development will automatically increase financial deepening to the extent of 0.195340. Therefore, the study rejects $H0_1$, which states that deposit money bank development has no significant effect on financial deepening in Nigeria.

Also, the analysis shows that the insurance industry development has a significant effect on financial deepening because the p-value is 0.0009 which is lower than the 5% significant level, indicating that an increase in the insurance industry development will automatically increase financial deepening to the extent of 4.499914. Therefore, the study rejects $H0_2$, which states that the insurance industry development, has no significant effect on financial deepening in Nigeria.

However, stock market development has an insignificant effect on financial deepening because their p-value is 0.0719 which is greater than the 5% significant level, indicating that an increase in stock market development will not automatically increase financial deepening to the extent of 0.142556. Therefore, the study accepts $H0_3$, which states that stock market development has no significant effect on financial deepening in Nigeria.

The coefficient of determination (R^2) is 0.986705 implying that the informal financial sector explains variation in financial deepening to the extent of 98.7%, while the remaining variation was explained by other variables not captured in the model.

Table 6: Post-Estimation Test

| Description	Probability values
Normality Test:	
Jarque-Bera	0.340924
P-value:	0.843275
Serial Correlation	
F-statistics	0.615897
P-value	0.5459
Heteroskadasticity Test	
F-statistics	1.367630
P-value	0.2669

Source: *Researcher's computation*, 2023

Table 6 above indicates that the data is skewed, denoting that the data are normal. This is corroborated by the Jarque-Berra Statistic of 0.340924 and its corresponding P-value of 0.843275 which is greater than the p-value of 0.05.

The Breusch-Godfrey Serial Correlation LM Test indicates that there is no autocorrelation. This is given by the F-statistic of 0.615897 and its corresponding P-value of 0.5459. The Breusch Pegan Test of Heteroskedasticity with F-statistics 1.367630 and its corresponding P-value of 0.2669 indicates that there is no problem with heteroskedasticity.

Figure 2: Stability Test
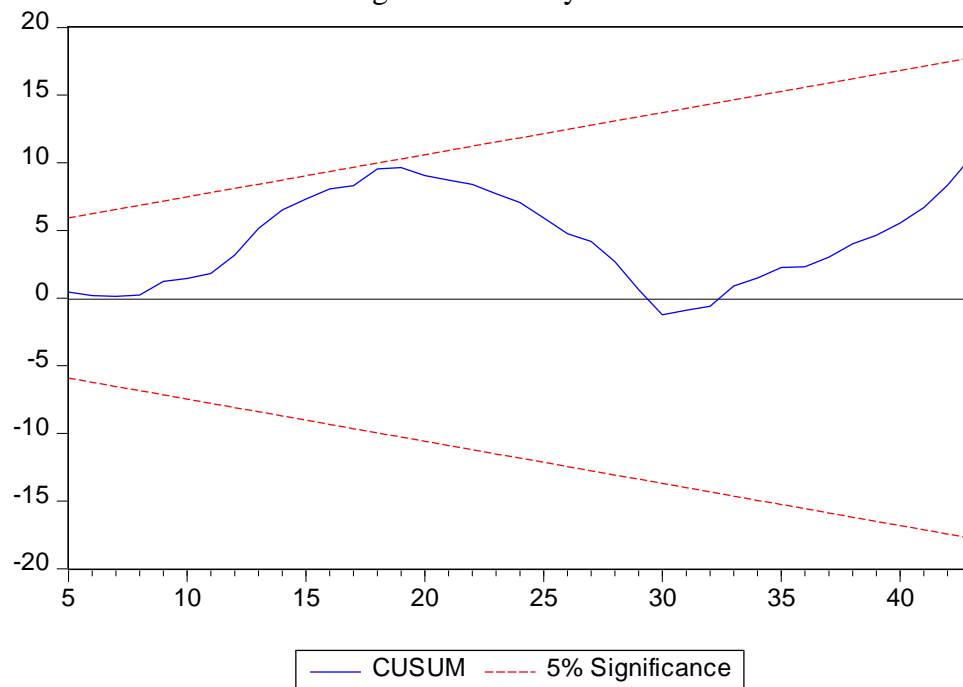
Source*: Eview Version 10 Output, 2023*

The stability of the model was checked using the CUSUM test and it shows that the model is stable as it is within the 5% boundary.

Conclusion and Recommendations

The main objective of the study is to empirically examine the effect of the formal financial sector on financial deepening in Nigeria for the period 2012Q1 to 2022Q3. The study concludes that deposit money bank development has a significant effect on financial deepening in Nigeria. This means that the development of deposit money banks in Nigeria does have a proportionate increase in financial deepening. This finding is in line with the works of Adewunmi (2020) and Olawumi et al. (2017). In like manner, the insurance industry development significantly increases financial deepening. This result is in tandem with the findings of Baruti (2020) that the insurance sector in Kosovo is an important factor in the further development of the financial system. But does not support the findings of Torbirai and Ogbulu (2014) who studied the relationship between fund mobilization by insurance companies and gross fixed capital formation (as a proxy of the financial sector) in Nigeria. They found out that the premiums from insurance companies insignificantly correlate with the financial sector. The stock market development on the other hand had an insignificant effect on financial deepening in Nigeria. This indicated that the development of the stock market does not contribute to the depth of the financial sector in Nigeria. This result is in disagreement with the findings of Attah-Botchwey et al. (2022), who found that there is a positive relationship between financial deepening and stock market performance in each of the four countries considered in their study.

Based on the findings of this study, it is recommended that:
Nigerian deposit money banks should employ strategies that will develop the industry, especially investing in technology and in the aspect of Artificial Intelligence (AI), such that most of its banking products and activities will be carried out seamlessly in the comfort of the customers. This will make banking more accessible and will attract more customers, thereby increasing the financial depth of the sector. The Nigerian government should also encourage innovation in the banking industry by supporting research and development in areas such as digital banking, mobile payments, and fintech. This will help deposit money banks to better meet the needs of their customers and provide more convenient and efficient banking services.

The result that the insurance industry development is pivotal for financial deepening indicates that the Nigerian government needs to do more in the industry. Therefore, the Nigerian government through National Insurance Commission (NAICOM) should create a regulatory framework that is conducive to the growth of the insurance industry. This can include laws and regulations that encourage the establishment of new insurance companies, promote transparency and accountability in the industry, and ensure that insurers have adequate capitalization. Furthermore, the government should provide incentives for individuals and organizations to invest in the insurance industry. This can include tax breaks or other financial incentives for investing in insurance companies or purchasing insurance products. The Nigerian government through all necessary agencies should enforce all the mandatory insurance given by law such as employer's liability/workmen's compensation insurance (domiciled with Nigerian Social Insurance Trust Fund), group life assurance, insurance of buildings under construction, insurance of public buildings, motor third party insurance and so on.

Stock market development being insignificant to financial deepening means that the Nigerian Exchange Group need to do more in getting companies listed. This will increase the market capitalization of the sector while providing a platform for companies, states and the Federal government to raise capital and for investors to participate in the growth of the sector. The government should also encourage innovation in the stock market by supporting the development of new financial products, such as exchange-traded funds (ETFs) and derivatives. This will help to attract more investors to the market and increase the overall liquidity and depth of the market.

This study is limited to quarterly data covering the period 2012Q1 to 2022Q3. This is because data relating to 2022Q4 to date are not available.

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