# Stock Response to Measures of Financial Inclusion, Financial Services, and Lending Rate: VAR Evidence from Nigeria

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## Abstract

*This is an investigation of the stock performance response to measures of financial inclusion, financial services, and lending rate in Nigeria. It uses secondary data from the Central Bank of Nigeria, 1981-2018. It employs descriptive and inferential statistics, ADF-test of stationarity, VAR, VD, and IRF analytical techniques. Also, it uses residual serial correlation, heteroskedasticity, normality, and stability diagnostic tests procedures to confirm the estimated VAR model's empirical strength. Results reveal all series as I(1), but not cointegrated. VAR analysis discloses that past stock performance (P<.01), financial inclusion (p<.01), and financial services (p<.01), significantly impact current stock performance. The first two variables have positive signs while the third has a negative sign. Both financial inclusion and financial services measures are strongly endogenous in predicting the future stock performance levels. Thus, while improving money-supply-to-GDP ratio has boosted activities, financial inclusion through granting private sector credit has been a disincentive to private sector investment. For more impact, existing credit regime should be restructured and its associated harsh terms and conditions reviewed. Also, reviewing the existing business regulatory protocol and introducing a suitable mix of policy tools will help to checkmate the negative effects of rising prices, and promote ease-of-doing-business for private sector investors.*

***Keywords:*** Stock performance, financial services, inclusion, ease-of-doing business, VAR, linkages, Nigeria.

## Introduction

The capital market contributes immensely to development of national economies. Maku and Atanda (2010) attest that the capital markets are at the center of the nation's economy because they play vital role in boosting total savings and tangible investments and remain tenacious in their response to changes in economic realities. Moreover, they guarantee efficiency in the transfer of financial assets between the money savers on the supply side and investors on the demand side of the market (Ali *et al*., 2018; Gatsimbazi *et al*., 2018). The stock market is an integral part of the Nigeria's capital market. Forti *et al*. (2011) argue that the relationship between economic growth and the stock market activities is significant, considering that the stock market makes it possible for persons, companies, and corporate entities to allocate funds to profitable investments. Also, it is affirmed that the "stock market liquidity and banking development both positively predict

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growth, capital accumulation, and productivity improvements" (Levine & Zervos, 1998, p. 537). In the developing and emerging nations alike, the liquidity of the stock market amplifies long-term growth by facilitating transactions in capital and providing lucrative long-term investment platforms (Okonkwo *et al*., 2014). A liquid equity market guarantees holders' stress-free sale of shares, while companies can also negotiate equity capital on auspicious terms and conditions (Okonkwo *et al*., 2014).

The Security and Exchange Commission (SEC) is a Nigerian agency affiliated to the Federal Ministry of Finance. It is responsible for regulating the nation's capital market to protect the investors and develop the market to improve its "allocative efficiency" and herald a "private sector-led economy" (SEC, 2010; 2019). SEC supervises the Nigerian Stock Exchange, also called "The Exchange" or "NSE" for short. NSE was set up in March 1960 to coordinate the capital market operations (Okonkwo *et al*., 2014). Its vision is "to be Africa's preferred exchange hub" and its mission is to "provide investors and businesses a reliable, efficient and an adaptable exchange hub in Africa, to save and to access capital" (NSE, 2019a; NSE, 2019b). The Exchange is domiciled in Lagos. As at the mid-2018, it had 169 listed companies and a total market capitalization in excess of thirteen trillion naira (about US$42.6 billion), which made it the second biggest stock exchange in Africa. All the NSE listings were built into its all shares index (ASI).

Several factors have contributed to the development of the Nigerian stock market amidst the complex operating macroeconomic environment (Ali *et al*., 2018). Among these are the government policies and programs, including monetary policies seeking to provide financial services and regulate credit terms and conditions, with direct consequences on stock market performance. By and large, governments through the central banks use financial services and inclusion policy instruments like money supply, credit facilities to the private sector, and interest rates on lending, among others, to regulate economic activities. But, to what extent have the policy instruments been used to influence stock market activities? Are there any relationships among the stock performance, measures of financial services and inclusion? Is there a relationship between stock performance and the lending rate? Where relationships exist what is the nature and direction? How does stock performance react to emerging shocks from the indexes of financial inclusion, financial services and the lending rate?

This study seeks to provide answers to the foregoing questions. The general objective is to explore the relationship between the stock market performance and the banking sector's measures of financial inclusion, financial services and the lending rate in Nigeria. Specifically, the study examines the time series properties of the stock performance (market capitalization as a percentage of the gross domestic product or

GDP), financial services (money supply as a percentage of the GDP), financial inclusion (credit to the private sector), and the commercial lending rates of the deposit money banks (DMBs), to ascertain possible existence of a relationship that would indicate predictability (Berggrun, 2005). Consequently, this would permit the use of multivariate models to scrutinize through impulse response functions (IRF) and variance decomposition (VD) procedures, in what ways the emerging shocks from the variables are transmitted to stock activities and performance. The emerging results are expected to guide the policy makers, stock market watchers, investment analysts, and the general public in their regulatory and investment decision making in Nigeria.

## Literature Review

### Theoretical Literature Review

***Keynesian theory of increase in government expenditure:*** An important claim of the *Keynesian theory* is that expansion in government expenditure through injection of money into the economy will boost aggregate demand, income and full employment. This is a measure of "financial deepening" (Godfrey & Agwu, 2020), an "increased provision of financial services (UNESCWA, 2020). Financial deepening emphasizes on 'liquid money" that provides further opportunities for continued economic growth (UNESCWA, 2020).

***Theoretical support from the dividend discount model (DDM:*** The typical Dividend Discount Model (DDM) provides a theoretical support to the effects of monetary policy shifts on stock market performance. DDM, which also goes by such other names as the Present Value model and the Discounted Cash Flow model, was originated by Miller and Modigliani in 1961. Its proposition is that the present-day price of a stock is comparable to the sum of the present value of all future cash flows to equity (Kuwornu & Owusu-Nantwi, 2011). That means that the present stock price ($S_t$) equates to the present value of projected future dividends ($D_{t+j}$).

DDM predicts the direct and indirect effects of monetary policy on stock returns (Ioannidis & Kontonikas, 2006). The "direct effect" arises from alterations in the "discount rate" (DR) known among market players, which gets larger as tighter monetary policy is adopted. DR are inversely related to the stock prices. According to Thorbecke (1997), this is based on the twin assumptions: (i) a direct linkage of the market interest rates to the discount factors adopted by the market actors; and (ii) the monetary authority's ability to regulate the market rates. The "indirect effect" follows changes in the proposed future cash flows. Ceteris paribus, a favorable monetary policy is expected to have a positive impact in the levels of economic activity, and by extension prompt a direct response of the stock price. This is built on the assumption of direct relationship between monetary policy and the aggregate demand of the economy. Patelis (1997) contends that so long as the monetary policy serves as a real economic stimulant, the monetary settings should have impact on the stock markets given that stocks are holdings on future economic output. It is a widely-held view that "restrictive monetary policy" entails mutuality in use of higher discount rates and lower future cash flow (Osakwe & Chukwunulu, 2019).

**Empirical Literature Review**

***Financial development and economic growth:*** The linkages between financial deepening and economic advancement has been grossly discussed in literature. Studies conducted in the sub-Saharan African (SSA) included Akinlo and Egbetunde (2010) who investigated dynamic and causal association between financial development and economic achievement in ten SSA countries – Chad, Central African Republic, Congo, Gabon, Kenya, Nigeria, Sierra Leone, South Africa, Swaziland and Zimbabwe. The research used the cointegration, VECM and Granger-causality techniques. It confirmed that "financial development" was co-integrated with economic growth in all ten countries, but the direction of causality differed among the different countries. In Nigeria, Andabai and Igbodika (2015) found that a long-run equilibrium relationship existed between financial deepening and economic attainment with around 70% short-run adjustment speed from long-run disequilibrium. Also, the study established a causal relationship between financial deepening and economic achievement. There are numerous other studies that investigated the relationships between provision of financial services and economic growth (including Alenoghena, 2014; Onwumere *et al*, 2012; Sackey & Nkrumah, 2012).

***Financial development and stock performance:*** In the United States Jensen and Johnson (1995) investigated the impact of discount rate variations on security returns from 1962–1991. They reported that decreases in discount rates resulted to increases and less volatility of stock returns. In addition, they observed that the stock performance patterns were not determined by changes in short- or long-term bond rates during the period of study. Stoica and Diaconașu (2012) studied the relationships between stock prices and interest rates in the European Union (EU) countries using monthly data from January 2000 to February 2012. They reported existence of short-run and ling-run relationships, but observed that a long-run co-movement between interest rates and stock prices were stronger during the crisis era within the study period. Elsewhere, Bissoon *et al*. (2016) analyzed the impact of monetary policy on stock return in five growing stock markets of Mauritius (Africa), London (Europe), Australia (Oceania), Japan (Asia) and Trinidad (South America). The study, which applied a random-effect model on panel data from 2004-2014, revealed that both money supply and interest rate significantly explained variability in stock returns. However, while interest rate had significant negative influence on stock price during periods of financial crises, money supply had no influence whatsoever. Elsewhere, Ioannidis and Kontonikas (2006) studied the effect of monetary policy on stock returns in 13 OECD countries and revealed that monetary policy influenced stock returns.

In Namibia, where Eita (2014) used the cointegrated VAR technique to assess the existence of causal relationship between stock market return and rate of interest using monthly data covering the period from 1996-2012. The research revealed a negative relationship between stock market returns and interest rates. It also detected bi-directional causality between stock market returns and interest rate and concluded that "contractionary monetary policy" through higher interest rate diminishes stock market returns. In Botswana, Nemaorani (2012) performed a single equation model estimation that regressed real and nominal stock returns on deviances in short-term rate of interest. The study was based on monthly data from 2001-2011. In what appeared to be in a swift contrast to the study's a priori expectation based on the hypothesized negative relationship, it found that a positive relationship existed between changes in 91-day rate and stock returns. The author attributed the contradictory finding to the fact that the main actors in the country's domestic stock market were the few commercial banks, which benefitted principally from interest rates by virtue of their involvement in the issuance of Bank of Botswana Certificates.

In Nigeria, the early work by Omole (1999) was a multivariate regression analysis of the relationship between financial deepening and stock market during the period from 1970-1994. The study attested to the weakness of the "financial deepening" vis-à-vis the size of the entire economic undertakings, but confirmed its ability to stimulate stock market growth. Nwakoby and Alajekwu (2016) studied the effect of monetary policy on Nigerian Stock Market Performance" using annual data covering 1986 – 2013 period. The study combined the OLS, Cointegration, Granger-Causality techniques. Revelation from the Cointegration analysis was that a long run relationship existed between monetary policy and stock market performance measured by the all shares index (ASI). OLS results indicated that ASI was positively influenced by lending interest rate and negatively deposit rate. Overall, the included monetary policy variables explained 53% of the variations in stock performance. Granger causality test revealed unidirectional causality running from ASI to lending interest rate on the one hand and from ASI to deposit rate on the other. Oniore and Akatugba (2017) combined the techniques of Dynamic Ordinary Least Squares (DOLS), Fully Modified Ordinary Least Squares (FMOLS), and the ECM framework in their assessment of the relationship between stock market returns and monetary policy in Nigeria. The study found an existing long-run equilibrium relationship among the variables. Although monetary policy rate, credit to private sector, exchange rate and broad money supply produced positive signs, relating to their relatedness to stock market returns in both the DOLS and FMOLS model, only the exchange rate and broad money supply were found to be statistically significant. The short-run component of the ECM results indicated that whereas credit to private sector and exchange rate had positive effects, the influence of the monetary policy rate and broad money supply was negative in explaining the short-run variations in stock market prices. The authors concluded that the influence of monetary policy variables could not be undermined.

Still in Nigeria, Okoli (2012) used the applied the generalized autorregressive conditional heteroskedasticity or GARCH (1, 1) model to study the linkages between financial deepening and stock market returns. Results showed that when measured as the ratio of market capitalization to GNP, financial deepening affected stock returns, but when measured as the ratio of value traded to GDP financial deepening did not influence stock returns. Also, Nwaogwugwu (2018) investigated the effects of monetary and fiscal policy (including use of money supply and interest rate) on the stock market performance. The study used annual data from 1970-2016 and applied the Autoregressive distributed lag (ARDL) bounds testing approach. The author found that both macroeconomic policy instruments significantly influenced the stock market performance both in the short- and long-run. Specifically, he found that both short-run and long-run relationships existed between broad money supply and the stock market and between interest rate and the stock market. The recommendation is for joint use of the fiscal and monetary policy instruments to enhance realization of stock market potentials in Nigeria.

To the best of this researcher's knowledge, none of the past Nigeria-based studies was a deliberate and conscientious attempt to scrutinize the impact, which the banking sector's instruments of financial inclusion and financial services – in the form of regulating monetary liquidity, credit facility to the private sector, and managing the lending rates – have on Nigeria's stock market performance. Financial inclusion is acclaimed to be an important "enabler" to "poverty" reduction and "prosperity" enhancement (World Bank, 2018). It enables individuals and businesses to have suitable, reasonable, and timely access to financial products and services. This study was primarily designed to fill this gap. The general objective is to explore the relationship between the stock market performance and the banking sector's measures of financial inclusion, financial services and the lending rate in Nigeria. The expectation is that the emerging result will guide the policy makers, stock market watchers, investment analysts, and the general public in their regulatory and investment decision making in Nigeria.

## Methodology

### Study Area Description

Nigeria is a West African nation-state, and a bona fide member of the Economic Community of West African States (ECOWAS). Nigeria situates between latitudes 4.67ºN and 13.87ºN and longitudes 2.82ºE and 14.62ºE. The population is over 200 million persons (Worldometer, 2019). The nation harbors several commercial and industrial cities, including Lagos in the southwest, Kano in the northwest, Port Harcourt in the south-south, and Aba and Onitsha in the south-east.

### Study Data and Method of Collection

The study used quantitative data from secondary sources (Saunders *et al*., 2009). Data were collected from the Statistical Bulletins, Annual and Activity Reports, and other publications of the Central Bank of Nigeria (CBN), covering 38 years from 1981-2018. The year 1981 is when the CBN began recording data on most of the basic macroeconomic fundamentals (CBN, 2019). The author of this study sternly observes the "Code of Ethics" requirement on using documented data, including holding all data in strict confidence, ensuring that their use is restricted to the needs of this research, and that the data were not tampered with humanly.

### Method of Data Analysis

***Analytical techniques and software:*** Data were analyzed using "descriptive" and "inferential" techniques." The Augmented Dickey-Fuller (ADF-test) statistic was used for "stationarity" testing while the vector autoregressive (VAR) model was used to evaluate impact of changes in the explanatory variables on the target variable. Also, the study used the "variance decomposition" (VD) and impulse response function (IRF) techniques to estimate the impact of shocks from each of the included endogenous variables. Relevant tests (including diagnostic tests) were conducted to determine the time series properties of the variables, appropriate lag length for the cointegration verification, existence or otherwise of short and long-term relationships, the appropriate estimable model and the suitability and generalizability of the emerging model parameters. The software used for most of the analyses is the Standard EViews (Version 11) Statistical Package.

***Theoretical vector autoregressives (VARs):*** The VAR model of the relationship between stock performance and the variables depicting provision of financial services and financial inclusion is estimated. "Autoregressive" signifies presence of lagged values of the dependent variable among the regressors. "Vector" signifies presence of two or more variables in the structure. Construction of a VAR system is recommended when the included variables are integrated of order one, I(1), but are not cointegrated. It considers all variables as "endogenous" (IHS Global, 2017).

A typical "stationary" VAR($p$) process of k-dimensions is provided in equation (1)

$$z_t = \alpha_1 z_{t-1} + \cdots + \alpha_p z_{t-p} + cx_t + e_t \text{ ...... (1)}$$

where: (a) $z_t = (z_{1t}, z_{2t}, \ldots, z_{kt})'$ is a "k x 1" vector of endogenous factors; (b) $x_t = (x_{1t}, x_{2t}, \ldots, x_{dt})'$ is a "d x 1" vector of exogenous variables; (c) $\alpha_1, \ldots, \alpha_p$ are "k x k" matrices of expected lag parameters; (d) "c" is a "k x d" matrix of expected parameter of the exogenous; and (e) $e_t = (e_{1t}, e_{2t}, \ldots, e_{kt})'$ is a "k x 1" vector of the stochastic disturbances (white noise) having $E(e_t) = 0$, $E(e_t e_t') = \Sigma_e$, and $E(e_t e_t') = 0$ for $t \neq s$.

The "vector of innovations" correlate synchronously with the full rank matrix, $\Sigma_e$, but are uncorrelated with the "leads" and "lags" of the shocks. It suggests that the stochastic disturbances are not correlated with all the variables in the right-hand side of equation (1), by the usual assumption of the typical $x_t$ "orthogonality".

The matrix form of a VAR system in four variables ($z_{1t}$, $z_{2t}$, $z_{3t}$ and $z_{4t}$) transformed to logarithm values is specified as follows:

$$\begin{bmatrix} \ln z_{1t} \\ \ln z_{2t} \\ \ln z_{3t} \\ \ln z_{4t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} + \begin{bmatrix} \sum_{i=1}^{p} \beta_{1i} & \sum_{j=1}^{p} \phi_{1j} & \sum_{m=1}^{p} \gamma_{1m} & \sum_{v=1}^{p} \varpi_{1v} \\ \sum_{i=1}^{p} \beta_{2i} & \sum_{j=1}^{p} \phi_{2j} & \sum_{m=1}^{p} \gamma_{2m} & \sum_{v=1}^{p} \varpi_{2v} \\ \sum_{i=1}^{p} \beta_{3i} & \sum_{j=1}^{p} \phi_{3j} & \sum_{m=1}^{p} \gamma_{3m} & \sum_{v=1}^{p} \varpi_{3v} \\ \sum_{i=1}^{p} \beta_{4i} & \sum_{j=1}^{p} \phi_{4j} & \sum_{m=1}^{p} \gamma_{4m} & \sum_{v=1}^{p} \varpi_{4v} \end{bmatrix} \begin{bmatrix} \ln z_{1(t-i)} \\ \ln z_{2(t-j)} \\ \ln z_{3(t-m)} \\ \ln z_{4(t-v)} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix} \text{ ...... (2)}$$

where "k" is the selected lag length; the $\beta_i$, $\phi_j$, $\gamma_m$ and $\varpi_v$ are parameters estimates; and the $e_{1t}$, $e_{2t}$, $e_{3t}$ and $e_{4t}$ are the impulses/shocks or innovations in the VAR model.

***Testing for stationarity.*** The unit roots' testing is necessary to confirm the "stationarity properties" of the used variables (Kalyanaraman & Tuwajri, 2014). This study employs the Augmented Dickey-Fuller (ADF) unit roots' test technique for checking the order of integration of the included variables. Only variables confirmed as integrated of the same order, usually "order one" or I(1), are tested for cointegration.

***Determining the acceptable lag length:*** Before applying the cointegration technique a prior selection of the appropriate lag length is important. This will help to avoid model misspecification that may result from use of very few lags and "over parameterization" that may result from use of too many lags (Kalyanaraman & Tuwajri, 2014). The suitable number of lags was determined using the LR test for the "VAR Lag Order Selection Criteria" provided by the EViews. The included information criteria such are the Final Prediction Error (FPE), Schwarz Criterion (SC), Akaike Information Criterion (AIC), and Hannan and Quinn Criterion (HQ).

***Empirical VAR model:*** The explicit form of the empirical VAR model estimated in this study is expressed in equation (3):

$$\begin{aligned}
\ln SPF_t &= c_1 + \sum_{i=1}^{p} \beta_{1i} \ln SPF_{t-i} + \sum_{j=1}^{p} \phi_{1j} \ln CPS_{t-j} + \sum_{m=1}^{p} \gamma_{1m} \ln FSS_{t-m} + \sum_{v=1}^{p} \varpi_{1v} \ln MLR_{t-v} + e_{1t} \\
\ln CPS_t &= c_2 + \sum_{i=1}^{p} \beta_{2i} \ln SPF_{t-i} + \sum_{j=1}^{p} \phi_{2j} \ln CPS_{t-j} + \sum_{m=1}^{p} \gamma_{2m} \ln FSS_{t-m} + \sum_{v=1}^{p} \varpi_{2v} \ln MLR_{t-v} + e_{2t} \\
\ln FSS_t &= c_3 + \sum_{i=1}^{p} \beta_{3i} \ln SPF_{t-i} + \sum_{j=1}^{p} \phi_{3j} \ln CPS_{t-j} + \sum_{m=1}^{p} \gamma_{3m} \ln FSS_{t-m} + \sum_{v=1}^{p} \varpi_{3v} \ln MLR_{t-v} + e_{3t} \quad \ldots (3) \\
\ln MLR_t &= c_4 + \sum_{i=1}^{p} \beta_{4i} \ln SPF_{t-i} + \sum_{j=1}^{p} \phi_{4j} \ln CPS_{t-j} + \sum_{m=1}^{p} \gamma_{4m} \ln FSS_{t-m} + \sum_{v=1}^{p} \varpi_{4v} \ln MLR_{t-v} + e_{4t}
\end{aligned}$$

where "SPF" is a measure of the stock market performance; "CPS" is the credit to the private sector, which is a measure of financial inclusion; "FSS" is an index that measures the provision of financial services; "MLR" is the commercial lending rates of the deposit money banks (DMBs); p is the lag length selected through use of appropriate optimal lag selection technique; $\beta_i$, $\phi_j$, $\gamma_m$ and $\varpi_v$ are parameters to be estimated; $e_{1t}$, $e_{2t}$, $e_{3t}$ and $e_{4t}$ are the impulses, shocks or innovations in the VAR model.

The VAR model of equation 3 is a short-run model estimated by the ordinary least squares (OLS), making the estimates to be considered as the ceteris paribus effects, with inferences based on the usual OLS standard errors and t-statistics.

***Variables in the empirical model:*** The following are description, measurements, and expected signs of the included variables:

"SPF" is an index of stock market performance and the target variable. It is calculated as the level of market capitalization as a percentage of the GDP. Market capitalization is defined as the value of all domestic shares listed on the Exchange (Galebotswe & Tlhalefang, 2012). It is predicted that the previous years' levels of SPF would be positively related to the current levels, other things being equal.

"$CPS_t$" is the DMBs' commercial credit to the private sector of the economy. Indeterminate sign is predicted for "CPS", since its behavior depends on the credit terms and conditions: under favorable terms and conditions, a credit facility would prompt higher investment, boost economic activities (Okorie & Chikwendu, 2019; Onodugo *et al*., 2014) and higher returns, enhanced company growth, higher rating and higher share prices. The opposite will be the case if credit terms and conditions are stringent, like absence of moratoriums, high cost of debt-service, and interest rates.

"$FSS_t$" is the financial services provision index. It is measured as the level of money supply as a percentage of the GDP. This study hypothesizes an indeterminate sign for FSS. On the one hand, an increasing FSS through money supply increase is an expansionary strategy that is expected to increase the disposable incomes of the economic players, and by extension lead to increase in the "aggregate demand" (Malaolu *et al*., 2013). Higher aggregate demand for goods and services would prompt an upward pressure on the general prices, including stock prices. One the other hand, given that money growth rate has a direct link with inflation, increasing "FSS" through increased money supply will cause an increase in the discount rate and lead to reduction in the stock prices.

"$MLR_t$" is the maximum interest rate on commercial lending or the cost of borrowing. As Malaolu *et al*. (2013) argued, increasing interest rate prompts preference to invest in the money market rather than in the stock market while reducing the interest rate inspires speculative need for cash, which has the tendency to prompt more dealings in the stock market. This study predicts a negative sign for MLR.

***Impulse response functions (IRF):*** The IRF tracks the effects of a unit standard deviation shock to one variable on the present and future values of itself and all other endogenous variables in a VECM system, over a given time period (Berggrun, 2005). It is employed in this study to track the impact of a one standard deviation shock to innovations (error terms) from one variable on current and future values of all other endogenous variables ($SPF_t$, $FSS_t$, $CPS_t$, and $MLR_t$).

***Variance decomposition (VD):*** The "orthogonolisation" or VD procedure splits the forecast error variance according to the share of shocks from the various variables (Ali *et al.*, 2018). In this study, the VD allows for the evaluation of the "economic significance" of each endogenous variable ($SPF_t$, $FSS_t$, $CPS_t$, and $MLR_t$) as a source of shock in the forecast error variance of the VAR system. The share of impact from all endogenous variables add up to one.

***Diagnostic tests:*** Diagnostic tests of residual serial correlation, heteroskedasticity, normality, and stability are conducted to determine the empirical strength of the estimated VAR model.

***Serial correlation:*** The "Breusch-Godfrey serial correlation LM test" is employed for serial correlation. It tests the null hypothesis ($H_0$) of "no serial correlation" against the alternative hypothesis ($H_1$) of "presence of serial correlation. Decision criterion is to reject ($H_0$) if each of the observed F-statistic and Obs*R-squared statistic has associated probability value are less than 5%, if not fail to reject $H_0$.

***Heteroskedasticity:*** The "Breusch-Pagan-Godfrey" heteroskedasticity test" is employed to test the null hypothesis ($H_0$) of "equality of the error variances" against the alternative hypothesis ($H_1$) of "inequality in variance." Decision rule is to reject ($H_0$) if the associated probability values of the observed F-statistic and Obs*R-squared statistic are less than 5%, otherwise fail to reject $H_0$.

***VAR residual normality*:** The test of normality in distribution of the residuals of the VAR system is used to test the null hypothesis that the "VAR residuals is normally distributed" against the alternative is that the distribution is not normal. Decision criteria is to reject the null hypothesis if probability of the observed "Jarque-Berra statistic" is less than 5%, otherwise fail to reject the $H_0$.

***Stability of the recursive residual estimates:*** The "cumulative sum" ("CUSUM") test and "cumulative sum of squares" ("CUSUM of Squares") test are used to test for the stability of the recursive residual estimates of a model. Each tests the null hypothesis that the model is stable against the alternative hypothesis that the model is not stable. Decision rule is to reject $H_0$ if the estimates fall within the 5% significance bands, otherwise, fail to reject $H_0$. In a case where the "CUSUM" or "CUSUM of squares" tests lead to conclusion of model instability, it may be an indication of existence of "structural breaks" in the data series.

## Results and Discussions

### Descriptive Statistics

The descriptive statistics of the variables are presented in Table 1. Stock market performance ($SPF_t$), defined as the market capitalization measures as a percentage of the GDP, has its observed mean value is 10.60%, which ranges from 3.05% realized in 1989 to 39.95% realized in 2007. Credit to the private sector ($CPS_t$) has its observed mean value as ₦5.021 trillion (US$16.413 billion) and ranges from for ₦8.570 billion (US$0.028 billion) observed in 1981 to ₦22.521 trillion (US$73.625 billion) observed for 2018. The calculated mean of the index of financial services ($FSS_t$) is 14.67%. The lowest rate (9.15%) is reported for 1996 while the highest rate (24.34%) is reported for 2009. For the lending rate, the observed average is 21.87% while it records the lowest rate (10.00%) in 1981 and highest rate (36.09%) in 1993. The probability of the Jarque-Bera (JB) statistics suggest rejection of the null hypothesis of "normality in distribution" for stock performance ($p<.01$) and credit to the private sector ($p<.01$). However, the JB-statistic does not suggest rejection of the null hypothesis of normal distribution for the lending rate with an observed $p=.97$ and financial services with an observed $p=.08$.

Table 1: *Descriptive statistics of variables, 1981-2018*

| Description | Stock Performance Index* ($SPF_t$) (%) | Credit to the private sector ($CPS_t$) (₦ billion)** | Financial Services Index ($FSS_t$) (%) | Maximum lending rate ($MLR_t$) (%) |
|---|---|---|---|---|
| Mean | 10.597 | 5020.640 | 14.673 | 21.875 |
| Median | 6.853 | 480.771 | 12.693 | 21.444 |
| Maximum | 39.950 | 22521.930 | 24.343 | 36.090 |
| Minimum | 3.053 | 8.570 | 9.152 | 10.000 |
| Std. Dev. | 8.411 | 7672.899 | 4.590 | 6.093 |
| Skewness | 1.318 | 1.275 | .747 | -.036 |
| Kurtosis | 4.893 | 3.022 | 2.013 | 2.802 |
| Jarque-Bera | 16.674 | 10.290 | 5.074 | .070 |
| Probability | .000 | .005 | .079 | .966 |
| Sum | 402.697 | 190784.3 | 557.557 | 831.252 |

| | | | | |
|---|---|---|---|---|
| Sum Sq. Dev. | 2617.372 | 2.18E+09 | 779.593 | 1373.420 |
| Observations | 38 | 38 | 38 | 38 |

* Stock performance (SPF) is calculated as SPF=Market capitalization/GDP*100%);
**Official exchange rate of the local currency (₦) to the United States dollar is ₦305.90/US$1.00

Figure 1 shows the graphs of the year-on-year growth in the variables. The graphs do not depict any definite growth pattern, as each graph fluctuated overtime.

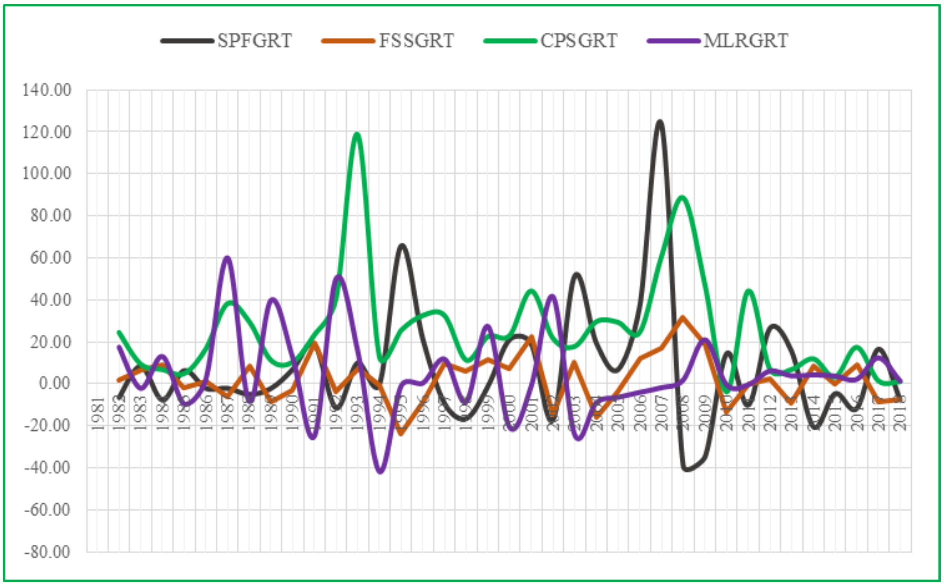


Figure 1: *Year-on-year (percentage) growth in the data series, 1981-2018*

The correlation matrix of the year-on-year growth of the variables are displayed in Table 2. The SPF growth is negatively correlated with CPS growth (-.294) and MLR growth (-.298). Also, negative correlation is observed between the CPS growth and MLR growth (-.212). To the contrary, positive correlation is observed between SPF growth and FSS growth at .034. Equally positive association is observed between FSS growth and CPS growth (.431) and between FSS growth and MLR growth (.151). No observed pairwise correlation coefficient is significantly high at above .50. The next step is to carry out stationarity test on the time series.

Table 2: *Pairwise Pearson's correlation matrix of year-on-year growth of variables*

| Variable | Short name | ($SPFGRT_t$) | ($FSSGRT_t$) | ($CPSGRT_t$) | ($MLRGRT_t$) |
|---|---|---|---|---|---|
| Stock Performance Index (growth rate) | ($SPFGRT_t$) | 1.000 | - | - | - |
| Financial Services Index (growth rate) | ($FSSGRT_t$) | .034 | 1.000 | - | - |
| Credit to private sector (growth rate) | ($CPSGRT_t$) | -0.094 | 0.431 | 1.000 | - |
| Lending rate (growth rate) | ($MLRGRT_t$) | -0.298 | 0.151 | -0.212 | 1.000 |

**. Correlation is significant at the 0.01 level (2-tailed); number of observation is n=37.

**Stationarity of the Times Series**

Table 3 shows the output of the ADF unit roots' test for each time series.

Table 3: *Unit Roots' Test Output, 1981-2018*

| Variable | ADF-statistic | Level | | First difference | |
|---|---|---|---|---|---|
| | | Intercept only | Trend & intercept | Intercept only | Trend & intercept |
| $lnSPF_t$ | t-statistics | -.952 | -2.412 | $-5.925^{***}$ | $-5.837^{***}$ |
| | ADF C.V. (1%) | -3.622 | -4.227 | -3.627 | -4.235 |
| | ADF C.V. (5%) | -2.943 | -3.537 | -2.946 | -3.540 |
| $lnCPS_t$ | t-statistics | -.658 | -1.853 | $-4.331^{***}$ | $-4.299^{***}$ |
| | ADF C.V. (1%) | -3.621 | -4.235 | -3.627 | -4.235 |
| | ADF C.V. (5%) | -2.943 | -3.540 | -2.946 | -3.540 |
| $lnFSS_t$ | t-statistics | -1.197 | -2.231 | $-5.456^{***}$ | $-5.370^{***}$ |
| | ADF C.V. (1%) | -3.621 | -4.227 | -3.627 | -4.235 |
| | ADF C.V. (5%) | -2.943 | -3.537 | -2.946 | -3.540 |
| $lnMLR_t$ | t-statistics | -2.667 | -2.924 | $-7.817^{***}$ | $-6.150^{***}$ |
| | ADF C.V. (1%) | -3.621 | -4.227 | -3.627 | -4.244 |
| | ADF C.V. (5%) | -2.943 | -3.537 | -2.946 | -3.544 |

$^{***}$=significant at 1%; $^{**}$=significant at 5%; C.V=Critical value; Lag Length: 2 (Automatic – based on AIC, maxlag=2)

None of observed t-statistics is significant at levels for cases involving "intercept only" and "intercept and trend." The absolute values of each critical ADF-statistics is greater than the absolute value of the observed t-statistic at 5%. None of the null hypotheses of "non-stationarity" is rejected at level. At first differences, tests show the absolute values of the critical ADF-statistics as lesser than the absolute values of the observed t-statistics at 5% levels of significance. The outcomes are consistent for tests involving "intercepts only" and "intercepts and trends." For example, test for $SPF_t$ at first difference for "intercept only" produces an absolute value of observed t-statistic as 5.925, which is greater than the absolute value of the critical ADF-statistic given as 3.627 at 1% level and 2.926 at 5% level. Similar test for "intercept and trend" produces an absolute value of observed t-statistic as 5.837 that is greater than the absolute value of the critical ADF-statistic given as 4.235 at 1% level and 3.540 at 5% level. Test results obtained for $CPS_t$, $FSS_t$ and $MLR_t$ are also reported in Table 3. The outcomes means the rejection of the null hypothesis that each times series has a unit root at first difference and leads to the conclusion that each is a I(1) series.

**Determining the Optimal Lag Length for Use**

The researcher conducted the lag order selection test to determine the optimal lag length for use for the cointegration test. Results are displayed in Table 4.

Table 4: *Output of the VAR Lag Order Selection Criteria test*

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -52.276 | NA | .000 | 3.216 | 3.394 | 3.277 |
| 1 | 96.676 | 255.346* | 1.48e-07* | -4.381* | -3.493* | -4.075* |
| 2 | 105.370 | 12.917 | 2.34e-07 | -3.964 | -2.364 | -3.412 |
| 3 | 113.914 | 10.741 | 3.97e-07 | -3.538 | -1.227 | -2.740 |

* indicates lag order selected by the criterion; LR: sequential modified LR test statistic (at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion; Endogenous variables: LNSPF LNFSS LNCPS LNMRT.

The flagged numbers are the values selected for each criteria. All the flagged values relate to lag 1 of each selection criteria, but the AIC has the least value of -4.381. Consequently, lag length 1 is selected as the optimal lag length for the cointegration test. Also, the AIC is the applied selection criteria.

**Analysis of Cointegration**

Table 5 is the Johansen cointegration test output showing both the “Trace” and “Maximum Eigenvalue” statistics. For each hypothesis, the observed Trace-statistic and Max-eigen statistics are less than the critical values at 5% levels. For example, for “no contegrating equation” the observed Trace-statistic is 45.624 while the 5% critical value is 47.856. Similarly, the observed Maxi-Eigen statistic is 24.390 while the 5% critical value is 27.584. The fact that the observed values are less than the 5% critical values suggests that the null hypothesis is not rejected at 5%. The associated probability values observed as p=.080) for Trace and p=.122 for Max-Eigen statistics also support that the null hypothesis should not be rejected at 5%. This outcome is consistent for all other hypotheses involving higher numbers of cointegrating equations’ tests – the observed p-values are greater than .05 meaning that the linked null hypotheses could be rejected at 5% levels. No case of cointegrating relationship is established among the variables. It means that even though each variable is I(1) series, the variables are not integrated. This finding makes the use of the VAR model appropriate for further analysis of the relationships. Consequently, the study proceeds with the VAR model estimation using the four variables and the selected optimal lag length (k=1) for each variable.

Table 5: *Cointegration test output: Trace-statistic and Max-Eigen value statistic*

| Hypothesized No. of CE(s) | Eigenvalue | Trace Stat. ($\lambda_{trace}$) | 5% Critical value | Prob. | Max-Eigen Stat. ($\lambda_{max}$) | 5% Critical Value | Prob. |
|---|---|---|---|---|---|---|---|
| None | .492 | 45.624 | 47.856 | .080 | 24.390 | 27.584 | .122 |
| At most 1 | .326 | 21.234 | 29.797 | .343 | 14.223 | 21.132 | .347 |
| At most 2 | .151 | 7.011 | 15.495 | .576 | 5.884 | 14.265 | .628 |
| At most 3 | .031 | 1.127 | 3.841 | .289 | 1.127 | 3.841 | .289 |

***denotes rejection of the hypothesis at the 1% level; **denotes rejection of the hypothesis at the 5% level; Trace test indicates no cointegration at the 0.05 level; Max-eigenvalue test indicates no cointegration at the 0.05 level; included series are $\ln SPF_t$, $\ln CPS_t$, $\ln FSS_t$ and $\ln MLR_t$.

**Estimates of the VAR Model**

The following expressions (4a) – (4e) show the output equation forms of the four-variable VAR system estimated.

$$\ln SPF_t = \underset{[2.320]}{\underset{(0.906)}{2.1009}} + \underset{[2.527]}{\underset{(0.182)}{0.4608}} * \ln SPF_{t-1} + \underset{[2.946]}{\underset{(0.0720)}{0.2121}} * \ln FSS_{t-1} - \underset{[-2.157]}{\underset{(0.251)}{0.5409}} * \ln CPS_{t-1} - \underset{[-1.383]}{\underset{(0.199)}{0.2749}} * \ln MLR_{t-1} + e_{1t} \quad \text{.... (4a)}$$

$$Adj.R^2 = 0.923;\ F-stat. = 108.576;\ \Pr ob(F-stat.) = 0.000;\ D-W\ stat. = 1.752$$

$$\ln FSS_t = \underset{[-1.357]}{\underset{(0.595)}{-0.8078}} + \underset{[3.917]}{\underset{(0.120)}{0.4696}} * \ln SPF_{t-1} + \underset{[17.882]}{\underset{(0.047)}{0.8462}} * \ln FSS_{t-1} - \underset{[-0.327]}{\underset{(0.165)}{0.0541}} * \ln CPS_{t-1} + \underset{[2.895]}{\underset{(0.131)}{0.3783}} * \ln MLR_{t-1} + e_{3t} \quad \text{.... (4b)}$$

$$Adj.R^2 = 0.997;\ F-stat. = 3160.636;\ \Pr ob(F-stat.) = 0.000;\ D-W\ stat. = 2.030$$

$$\ln CPS_t = \underset{[-0.219]}{\underset{(0.413)}{-0.0906}} + \underset{[3.106]}{\underset{(0.083)}{0.2584}} * \ln SPF_{t-1} - \underset{[-1.926]}{\underset{(0.033)}{0.0632}} * \ln FSS_{t-1} + \underset{[7.228]}{\underset{(0.114)}{0.8271}} * \ln CPS_{t-1} + \underset{[1.542]}{\underset{(0.091)}{0.1398}} * \ln MLR_{t-1} + e_{2t} \quad \text{.... (4c)}$$

$$Adj.R^2 = 0.886;\ F-stat. = 71.170;\ \Pr ob(F-stat.) = 0.000;\ D-W\ stat. = 2.073$$

$$\ln MLR_t = \underset{[0.935]}{\underset{(0.753)}{0.7045}} - \underset{[-0.476]}{\underset{(0.152)}{0.0722}} * \ln SPF_{t-1} + \underset{[0.334]}{\underset{(0.060)}{0.0200}} * \ln FSS_{t-1} + \underset{[0.804]}{\underset{(0.2086)}{0.1677}} * \ln CPS_{t-1} + \underset{[3.872]}{\underset{(0.165)}{0.6403}} * \ln MLR_{t-1} + e_{4t} \quad \text{....(4d)}$$

$$Adj.R^2 = 0.604;\ F-stat. = 14.767;\ \Pr ob(F-stat.) = 0.000;\ D-W\ stat. = 2.239$$

where values in parentheses "( )" are standard errors and "[ ]" are t-values.

The discussion will focus on the estimated stock performance model represented by equation (4a). It reveals that the previous year's stock performance index ($p<.01$), financial services ($p<.01$) and credit to the private sector ($p<.01$) offer significant explanation for variations in stock performance. Past indexes of stock performance and financial services have positive signs while credit to the private sector has a negative sign. From the results, a 10% rise in the previous year's performance index results to a 4.61% rise in the current stock performance level on average ceteris paribus. A similar 10% rise in the past year's financial services index results to a 2.11% rise in the current stock performance on average ceteris paribus. To the contrary, a 10% rise in the previous year's level of commercial credit to the private sector produces a 5.41% drop in the current stock performance on average ceteris paribus. This result suggests that while provision of financial services has served as an incentive to stock activities, credit facility has served more as a disincentive to stock performance. The other included variable–lending rate–has the anticipated negative sign, but not significant in explaining variations in the VAR model. This finding corroborates the finding in a Ghana-based study that interest rate was both inversely related and insignificant in explaining stock returns (Addo & Sunzuoye, 2013). Also, there are other Nigeria-based studies that suggest that real interest rate is not a key determinant of movements in stock prices (Malaolu *et al*., 2013; Ologunde *et al*., 2006). Altogether, the included variables explained 92.30% of the variations in stock performance as revealed by the adjusted $R^2$ =.923. Overall, the estimated VAR model is a good fit (F-statistic=108.58; P (F-stat)<.01).

In the next section, we take an investigative assessment of the empirical strength of the VAR model we estimated in this study – results of tests or residual serial correlation, heteroskedasticity, normality and model stability are reported.

**Diagnostic Tests Linked to the VAR Model**

***VAR model serial correlation test output:*** The VAR serial correlation LM test technique was conducted and the result is reported in Table 6.

Table 6: *Summary output of VAR Residual Serial Correlation LM Tests*

| | Null hypothesis: No serial correlation at lag h | | | | | | Null hypothesis: No serial correlation at lags 1 to k | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lag | LRE*stat | df | Prob. | Rao F-stat | df | Prob. | LRE*stat | df | Prob. | Rao F-stat | df | Prob. |
| 1 | 14.960 | 16 | .528 | .938 | (16, 77.0) | .531 | 14.950 | 16 | .528 | .938 | (16, 77.0) | .531 |
| 2 | 16.428 | 16 | .424 | 1.040 | (16, 77.0) | .427 | 38.135 | 32 | .210 | 1.235 | (32, 79.0) | .223 |
| 3 | 22.735 | 16 | .121 | 1.496 | (16, 77.0) | .123 | 52.881 | 48 | .291 | 1.116 | (48, 67.5) | .335 |
| 4 | 19.891 | 16 | .225 | 1.286 | (16, 77.0) | .228 | 83.454 | 64 | .052 | 1.408 | (64, 53.2) | .100 |
| 5 | 15.033 | 16 | .522 | .943 | (16, 77.0) | .525 | 95.639 | 80 | .112 | 1.169 | (80, 37.9) | .301 |

*Edgeworth expansion corrected likelihood ratio statistic; included number of observations is 37.

For each individual lag and range of lags, the observed LRE*statistic and observed Rao F-statistic have probability values that are higher than .05. For example, in the case of lag 5, the observed LRE*statistic is 15.033 (with a probability of p=.522) while the observed Rao F-statistic is .943 (with a probability of p=.525). This result means that the null hypothesis ($H_0$: no serial correlation at lag 5) is not rejected at 5% level. Also, for the lag range 1 to 5, the observed LRE*statistic is 95.639 (with a probability of p=.112) while the observed Rao F-statistic is 1.169 (with a probability of p=.301). It means also that the null hypothesis ($H_0$: no serial correlation at lags 1-5) is not rejected at 5% level. Thus, the conclusion is that the VAR model is free from the problem of serial correlation.

***Test of heteroskedasticity:*** The output of the VAR residual heteroskedasticity test is reported in Table 7. It is in two parts: joint test, and individual components' test.

Table 7: *Summary of the VAR Residual Heteroskedasticity Tests (for levels and squares)*

| Joint test | | Chi-sq | | df | | Prob. |
|---|---|---|---|---|---|---|
| | | 88.304 | | 80 | | .246 |
| Individual components | Dependent | R-squared | F(8,28) | Prob. | Chi-sq(8) | Prob. |
| | res1*res1 | .186 | .798 | .609 | 6.871 | .551 |
| | res2*res2 | .235 | 1.072 | .410 | 8.678 | .370 |
| | res3*res3 | .361 | 1.975 | .088 | 13.346 | .101 |
| | res4*res4 | .538 | 4.077 | .003 | 19.909 | .011 |
| | res2*res1 | .165 | .692 | .695 | 6.111 | .635 |
| | res3*res1 | .262 | 1.245 | .311 | 9.709 | .286 |
| | res3*res2 | .094 | .364 | .931 | 3.483 | .901 |
| | res4*res1 | .243 | 1.121 | .380 | 8.974 | .345 |
| | res4*res2 | .430 | 2.644 | .027 | 15.924 | .044 |
| | res4*res3 | .149 | .614 | .759 | 5.521 | .701 |

Included number of observations is 37.

With main focus on the joint test, the calculated Chi-squared of is 88.304. It has an observed probability value, p=.246, that is greater than .05. This means that the null hypothesis of homoscedasticity (absence of heteroskedasticity) is not rejected at 5% level when all the components are jointly considered. Therefore, the conclusion is that the residual of the VAR system is free from heteroskedasticy problem, which is an indication of the model's goodness.

***VAR residuals normality test:*** The output of the residual normality test of the VAR system in reported in Table 8. The output relates to the VAR residual normality of each variable and for all variables taken together. Based on the observed Jarque-Bera statistics and associated probability values, the null hypothesis of normality is rejected for SPF (JB-stat.=58.821; p<.01) and FSS (JB-stat.=16.643; p<.01). However, it is not rejected for CPS (JB-stat.=1.256; p=.534) and MLR (JB-stat.=.209; p=.901). For the joint test, the observed is JB-stat.=76.929 and its associated probability value is p<.01, which is lower than 0.05. Following this result, we reject the null hypothesis of joint normality at 5% level. This leads to the conclusion that the distribution of the VAR system' residuals was not multivariate normal. This may have resulted from the fact that most of the times series recorded rising trends over the years studied.

Table 8: *Output of the VAR residual normality tests*

| Component | Skewness | | | | Kurtosis | | | | Jarque-Bera | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | Chi-sq | df | Prob.* | Coeff. | Chi-sq | df | Prob.* | J-B Coef. | df | Prob.* |
| 1: $\ln SPF_i$ | 1.598 | 15.750 | 1 | .000 | 8.286 | 43.072 | 1 | .000 | 58.821 | 2 | .000 |
| 2: $\ln FSS_i$ | 1.222 | 9.214 | 1 | .002 | 5.195 | 7.429 | 1 | .006 | 16.643 | 2 | .000 |
| 3: $\ln CPS_i$ | -.449 | 1.242 | 1 | . 265 | 2.908 | .013 | 1 | .909 | 1.256 | 2 | .534 |
| 4: $\ln MLR_i$ | .171 | .181 | 1 | .670 | 2.867 | .027 | 1 | .868 | .209 | 2 | .901 |
| Joint (All) | | 26.387 | 4 | .000 | | 50.542 | 4 | .000 | 76.929 | 8 | .000 |

Null hypothesis: residuals are multivariate normal; included observations are 37; *approximate p-values do not account for coefficient estimation.

***Test of stability of recursive estimates:*** The cumulative sum (CUSUM) and cumulative sum of squares (CUSUM of squares) stability tests results are presented in Figures 3a and 3b.

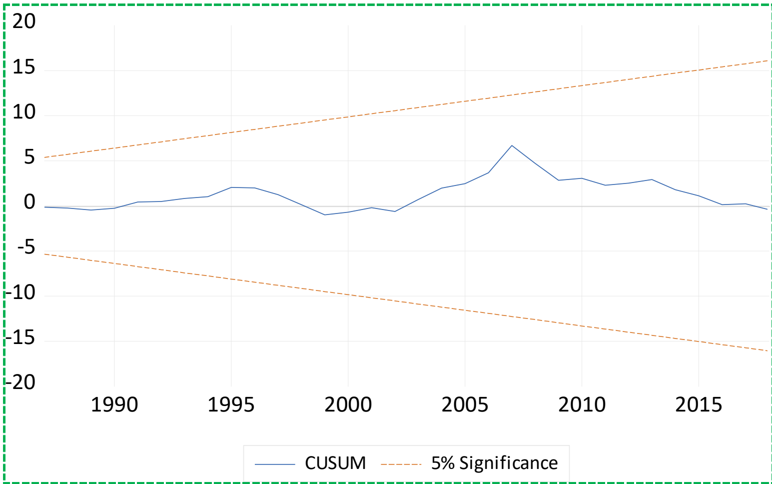


Figure 2 (a): *Cumulative sum (CUSUM) test output*

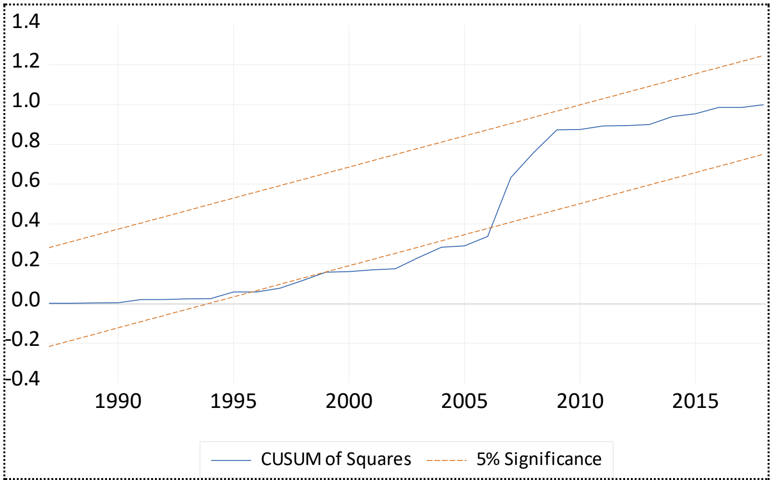


Figure 2 (b): *Cumulative sum of squares (CUSUM of squares) test output*

The CUSUM graph of Figure 3 (a) is evidently fitted inside the 5% significance strip, defined by the upper and lower lines. This means that the recursive estimates are statistically significant at $p<0.05$ levels, which is an indication of stability. Following the outcome, we reject the null hypothesis that "the recursive estimates are not stable" at 5% level. It is concluded that the model is stable. In the second case in Figure 3(b), it is observed that although the CUSUM of squares graph shows some degree of instability when it drifts off the 5% significance strip, the slip off is reversed and stability sustained thereafter. The slip off results from structural breaks in data between the late-1990s and mid-2000s. Elsewhere, it is reported using the CUSUM test that the volume of traded stock in Nigeria is unrelentingly stable, even in the midst of willowy erratic shocks occurring overtime (Saibu *et al*., 2016).

The results of the foregoing diagnostics indicate that the estimated VAR model of this study passes the tests of serial correlation, heteroskedaticity and stability. Even though the model failed to pass the joint test multivariate normality of residuals, it is still good enough to enable an understanding the stock performance behavior in response to impulses ignited by the included monetary policy variables. In the next two subsections, the discussion will focus on the variance decomposition (VD) and the impulse response function (IRF) analyses. These will enable an understanding and prediction of the influence each variable has on others and how variables respond to impulses from any dominant variable.

**Examining the Variance Decomposition of Error Variance**

Table 10 displays the VD output for 10 periods. To guide this analysis, we consider period 1 as the short-run and period 10 as the long-run. In period one, the SPF solely accounts for 100% of the forecast error variance in itself. It means that during this period SPF has a "strongly endogenous" influence. In period 2, the self-influence of SPF reduces by 4.67%, which is taken up by CPS (2.34%) and MLR (2.33%). In period 3, the percentage share of error variance attributable to the SPF drops by additional 6.30% to close at 89.04% while the percentage shares attributable to FSS, CPS and MLR rise to .07%, 6.54% and 4.35% respectively. Noticeable in period 3 is a significant rise in the percentage shares of the forecast error variance for CPS and MLR.

As we move into the future, the self-influence of SPF continuously weakens while the relative influence from other variables increases in prominence. As at period 10, the percentage error variance drops to 64.31% for the SPF and rises to as much as 23.47% for the CPS, 7.41% for the FSS and 4.81% for MLR. So, much of the percentage share of error variance being let go by SPF is taken up by CPS and FSS, indicating their relative significance in explaining variations in the long-run stock performance model. Similar explanations can be accorded for the other equations in the VAR system as shown by the output reported in Table 9.

Table 9: *Variance Decomposition of "Variance Decomposition" and forecast error variance*

| Variable | Period | Standard error | Variance decomposition (%) | | | |
|---|---|---|---|---|---|---|
| | | | $lnSPF_t$ | $lnFSS_t$ | $lnCPS_t$ | $lnMLR_t$ |
| $lnSPF_t$ | 1 | .216 | 100.000 | .000 | .000 | .000 |
| | 2 | .256 | 95.334 | .000 | 2.340 | 2.325 |
| | 3 | .277 | 89.039 | .0748 | 6.536 | 4.350 |
| | 4 | .290 | 83.199 | .4153 | 11.113 | 5.272 |
| | 5 | .300 | 78.350 | 1.108 | 15.128 | 5.413 |
| | 6 | .308 | 74.426 | 2.119 | 18.232 | 5.224 |
| | 7 | .315 | 71.218 | 3.351 | 20.440 | 4.991 |
| | 8 | .322 | 68.540 | 4.698 | 21.923 | 4.839 |
| | 9 | .327 | 66.264 | 6.071 | 22.876 | 4.788 |
| | 10 | .333 | 64.305 | 7.408 | 23.471 | 4.816 |
| $lnFSS_t$ | 1 | .142 | 3.618 | 96.382 | .000 | .000 |
| | 2 | .237 | 20.214 | 73.630 | .994 | 5.162 |
| | 3 | .314 | 27.092 | 63.349 | 2.900 | 6.660 |
| | 4 | .377 | 29.606 | 58.235 | 5.371 | 6.788 |
| | 5 | .429 | 30.031 | 55.350 | 8.076 | 6.544 |
| | 6 | .475 | 29.439 | 53.579 | 10.731 | 6.251 |
| | 7 | .517 | 28.403 | 52.440 | 13.148 | 6.010 |
| | 8 | .555 | 27.228 | 51.693 | 15.238 | 5.842 |
| | 9 | .590 | 26.072 | 51.204 | 16.980 | 5.743 |
| | 10 | .622 | 25.010 | 50.887 | 18.401 | 5.702 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $lnCPS_t$ | 1 | .099 | .769 | 2.289 | 96.942 | .000 |
| | 2 | .131 | 9.195 | 2.546 | 85.969 | 2.289 |
| | 3 | .151 | 18.317 | 2.433 | 76.428 | 2.822 |
| | 4 | .162 | 24.908 | 2.331 | 70.094 | 2.667 |
| | 5 | .167 | 29.150 | 2.296 | 66.066 | 2.489 |
| | 6 | .171 | 31.628 | 2.325 | 63.624 | 2.423 |
| | 7 | .173 | 32.912 | 2.418 | 62.247 | 2.423 |
| | 8 | .174 | 33.457 | 2.580 | 61.533 | 2.430 |
| | 9 | .175 | 33.584 | 2.813 | 61.184 | 2.419 |
| | 10 | .176 | 33.490 | 3.116 | 61.001 | 2.393 |
| $lnMLR_t$ | 1 | .180 | 10.395 | 19.851 | 7.271 | 62.482 |
| | 2 | .217 | 13.296 | 20.508 | 5.476 | 60.719 |
| | 3 | .233 | 13.754 | 20.964 | 4.792 | 60.490 |
| | 4 | .241 | 13.322 | 21.215 | 4.865 | 60.598 |
| | 5 | .246 | 12.864 | 21.308 | 5.233 | 60.595 |
| | 6 | .248 | 12.650 | 21.313 | 5.595 | 60.441 |
| | 7 | .250 | 12.657 | 21.289 | 5.835 | 60.219 |
| | 8 | .250 | 12.784 | 21.263 | 5.950 | 60.003 |
| | 9 | .251 | 12.943 | 21.248 | 5.982 | 59.826 |
| | 10 | .251 | 13.086 | 21.244 | 5.978 | 59.692 |

Cholesky Ordering: $lnSPF_t$ $lnFSS_t$ $lnCPS_t$ $lnMLR_t$

## Analysis of the Impulse Response Function

The output showing the response of the individual time series to Cholesky one standard deviation (degree of freedom adjusted) innovations is presented in Figure 4. The responses are given as the impulse response function (IRF) graphs.

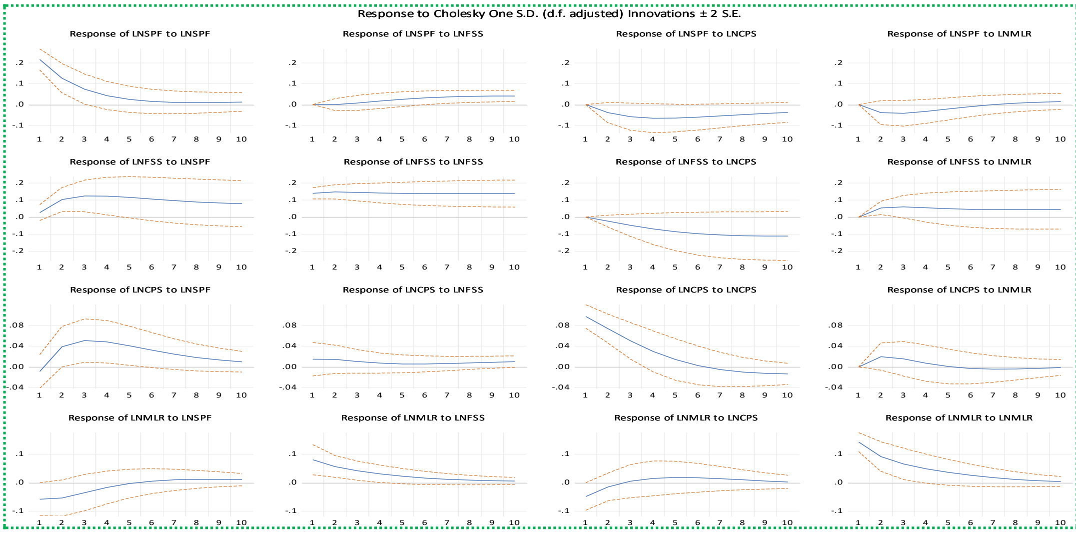


Figure 3: *Impulse response function multiple graphs*

With particular focus on the target variable (SPF), the graphs in the first row relate to the response of stock performance to one-standard deviation innovations from itself and the other variables over a period of time. The response appears as a graph (in blue) in the middle, sandwiched by the plus/minus two standard error upper and lower strings. From the first graph, the SPF's response to self-emanating shock shows an initial sharp decline, but thereafter persistently declines at a decreasing rate while remaining positive throughout the ten-year period. The outcome is a downward-sloping (convex) curve in the first quadrant. SPF's response to one-standard deviation innovation from CPS drops from zero in period 1 to a negative value in period 2. It remains negative throughout the ten-year period. The graph reflecting the response appears in the fourth quadrant as the third case in the first row of Figure 5. The response of SPF to one standard deviation shock emanating from of the FSS, dropped slightly from zero in period one to a negative value in period two. It returns to positive in period 3. It remains positive in the first quadrant with sustained incremental trend throughout periods 3-10. Similar explanation can be extended to the responses of CPS, FSS and MLR to one-standard deviation shocks from all variables as also reflected in Figure 5.

**Discussion of Results**

The statistically significant variables in the stock market performance component of the estimated VAR system are the indexes of past stock performance, financial services and commercial credit to the private sector. The first two factors have positive impact while the third has a negative impact. The significance of the three variables is remarkable and partially corroborates the finding of another study by Osisanwo and Atanda (2012) that equally recognized previous levels of stock returns and money supply among the key determinants of stock returns in Nigeria.

First, the effect of past stock performance on its current level is understandable. It is evident that rising stock prices get more attention from investors towards the firms or economic sectors that are experiencing boom/ increasing level of activity. Such renewed interests would often result to higher growth in revenues, which further attracts more investors (Investopedia, 2019). Second, considering that money supply-to-the-GDP ratio depicts access to financial services provided by the monetary authority, the finding shows that increasing rate of financial services has an expansionary influence in the stock performance. This expansionary impact means that overtime the financial services provision policy has boosted aggregate demand and the general transactions in goods and services (Malaolu *et al*., 2013). It is expected based on economic theory that increasing money supply often leads to upward trend in general prices. The evidence of correlation between money supply and inflationary trends in Nigeria has been highlighted by previous empirical findings (Bawa *et al*., 2016; Otto & Ukpere, 2016). Available data put the average consumer price index (inflation) rates at over 19 percent during the period of study. Therefore inasmuch as rising money supply has boosted levels of economic activities and stock transactions in the country, it has also heightened inflationary tendencies, cost of raw materials and general costs of doing business. The resulting economic instability has led to the shutdown of many micro-, medium and small-scale enterprises (MSMEs) that persistently failed to cover their marginal production costs, thereby causing job loss, especially among the downstream operators. At the households' level, it has caused drastic reduction in the purchasing power and led to increased households' poverty.

Third, the finding that commercial credit to the private sector has a contractionary impact on stock performance can be attributed to twin-problem of unfavourable terms and conditions attached to the commercial credit and loan facilities and unconducive business operating environment. Since credit to the private sector-to-the-GDP ratio serves as an index of financial inclusiveness, the finding suggests that commercial credit has not been used to achieve the ultimate objective of financial inclusion for the private sector investors. Under a conducive business environment, a suitably structured credit facility ought to instigate greater investment, boost economic activities and output (Okorie & Chikwendu, 2019; Onodugo *et al*., 2014). This will create higher returns, promote growth, rating, and share value of firms. Presently, thes expected gains are decreased due to the diminishing role of the (harsh) business operating environment that is inimical to the ease-of-doing business in the country. The VD and IRF results corroborate the short-term effect of previous stock performance level on current performance. The rising impact of financial services and credit to the private sector starts emerging after the early period and gets stronger with time. This study shows that in the long-run stock performance demonstrates "weak endogeneity" with relative weaker self-influence while the indexes of financial services and credit to the private sector become "robustly endogenous." In their study of the stock market in Bangladesh, Ali *et al*. (2018) documented that virtually all variance in stock performance was attributable to the short-term tremors from itself whereas the weight decreased towards the long-term.

Among the recommendation from this study is that while pushing more money into the economy the federal government of Nigeria, through its relevant ministries, departments and agencies (MDAs), should simultaneously, deploy a suitable mix of policy instruments to checkmate the negative effects of the rising prices on the economy. There is need to replace the existing protocols that inimical to smooth business operations with suitable policies capable of providing good business enabling environment, to further promote ease-of-doing-business for the private sector investors. Secondly, the terms and conditions of the DMBs' credit and loan facilities should be reviewed to make the instrument investment-friendly and more impactful to the investing public. There is a need to reduce the institutional and administrative hiccups associated with accessing the credit and loan packages to make them easily accessible at lower costs. Also, the facilities should be provided for longer moratorium periods, lower cost of debt serving and single digit interest rates.

## Conclusions

This study employs the autoregressive model to investigate the behavior of stock performance in response to financial services and inclusion policy instruments in Nigeria from 1981-2018. It finds that all series are integrated of order one, but not cointegrated. Previous levels of stock performance and financial services have positive effect on current stock performance while credit to the private sector has a negative influence. The findings imply that the hypothetical expansionary impact of provision of financial services on stock performance was achieved while the impact of financial inclusiveness was contractionary against premeditated outcome. This study is an addition to existing basket of studies on the link between financial development and growth of economic activities in Nigeria. Specifically, however, it finds that use of credit to the private sector as a financial inclusion policy instrument has been more of a disincentive to private sector investment in Nigeria that needs to be reviewed to realize the potential gains. The study faults the stringent terms and conditions associated with the DMBs' provided commercial credit and loan facilities as well as the unconducive business operating environment for the negative impact.

The researcher believes that a good understanding and knowledge of the interplay of these variables will guide the policy makers in the formulation of appropriate financial and economic policies. It will also benefit to stock market watchers, investment analysts, and the general public in their regulatory and investment decision making in Nigeria. The study recommends use of suitable mix of policies to promote business enabling environment and ease-of-doing-business for private sector operators. Minimizing the prevailing institutional and administrative bottlenecks impeding genuine access to credit and loan facilities, providing longer moratorium periods, lowering cost of debt serving, and granting credits at single digit interest rates are some of the ways of enhancing impact of credit on business performance. By and large, provision of suitable socio-economic infrastructure and conducive operating environment will reduce production cost, enhance output, and provide employment opportunities for the teeming population of Nigerian youths.

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