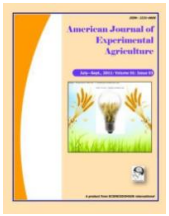

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Impact of Financial Sector Reforms on Agricultural Growth in Nigeria: A Vector Autoregressive (Var) Approach

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ABSTRACT

The financial sector has witnessed several reforms over the decade. The associated impact of this is also felt in the agricultural sector. The study was carried out to assess the impact of financial sector reforms on agricultural growth in Nigeria from 1970-2009. Secondary data were collected from Central Bank of Nigeria, National Bureau of Statistics and National Population Commission and analyzed using vector error correction model (VECM) approach. The result revealed that financial sector reforms in the baseline and sensitivity model significantly impact on agricultural growth both in the long and short-run. However, the impact of financial sector reforms shock in the sensitivity model on agricultural output growth was lower by 0.60 percent when compared with 78.85 percent in the baseline model. This implied that financial sector reforms could play a significant role in the growth of the agricultural sector by increasing its production level and independently generate positive investments in the sector than in the sensitivity result. It is therefore recommended that government should adopt strong macroeconomic policies targeted to kick-start meaningful growth in the agricultural and financial sectors as well as provide the enabling environment for farming as a business through concessionary interest rates, tax free and import duty concessions. These

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financial and fiscal incentives when provided would encourage further output growth in the agricultural sector of the country.

Keywords: Agricultural growth; financial sector reforms; impact; Nigeria.

1. INTRODUCTION

The issue of financial sector reforms has taken the center stage in the world's economy. Both developed and developing countries have tried to bring about reforms in their financial sectors in order to impact on the growth of either the entire economy or a sub-sector of the economy such as agriculture [1]. Financial sector reforms constitute that aspect of economic reforms which focuses mainly on restructuring the financial institutions (regulators and operators) via institutional and policy reforms [2]. It has also been described as deliberate measures and policies made by the relevant authorities to bring the needed changes in the financial institutions over a period of time [1]. These changes are expected to ultimately result in economic growth. Economic growth is defined in economic literature as the incremental outcome of productive activities, which can be assessed by observing the behavior of real Gross Domestic Product (GDP) or Gross National Product (GNP) per capita, year by year [3].

The financial system has been acknowledged to play an important role in economic growth and development [4,5]. Several theoretical and empirical studies at the international, national and provincial levels demonstrate that the financial sector could be a catalyst of economic growth if it is developed and healthy [6,7,8,9]. [10] opines that economic growth is significantly related to growth in agriculture in India, though it has declined in the recent years. Other researchers have lent credence to the fact that agriculture has important linkages and interrelate with the rest of the economy due to macroeconomic policies. [11] on his work on macroeconomic environment and agricultural sector growth in Nigeria stated that macroeconomic policies have directly and indirectly influenced agricultural output growth. He also reiterated that macroeconomic environment and other policies are not only used to regulate production activities in agricultural sector but in the other sectors of the economy. This interaction is highly vulnerable to changes in other sector especially macroeconomic policies not specially targeted at agriculture [12]. However, these macroeconomic policy outcomes vary greatly depending on the policy targets and instruments used [13]. While the earlier works of Binswanger [14,15] support that agricultural production marketing and financing decisions are influenced by the macroeconomic environment. [16] also reported that in most other developing countries where agriculture is a large sector of the economy, no other sector of the economy is large enough to serve as an engine of economic growth in the next decade. This is because a large proportion of the Gross Domestic Product (GDP) comes from the agricultural sector as in the case of Nigeria.

According to [17], in Sub-Saharan Africa (SSA), the international recessions, debt crises and political instability adversely affected savings and investment ratio in the region. This was occasioned by a decline in the domestic resource mobilization and narrow tax base, which further depressed investment and economic growth. The unfavourable conditions in SSA relating to the deterioration in economic performance alongside financial repression in the 1970s gave rise to the adoption of structural adjustment programme under the auspices of the Washington Consensus [18]. In Nigeria, these unfavourable conditions resulted to financial sector reforms as a subset of the Structural Adjustment Programme in August, 1987 with interest rates being deregulated [19,20]. The key objective of the financial sector reforms was to create strong financial institutions that would take advantage of the benefits of increase in size, improve the efficiency and raise the diversity of the financial system of the economy. This objective was also to ensure that bank as financial intermediaries can contribute effectively to the agricultural sector through sound allocation of resources [21].

However, various governments in Nigeria over the years have initiated and implemented a myriad of financial reform measures, agricultural policies and programmes in an attempt to stimulate the sustainable growth and development of agricultural sector. Such policies include fiscal policies (like institutional creation and investment), exchange rate, pricing, and monetary policies [22]. Others that involve direct agricultural production through parastatals were River Basin Development Authorities (RBDAS), Directorate of food, Roads and Rural

Infrastructure (DFRRI) and the Agricultural Development Project (ADP) while those done through programmes were the National Accelerated Food Production Programme (NAFPP) of 1972, the Operation Feed the Nation (OFN) of 1976 and the Green Revolution (GR) of 1980 [23,20]. These policy measures were aimed at improving the sector to serve as the engine growth for other sectors [24]. In spite of several reform measures, there is still a knowledge gap regarding financial sector reforms and agricultural growth because research effort in this regard have been minimal, when compared to efforts the other components of the economic reforms such as trade liberalization and exchange rate reforms. Even where research is available, emphasis has tended to be placed on the institutional aspects of the reform that is banking sub-sector [25,2,26]. Mentions are only on the potential effects of the reforms on agriculture with no empirical evidence with efforts geared towards the investigation of current account and government deficits as well as their implication for saving and growth imbalances. Apart from this, many similar studies have failed to or not sufficiently document empirically the effect of reforms on agricultural growth [2,5,27]. It is against this backdrop that it becomes necessary to assess the impact of financial sector reforms on agricultural growth in Nigeria. The specific objective is to examine the effect of financial sector reforms on agricultural output growth in Nigeria.

2. LITERATURE REVIEW

The importance of the financial system to economic development is not a clear-cut issue. Researchers like [28] are of the view that economic development creates demand for certain financial instruments while others like [29] holds a contrary view and argues that the financial system plays a crucial role in the mobilization of capital for industrialization. Thus, the financial system only responds to the demand created as a result of economic development. It is however known that countries with better developed financial systems, that is financial markets and institutions with most effective way of channeling society's savings to its most productive use, tend to experience faster economic growth compared to those with less developed financial systems [30]. [31] submitted that institutions have direct and indirect benefits on economic growth and development. [32] on the relationship between institutions, macroeconomic policy and the growth of the agricultural sector in Nigeria finds significant evidence in support of the hypothesis that institutions matter in economic growth especially the growth of the agricultural sector in Nigeria. This is because financial sector development helps economic growth through more efficient resource allocation and productivity growth rather than through the scale of investment or saving mobilization.

Although there is no single reform path, historical experience indicates that real and financial sector reforms can spur productivity growth and that is why the benefits of Productivity resulting from change in the component of output toward high-productivity sectors have played a vital role in some emerging market and developing economies [33]. They also stated that productivity growth in the tradable sectors (industry and agriculture) in emerging market economies exceeded that in services sector during the past decade of reforms while low-income countries were found to experience more significant productivity growth in the agriculture and service sectors. This explains why the growth and development of agricultural sector is fundamental for the overall process of socioeconomic development as various governments and institutions in the sub-Saharan African (SSA) sought for strategies that would lead to higher levels of production and a pivot factor for sustained increase of agricultural production in the improvement of productivity, which is carried out through technological and efficiency changes [34,35].

In agriculture, the physical inputs commonly used are land, labour, capital, management and water resource; part of this technological and efficiency changes are the reforms in the financial sector for effective and efficient mobilization of funds in the agricultural sector. For instance, [33] alluded that productivity-enhancing structural reforms were needed to boost technological catch-up, facilitate structural transformation into higher productivity sectors and new activities, and better allocate existing resources in the economy. According to [36], there are many areas in which reforms could have significant productivity impacts, either in the near-term or over the longer term. This was made possible by reforms in the financial sector which could be a catalyst of economic growth if it is developed and healthy [6,8]. Thus, the proper and timely reforms policies in the financial sector would enhance investment and growth in any sector such as agriculture since finance is postulated as

important determinant of investment which culminates in growth [20].

Quite a number of empirical studies have been carried out to examine the effect of financial reforms on economic growth. The results confirm that there is a positive correlation between the two. [37] in his work on institutional reforms, interest rate policy and the financing of the agricultural sector in Nigeria using cointegration and an error correction mechanism (ECM) technique with annual time series data covering the period 1980 to 2011 posited that there is a negative relationship between agricultural value added, interest rate spread and inflation in the country. [38] examine the impact of financial sector reforms on agricultural and manufacturing sectors in Nigeria using the VAR methodology. The results indicate that bank credit to the private sector as a ratio of GDP has a positive effect on manufacturing and agricultural sectors in the short run, medium term and long term. Also, [9] in their works on The Impact of Financial Sector Reforms on the Nigerian Agricultural Export Performance using cointegration and error correction model (ECM) revealed that financial sector reforms significantly affect major agricultural export commodities such as cocoa, palm kernel and palm oil in Nigeria both in the long and short-run While other studies have increasingly found financial development to have a causal effect in stimulating economic and productivity growth [39,40,41,42,43].

Using long-term time-series data and the vector autoregressive (VAR) method of analysis, this study attempts to empirically examine the effect of financial sector reforms on the long-term agricultural growth in Nigeria. In addition to the stated objectives, it builds on the existing literature in two important ways. First, financial sector GDP or RGDP (value added) is used as a measure of financial sector reforms. This is a major departure from the commonly used bank related measures such as: monetary aggregates like M2, liquid liabilities of the financial system, or bank credit to the private sector which are regarded as poor indicators of financial sector reforms [44,45,46] because of: (i) they measure more the extent of monetization rather than financial sector reform, especially for the developing economies (ii) make no differentiation of liabilities among financial institutions;(iii) cannot represent the actual volume of funds channeled to the productive sector [47,48] as compared to financial sector Gross Domestic Product (GDP) or Real Gross Domestic Product (RGDP) which is by far a better indicator of financial sector reforms [49,50] in a number of ways; (i) it represents a broader measure of financial reforms. (ii) it reflects all the activities of a financial system; that is, all financial transactions "involving the creation, liquidation, or change in ownership of financial assets and/or facilitating financial transactions".(iii) does not vary from structural changes within the financial sector.(iv) it does not underestimate the level of financial sector in Nigeria's economy, where a significant financial development, Investment, Productivity and economic growth or innovation occurs in the real sector. (iv) it uses a Granger causality testing procedure to conduct causality analysis.

2.1 Theoretical Framework

Many earlier studies have attempted to explain the interrelationship between financial sector reforms or financial development and economic growth using the endogenous growth theory, which shows that growth rates can be related to institutional arrangements [51,52,53,54]. However, little or no studies have been made to find the link between financial sector reforms and agricultural growth especially in developing country like Nigeria. In this study, it will adopt the earlier works of [55,50] on simple endogenous growth model, the "AK model", where aggregate real output is a function of the aggregate capital stock is used to illustrate the potential impacts of financial sector reform on agricultural growth.

$$Y_t = AK_t \quad (1)$$

Where, Y_t and K_t are output and capital stock at time t, respectively and A is a constant measuring the amount of output produced for each unit of capital. Assuming, that a fraction of income, σ, is saved and invested, and dropping the time indices, the capital accumulation (investment) equation is given by:

$$\Delta K = \sigma Y - \delta K \quad (2)$$

Where δ is the depreciation rate and both σ and δ are assumed to remain constant. Dividing both side of equation (2) by K results in the capital accumulation equation rewritten as: $\Delta K/K = \sigma Y/K - \delta$. Since, from equation (1), $Y/K = A$, substituting A for Y/K results in:

$$\Delta K/K = \sigma A - \delta \quad (3)$$

Finally, by taking logarithms and derivatives of equation (1) and combining it with equation (3), the steady state growth rate can be written as:

$$y = \sigma A - \delta \quad (4)$$

Where, y represent growth rate of output. Equation (4) indicates that the growth rate in output is the product of the saving rate and the marginal productivity of capital. Furthermore, it shows two ways through which financial sector reforms can affect agricultural growth. First, it increases σ, the saving rate, and thus, the investment rate. Second, it can increase A, the efficiency with which capital is used. The former effect is strongly emphasized by [56,57]. In the McKinnon-Shaw model, a well-developed financial system mobilizes savings by channeling the small-denomination savings into profitable large-scale investments. These savings might not be available for investment without the participation of financial institutions because mobilizing savings of disparate savers is usually costly due to the existence of information asymmetries and transaction costs. Financial institutions lower the cost of mobilizing savings and also provide attractive instruments and saving vehicles while offering savers a high degree of liquidity. According to [50], several theoretical models that emphasize the second, that is, the efficiency-enhancing and role of financial sector reform. These models show that financial sector reforms can affect productivity of capital in two major ways. (i) by collecting and processing information needed to evaluate alternative investment projects, thus improving the allocation of resources; (ii) by providing opportunities to investors to diversify and hedge risks, thereby inducing individuals to invest in riskier but more productive investment alternatives. These models affirmed that there is a positive two way causal relationship between financial sector reforms and agricultural growth thus showing that economic growth reduces the importance of fixed costs associated (incurred) in joining the financial market thereby facilitating the creation and expansion of more financial institutions.

3. MATERIALS AND METHODS

3.1 Data Collection

Secondary data for the study covering the period 1970-2009 were sourced from publication of the Central Bank of Nigeria Statistical Bulletin, 2009; Annual Report and Statements of Account of Central Bank of Nigeria (CBN) of various years, National Bureau of Statistics (NBS), 2009 and National Population Commission of various years.

3.2 Analytical Techniques

The study made use of an econometric model adopted by [20] to express: (i) Agricultural investments as dependent on financial sector reforms (ii) Agricultural growth as dependent on financial sector reforms. The relationships were specified as follows:

$$AGINV = f(\text{FSRGDP}) \quad (5)$$

$$\text{AGRGDP1} = f(\text{FSRGDP}) \quad (6)$$

Where:

$AGINV$ = Agricultural Investments (represented by Foreign Investment plus Domestic Investment. The Foreign Investment was proxied for Foreign Private Investment (FPI) in the agricultural sector while Domestic Investment was proxied for Credit to agriculture).

$AGRGDP1$ = Agricultural Growth (proxy for Growth Rate of Agricultural Sector Real Gross Domestic Product).

$LNFSRGDP$ = log of Financial Sector Real Gross Domestic Product (represented financial sector reforms)

3.3 Variables Description

SAV= Total Savings obtained from publication of Central Bank Nigeria (CBN, 2009) Statistical Bulletin as a measure economic activity; PSC = Private Sector Credit selected from financial Deepening Indicators (monetary aggregate) in CBN (2009) Statistical Bulletin to represents financial sector reforms in the sensitivity analysis; AGRGDP1 = Agricultural Growth (proxy for Growth Rate of Agricultural Sector Real Gross Domestic Product) was calculated from RGDP of agricultural sector from CBN (2009) Statistical Bulletin; FSRGDP = Financial sector reforms proxy for Financial sector RGDP representing RGDP of financial institutions sourced from CBN (2009) Statistical Bulletin; AGINV=Agricultural Investments (represented by Foreign Investment plus Domestic Investment. The Foreign Investment was proxied for Foreign Private Investment (FPI) in the agricultural sector while Domestic Investment was proxied for Credit to agriculture) obtained from publication of CBN (2009) Statistical Bulletin; ER = Exchange rate;

IR = Interest rate from CBN (2009) Statistical Bulletin publication; LFA = Labour Force in Agriculture (proxied by Agricultural labour force in the federal ministry) obtained from National Bureau of statistics (NBS) and National Population Commission (NPC) of various years; PCI = Per Capita income (calculated by dividing the GDP/Population) using data from Central Bank of Nigeria (2009) and NPC of various years.

From economic theory, other policy variables such as savings, income, output, interest rate and exchange rate also affect agricultural investments while agricultural investment, labour in agriculture, exchange rate and interest rate also affect agricultural growth. Therefore, we have:

$$LNAGINV = f(LNFSRGDP, LNSAV, LNAGRGDP1, LNPCI, LNER, LNIR) \quad (7)$$

$$LNAGRGDP1 = f(LNFSRGDP, LNAGINV, LNLFA, LNER, LNIR) \quad (8)$$

$LNSAV$ = Log of Total Savings
$LNPCI$ = Log of Per Capita Income
$LNLFA$ = Log of Labour Force in Agriculture
$LNER$ = log of Exchange Rate
$LNIR$ = log of Interest Rate

$(LNAGINV, LNAGRGDP1, LNFSRGDP)$ are logs of Agricultural Investments, Agricultural Growth and Financial Sector Reforms.

Given the various theories on the relationship between financial sector reforms and economic growth, various variables of interest such as

$(LNAGINV, LNAGRGDP1, LNFSRGDP, LNSAV, LNPCI, LNLFA, LNER, LNIR)$ were jointly determined. The empirical investigation into the relationships among these variables was carried out in a vector autoregressive (VAR) model and Granger causality test. A unique advantage of the VAR technique of analysis is that it treats all variables as potentially endogenous and also facilitates investigation of the related concept of causality in the Granger's sense of it [58]. Causality in Granger's sense is inferred when values of a variable say X_t have explanatory power in a regression of Y_t on lagged values of Y_t and X_t. The vector autoregression (VAR) model has become one of the leading approaches employed in the analysis of dynamic economic relationships [59,60,61,62,20] like the ones specified in equations 7 and 8 respectively. This study follows suit by specifying a VAR model that examined the short and long-run relationship of the impact of financial sector reforms on agricultural investment and growth in Nigeria.

The VAR representation of the model with lag order *k* is thus:

$$Y_t = C_0 + \sum_{i=1}^{k} A_i Y_{t-i} + \mu_t \quad (9)$$

Where:
$Y_t = (LNAGINV, LNAGRGDP1, LNFSRGDP, LNSAV, LNPCI, LNLFA, LNER, LNIR)$ is a 8X1 vector of endogenous variables or Integrated Variables (10)

$C_0 = (C_1, C_2 \ \ldots \ C_n)$ the *C* intercept vector of the VAR model.

A_i = matrix coefficients estimated of autoregressive coefficient vector Y_{t-i}, for *i = 1, 2 ...k*. Thus, A_i is 8 x 8 coefficient matrices.

μ_t = $\mu_t = (\mu_{1t}, \mu_{2t}, \ \ldots \ \mu_{nt})$ vector of independent and identically distributed error terms (I.I.D).

k = the number of lagged terms.

The VAR estimations are very sensitive to structure of lag variables and sufficient lag length does help to reflect the long term impact of variables on others. However, including longer lag lengths will lead to multicollinearity problems and will increase the degrees of freedom (DOF) [63]. From equation (10), it was expanded as follows:

$$\Delta \mathrm{LN}AGINV = \varphi_0 + \varphi_1 \sum_{i=1}^{k} \Delta \mathrm{LN}AGRGDP1_{q,t-i} + \varphi_2 \sum_{i=1}^{k} \Delta LNFSRGDP_{q,t-i} + \varphi_3 \sum_{i=1}^{k} \Delta \mathrm{LN}SAV_{q,t-i} + \varphi_4 \sum_{i=1}^{k} \Delta LNPCI_{q,t-i} + \varphi_5 \sum_{i=1}^{k} \Delta \mathrm{LN}LFA_{q,t-i} + \varphi_6 \sum_{i=1}^{k} \Delta \mathrm{LN}ER_{q,t-i} + \varphi_7 \sum_{i=1}^{k} \Delta LNIR_{q,t-i} + \mu_{1t} \quad (11)$$

$$\Delta\text{LNAG}RGDP1 = \theta_0 + \theta_1 \sum_{i=1}^{k} \Delta\text{LN}AGINV_{q,t-i} + \theta_2 \sum_{i=1}^{k} \Delta LNFSRGDP_{q,t-i} + \theta_3 \sum_{i=1}^{k} \Delta LNSAV_{q,t-i} + \theta_4 \sum_{i=1}^{k} \Delta\text{LN}PCI_{q,t-i} + \theta_5 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \theta_6 \sum_{i=1}^{k} \Delta LNER_{q,t-i} + \theta_7 \sum_{i=1}^{k} \Delta LNIR_{q,t-i} + \mu_{2t} \quad (12)$$

$$\Delta\text{LN}FSRGDP = \lambda_0 + \lambda_1 \sum_{i=1}^{k} \Delta LNAGINV_{q,t-i} + \lambda_2 \sum_{i=1}^{k} \Delta LNAGRGDP1_{q,t-i} + \lambda_3 \sum_{i=1}^{k} \Delta LNSAV_{q,t-i} + \lambda_4 \sum_{i=1}^{k} \Delta\text{LN}PCI_{q,t-i} + \lambda_5 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \lambda_6 \sum_{i=1}^{k} \Delta\text{LN}ER_{q,t-i} + \lambda_7 \sum_{i=1}^{k} \Delta\text{LN}IR_{q,t-i} + \mu_{3t} \quad (13)$$

$$\Delta\text{LN}SAV = \beta_0 + \beta_1 \sum_{i=1}^{k} \Delta LNAGINV_{q,t-i} + \beta_2 \sum_{i=1}^{k} \Delta LNAGRGDP1_{q,t-i} + \beta_3 \sum_{i=1}^{k} \Delta LNFSRGDP_{q,t-i} + \beta_4 \sum_{i=1}^{k} \Delta\text{LN}PCI_{q,t-i} + \beta_5 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \beta_6 \sum_{i=1}^{k} \Delta LNER_{q,t-i} + \beta_7 \sum_{i=1}^{k} \Delta\text{LN}IR_{q,t-i} + \mu_{4t} \quad (14)$$

$$\Delta\text{LN}PCI = \gamma_0 + \gamma_1 \sum_{i=1}^{k} \Delta\text{LN}AGINV_{q,t-i} + \gamma_2 \sum_{i=1}^{k} \Delta LNAGRGDP1_{q,t-i} + \gamma_3 \sum_{i=1}^{k} \Delta\text{LN}FSRGDP_{q,t-i} + \gamma_4 \sum_{i=1}^{k} \Delta LNSAV_{q,t-i} + \gamma_5 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \gamma_6 \sum_{i=1}^{k} \Delta\text{LN}ER_{q,t-i} + \gamma_7 \sum_{i=1}^{k} \Delta\text{LN}IR_{q,t-i} + \mu_{5t} \quad (15)$$

$$\Delta\text{LN}LFA = \psi_0 + \psi_1 \sum_{i=1}^{k} \Delta\text{LN}AGINV_{q,t-i} + \psi_2 \sum_{i=1}^{k} \Delta LNAGRGDP1_{q,t-i} + \psi_3 \sum_{i=1}^{k} \Delta LNFSRGDP_{q,t-i} + \psi_4 \sum_{i=1}^{k} \Delta LNSAV_{q,t-i} + \psi_5 \sum_{i=1}^{k} \Delta\text{LN}PCI_{q,t-i} \; \psi_6 \sum_{i=1}^{k} \Delta LNER_{q,t-i} + \psi_7 \sum_{i=1}^{k} \Delta\text{LN}IR_{q,t-i} + \mu_{6t} \quad (16)$$

$$\Delta\text{LN}ER = \sigma_0 + \psi_1 \sum_{i=1}^{k} \Delta LNAGINV_{q,t-i} + \sigma_2 \sum_{i=1}^{k} \Delta\text{LN}AGRGDP1_{q,t-i} + \sigma_3 \sum_{i=1}^{k} \Delta\text{LN}FSRGDP_{q,t-i} + \sigma_4 \sum_{i=1}^{k} \Delta LNSAV_{q,t-i} + \sigma_5 \sum_{i=1}^{k} \Delta LNPCI_{q,t-i} + \sigma_6 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \sigma_7 \sum_{i=1}^{k} \Delta LNIR_{q,t-i} + \mu_{7t} \quad (17)$$

$$]\Delta\text{LN}IR = \phi_0 + \phi_1 \sum_{i=1}^{k} \Delta LNAGINV_{q,t-i} + \phi_2 \sum_{i=1}^{k} \Delta LNAGRGDP1_{q,t-i} + \phi_3 \sum_{i=1}^{k} \Delta\text{LN}FSRGDP_{q,t-i} + \phi_4 \sum_{i=1}^{k} \Delta\text{LN}SAV_{q,t-i} + \phi_5 \sum_{i=1}^{k} \Delta LNPCI_{q,t-i} + \phi_6 \sum_{i=1}^{k} \Delta LNLFA_{q,t-i} + \phi_7 \sum_{i=1}^{k} \Delta LNER_{q,t-i} + \mu_{8t} \quad (18)$$

While it is easier measuring other variables described above, it is also of valued importance to note that measuring financial sector reforms often poses a challenge to researchers in their effort to assess the impact of financial intermediation on real economic activity. The reason is as earlier stated above in introduction. Based on the above assertions, financial sector RGDP (Real Gross Domestic Product) was utilized as indicator for financial sector reforms.

The *apriori* expectations for vector autoregressive models are suited to track and identify structural shocks within a system of equations, with respect to underlying economic theory. The focus of this study is on the relationship between the impacts of financial sector reforms on agricultural investment and growth in Nigeria's economy, thus, we concentrate on the expected theoretical relationships that should hold in equation (13). The parameter for λ_1 is expected to be positively related. Financial constraint is one of the problems in agricultural production; an efficient financial sector should ensure the channeling of funds to agricultural sector. Thus, as the financial sector becomes more efficient, more saving will be mobilized and this provides an opportunity for funds to be extended to provide investment opportunities in the agricultural sub-sector.

The parameter for λ_2 is expected to have a direct positive influence on income, interest rate, financial sector gross domestic product, financial sector reform and agricultural output growth. This implies that investment from the financial sector would greatly enhance agricultural output growth. The parameter for λ_3 is expected to be positively related. Generally, financial sector reform is expected to have a positive impact on saving mobilization in the economy. However, depending on the measure of the financial sector reform, a priori sign could be negative. The parameter λ_4 is expected to have a positive sign. Per capita income is very crucial for economic growth and it may increase savings, which may in turn help in boosting the financial system. The parameter λ_5 is expected to be positively related. The positive sign is to reflect the quality of

manpower being produced by the agricultural sector of the economy.

The parameter λ_6 is expected to have a positive sign. This is because a lower interest rate will induce private economic agents to undertake investment activities at the lower levels of interest rate. However, in an environment characterized by severe financial repression as being the case in developing countries over the years, investment funds may not be readily available to potential investors [64]. In this case, the only way to induce people to mobilize investment funds through saving is high interest rate. This implies that the higher the financial intermediaries, the more the availability of investment funds through savings and hence the high level of investment in agriculture. This is the premise of the argument of Mckinnon-Shaw hypothesis which postulated a positive relationship between financial liberalization and the real interest rate. The parameter λ_7 is expected to have a negative sign since the exchange rate is negatively related to the agricultural production. At a favourable exchange rate, more agricultural outputs would be produced. Also, with good macroeconomic policies that enhance favourable exchange rates, agricultural funds can be widely available at low interest rate.

According to [63], VAR technique would be invalid if variables are not stationary at level, in such situation, a cointegration and vector error correction (VECM) techniques are carried out to investigate the relationship among non-stationary variables. Hence, it became necessary to conduct preliminary diagnostics on the time series properties of the variables before further evaluation. In order to ascertain the pattern of integration of the variables, a unit-root test was conducted using two specifications of the augmented Dickey-Fuller (ADF) test: (i) intercept (ii) trend and intercept. The latter was used for confirmation tests. The essence of the test was to determine stationarity in trend of the variable and to show the order of integration at which they become stationary if it reveals a non-stationary trend.

The hypothesis for the unit root test is:

- H_0: ∞ = 1
- H_1: ∞ < 1

To ensure the authenticity of the results obtained [65], cointegration test was carried out. This was done using the Johansen approach of testing the number of cointegrating vectors: the Trace and the Maximum Eigenvalue statistics. The null hypothesis for the trace test was that there are at most *r* cointegrating vectors, while for the Max Eigenvalue test, the null of *r* = 0 was tested against the alternative that *r* = 1; *r* = 1 was tested against the alternative that *r* =2 and so on. The optimal lag length for the cointegration test was selected using the Schwarz Information Criterion (SIC).

After estimating the cointegtrated VAR, innovation accounting was conducted to determine the dynamic responses of the variables to one-standard deviation shocks in other variables in the system. This was done by generating the impulse response functions from the system. Impulse Response Functions (IRF), trace the responsiveness of the dependent variable in the VAR (VECM) to a unit shock in the error terms. For each variable from each equation, a unit shock was applied in the error term and the effects upon the VAR (VECM) to a unit shock in error terms are observed over a period of time. If there are *K* endogenous variables in the model, then a total of K^2 impulse responses can be generated. In this study, the analysis was confined to the responses of AGINV, AGRGDP, FSRGDP, SAV, PCI, LA, IR and ER to the shocks in FSRGDP.

To further obtain information concerning the relative importance of each innovation towards explaining the behaviour of the endogenous variables, variance decomposition analysis (VDC) was conducted. The generalized forecast error variance decomposition technique attributed by [66,67] were used. This technique has the advantage that its results are not sensitive to the ordering of the variables in the VAR (VECM).

To examine the short-run impacts of financial sector reforms on agricultural investments and growth in Nigeria, the Granger-casualty test developed by [58] was adopted. This test seeks to ascertain whether or not the inclusion of past values of a variable say Y_{t-p} do or do not help in the prediction of present values of another variable *X*. If *X* is better predicted by including past values of *Y*, than by not including them, then *Y* is said to Granger-cause *X* [68]. Several alternative methods of testing for Causality in Cointegrated VAR have emerged in the literature. The popular approach has been to re-parameterize the model into the equivalent

vector error correction model (VECM) and to conduct Causality tests following either the residual-based Engle-Granger two-stage method or the Johansen-Type Error.

Finally, to ensure that the conclusions arrived at from the baseline models (equations 11 to 18) are not spurious or outcomes of chance, sensitivity analysis and robustness checks on the results was carried out. This was done by replacing a variable in the baseline model. The basic difference between the models used for sensitivity analysis and the baseline model was the introduction of Private Sector Credit (PSC) as a measure (or proxy) for Financial Sector Reforms in sensitivity analysis and robustness analysis while Financial Sector Gross Domestic Product (FSGDP) was used as a proxy for Financial Sector Reforms in the baseline equation.

The reduced form representation of the VAR is thus:

$$X_t = C_0 + \sum_{i=1}^{k} \delta_i X_{t-i} + \mu_t \qquad (19)$$

Where:

$X_t = (LNAGINV, LNAGRGDP1, LNPSC, LNSAV, LNPCI, LNLFA, LNER, LNIR)$ is a *8x1* vector of five endogenous variables, while X_{t-i} is the corresponding lag term for each of the variables. A_i, is the *8 x 8* matrix of autoregressive coefficient vector X_{t-i}, for *i = 1, 2,...k.*

$C_0 = (C_1, C_2 \ \ldots \ C_n)$ is the *C* intercept vector of the VAR model.

$\mu_t = (\mu_{1t}, \mu_{2t,} \ \ldots \ \mu_{nt})$ is the 8x1 vector of independent and identically distributed error terms (I.I.D). *K* = the number of lagged terms.

LNPSC = Log of Private Sector Credit to Agriculture

$(LNAGINV, LNAGRGDP1, LNSAV, LNPCI, LNLFA, LNER, LNIR)$ = are as earlier defined.

4. RESULTS AND DISCUSSION

4.1 Effect of Financial Sector Reforms on Agricultural Output

The result of the Augmented Dicker-Fuller (ADF) unit root test is presented in Table 1. Schwarz Information Criterion (SIC) was used for the selection of the optimal lag length to a maximum of 9. The results revealed that variables used in the analysis possessed unit-roots at one percent level of significance and was stationary only after transformation at the first differences for both intercept and when trend specification was included. Only the agricultural output growth variable was stationary at level, that is, *I(0)*. With the above result, the unit-root test results gave a useful clue on how to arrange the variables into the vector error correction model (VECM) analysis. Thus, agricultural investments (LNAGINV), financial sector reforms (LNFSRGDP), total savings (LNSAV), per capita income (LNPCI), the labour force in agriculture (LNLFA), exchange rate (LNER) and interest rate (LNIR) were fed into the model at their first-differences, while agricultural growth (LNAGRGDP1) enters at its level.

With the fact that almost all the variables were stationary at the first differencing, it was necessary to carry out another test to assess if the non-stationary variables were co-integrated. In essence, the hypotheses were tested to affirm the rank of the cointegrating relationships that

Table 1. Result of ADF Unit root test

Variable	Levels		1st Difference		Conclusion
	Intercept	Trend + Intercept	Intercept	Trend + Intercept	
LNAGINV	-1.701[0]	-1.157[0]	-5.890[0]***	-6.161[0]***	*I(1)*
LNAGRGDP1	-6.039[0]***	-5.972[0]***	____	____	*I(0)*
LNFSRGDP	-2.819[0]	-2.392[0]	-5.935[0]***	-4.157[0]***	*I(1)*
LNSAV	1.130[0]	-0.771[0]	-4.661[0]***	-4.735[0]***	*I(1)*
LNPCI	-2.492[0]	-1.962[0]	-5.702[0]***	-6.046[0]***	*I(1)*
LNLFA	0.613[0]	-1.371[0]	-5.650[0]***	-5.856[0]***	*I(1)*
LNER	0.125[0]	-2.163[0]	-5.023[0]***	-4.995[0]***	*I(1)*
LNIR	-2.189[0]	-2.929[0]	-9.239[0]***	-9.162[0]***	*I(1)*

*Source: Computed by Author. Notes: *** indicates significance at 1% level. The values in bracket [ ] for the ADF test shows the optimal lag length selected by the SIC within a maximum lag of 9 .Variables are in log forms*

existed among the variables. Tables 2 and 3 show the results of Johansen cointegration tests indicating the presence of two (Trace) and one (Maximum Eigenvalue) cointegrating vectors respectively. This indicates that there were evidence of the existence of a long-run relationship among financial sector reforms, agricultural investment, output growth and other policy variables in Nigeria. Therefore, applying the vector error correction model (VECM) would enable us to track the long-run relationship between the variables and tie it to deviation that may occur in the short-run [69].

Table 2. Johansen cointegration trace test

Null hypothesis	Alternative hypothesis	Test statistic	Critical value 0.05
r = 0	r = < 1	198.682	159.530***
r = 1	r = < 2	134.750	125.615**
r = 2	r = < 3	91.215	95.754
r = 3	r = < 4	62.088	69.819
r = 4	r = < 5	38.263	47.856
r = 5	r = < 6	23.603	29.797
r = 6	r = < 7	10.765	15.494
r = 7	r = < 8	1.447	3.842

*Source: Computed by Author. Notes: r indicates the number of co-integrating vector. *** and ** are the significance levels at 1% and 5% respectively. P-values are obtained using response surfaces in [70]*

Table 3. Johansen cointegration maximum eigenvalue test

Null Hypothesis	Alternative hypothesis	Test statistic	Critical value 0.05
r = 0	r = 1	63.932	52.363***
r = 1	r = 2	43.535	46.231
r = 2	r = 3	29.128	40.078
r = 3	r = 4	23.825	33.877
r = 4	r = 5	14.659	27.584
r = 5	r = 6	12.839	21.132
r = 6	r = 7	9.318	14.265
r = 7	r = 8	1.447	3.842

*Source: Computed by Author. Notes: r indicates the number of co-integrating vector. *** and ** are the significance levels at 1% and 5% respectively. P-values are obtained using response surfaces in [70]*

Going by the Johansen cointegration results, a VECM (2) with at least two cointegrating vectors was carried out to ascertain that the estimated VECM was not false, the residual auto correlation and correlogram tests were also conducted. The results revealed that the residuals of the estimated VECM were appropriately uncorrelated, implying that the estimated VECM was correctly specified or unbiased and the parameters estimated were consistent. This was because the spikes from the correlograms revealed the relative correlation of the error terms in the VECM equations and the closer the spikes are to the zero line, the more uncorrelated the error terms. The coefficients from the estimated VECM were not of primary interest in this empirical work. Instead, focused was on the impulse response function (IRFs) and variance decomposition (VDC) generated from the VECM.

The impulse response functions traced out the responsiveness of the dependent variable in the VECM to shocks on each of the variables using the Cholesky one standard deviation innovations (Choleskey one Standard deviations examine the dynamic interactions among variables). This implies that impulse responses showed the path of LNAGRGDP1 (agricultural growth) when there were innovations in the financial policy variables. For each equation, a unit shock was applied to the error, and the effects upon the VECM system over 30 periods were examined. The VECM system has eight variables, thus a total of 64 impulses could be generated. But the primary objective was to examine the impact of financial sector reforms shocks on the other seven macroeconomic or endogenous variables. Thus, only the responsiveness of the financial sector reforms on the macroeconomic variables (LNAGINV, LNAGRGDP1, LNSAV, LNPCI, LNLFA, LNER and LNIR) was traced out.

Fig. 1, presented seven panels of impulse response graphs indicating how innovations in financial sector reforms variable affected agricultural investments; growth and other policy variables in Nigeria over a period of 30 periods. Each panel illustrated the response of the policy variables to a one standard deviation innovation (corresponding to a positive shock) in the policy variable. A value of zero means that financial sector reforms shock has no effect on the financial policy variables and the variables continued on the same path it would have followed had there been no financial sector reforms shock. A positive or negative value indicated that the shock caused the variable to be above or below its 'natural' path as the case may be. The solid lines depict the estimated effects of the shock.

Panels A, B, C and G displayed the impulse responses of agricultural investments, agricultural growth, total savings and interest rate respectively to the one time shock in the financial

sector reforms as presented in Fig. 1. These four financial policy variables fell below equilibrium with a negative response in an undulating but significant manner before stabilizing over the period reviewed to the positive shock in the financial sector reforms. This implies that there is a negative response among agricultural investments, savings and interest rate to the positive shock in financial sector reforms in Nigeria financial system. This would initially retard growth in agricultural sector as shown in panel B in the first two periods. However, in the long-run, it settles at a period below equilibrium level. That is, it leads to a long-run disequilibrium solution since the impulse response function does not return to the zero line. This is in line with the economic postulation that the higher the interest rate, the higher the savings and the greater the investment opportunities and vice versa. However, this was not consistent with our *apriori* expectations since economic agents are expected to adjust their spending and investment habits moderately and gradually in response to the increased supply of funds rather than immediately. The result correlated with that of [71] which reveals that low interest ceiling is seen to have restricted the real flow of loan-able funds, which depressed the quality of productive investment during financial sector reforms while [56] and [57] believe that when financial system is repressed by low level of savings rather than by the lack of investment opportunities, economic growth is severely hindered. Notwithstanding, investment is negatively linked to the effective real rate of interest on loans, but positively linked to the growth rate of the economy. They also opined that savings in many developing countries were barely sufficient to maintain the existing capital stock hence, could not permit enough investment to sustain economic growth.

The negative but significant effect of the financial sector reforms shock on these monetary variables displayed in Fig. 1 was not consistent with theoretical expectations and this confirms the weak and unstable nature of credit markets in the Nigeria economy but agree with [55] who stated that the financial sector reforms can affect economic growth by altering the saving rates. In this case, the sign of the relationship was not obvious, because financial sector development may also reduce savings and thereby growth while [72] affirms that the use of interest rate ceilings in a repressed system, distorts the economy in four critical ways: (i) Current consumption is favoured compared to future consumption (ii) financial institutions are favoured instead of lending via deposits and engage potential investors in relatively low-yielding investments (iii) the low level of interest rates would cause borrowers to favour capital-intensive projects (iv) the pool of potential borrowers is dominated by entrepreneurs who possess low- yielding projects.

Panel D indicated that per-capita income was consistently falling below equilibrium over the time period, though exhibited rising trend at the beginning of the period. This is plausible because of the argument that focuses on the negative effect of repression on the rate of per-capita income contrary to the McKinnon-Shaw premise. Financial researchers argued that the increase in the real interest rate may not necessarily lead to improved private savings. In very poor countries for instance, the level of income would be so low that households spend a very high proportion of their earnings on basic needs. In such a case, even with high real interest rates, the very little proportion of income would be saved. This implies that McKinnon–Shaw's proposition would therefore be more relevant in rich countries. In Panel E, labour force in agriculture increased consistently in a positive manner over time. This implies that labour force is skewed to the shock in the reform with a positive future expectation. This is consistent with theoretical postulation reflecting the quality of manpower being produced by the agricultural sector of the economy. Panel F revealed that exchange rate responded positively after a period of the thirty years. This shows that financial sector reforms have a positive impact on monetary policy (exchange rate) in Nigeria. This is contrary to the negative theoretical postulation considering the seasonal nature of agricultural production in a country with an open economy having many trading partners.

The Variance Decomposition Analysis (VDC) provides a means of analysis to determine the relative importance of the dependent variable in explaining the variations in the explanatory variables. The result of variance decomposition over a 30-year time period is displayed in Table 4. The values in the table confirmed the results obtained from the Impulse response analysis (IRFs). On the average, 3.84 percent of most of the variation in the forecast error for financial sector reforms was explained by the shocks to itself. Agricultural growth shock had a value of 78.84 percent of the variation in financial sector reforms over the 30-year period while the impact of financial sector reforms shock on agricultural

investments was 0.34 percent over the 30 year period.

The influence of the shocks on total savings was marginal at the onset with values less than one percent up to the fifteen periods but later increased to 1.37 percent over the thirtieth year period. The average contributions of LNPCI, LNLFA, LNER and LNIR were 2.49 percent, 10.53 percent, 5.19 percent and 0.08 percent respectively. The higher contributions of agricultural growth to the shocks in financial sector reforms indicate that financial sector reforms significantly affected agricultural output than other monetary variables which were mild and persistent. This correlated with the empirical works of [73,44] which confirms that financial development has a positive effect on economic growth. The implication of this is that policy makers will be faced with less uncertainty in planning for the long-term.

However, comparing the VDC analysis for agricultural output growth in Tables 5 revealed that agricultural output shocks on financial sector reforms was lower with an average contribution of 33.35 percent respectively than the shocks of financial sector reforms on agricultural output with an average of 78.84 percent as shown in Table 4. This implies that an increase in the financial sector through effective reforms would enhance growth in the agriculture sector of the country. On the other hand, agricultural output shocks on other policy variables showed a positive impact indicating a positive interaction among variables.

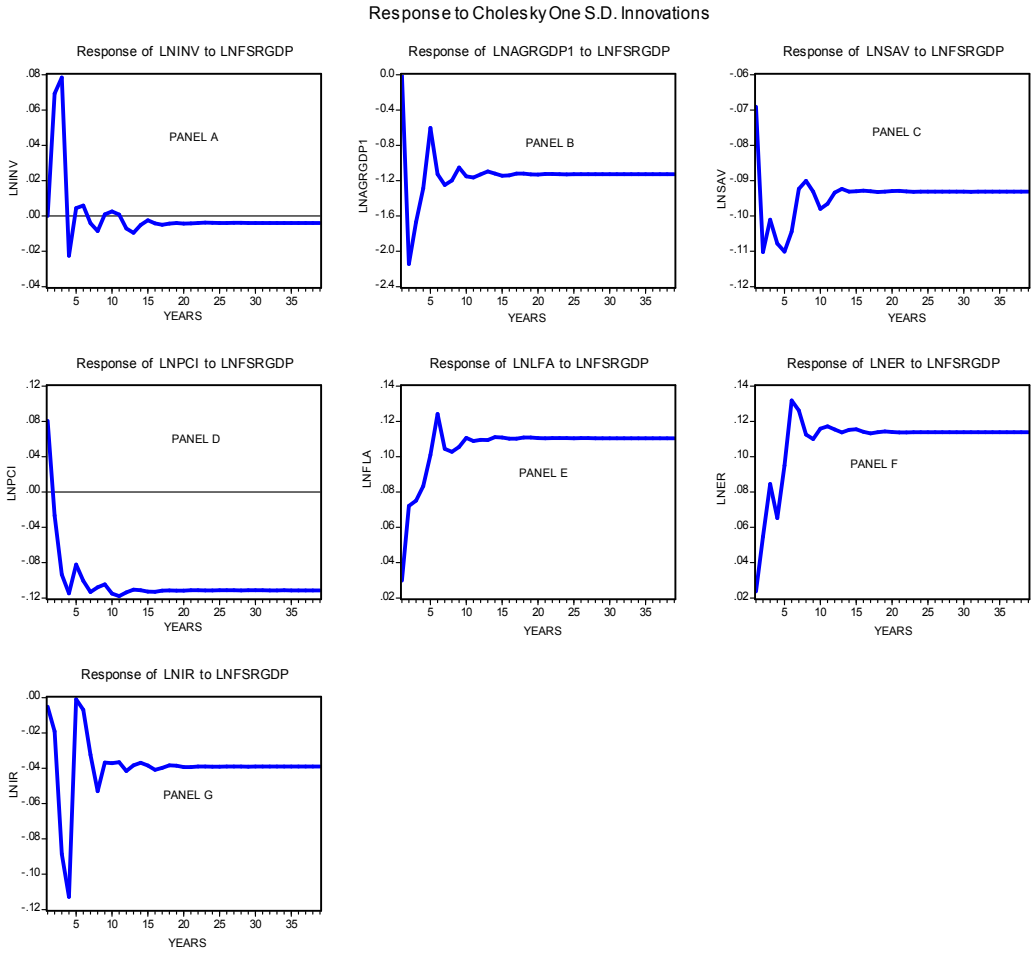

Fig. 1. Response of LNAGINV, LNAGRGDP1, LNSAV, LNPCI, LNLFA, LNER, and LNIR to LNFSRGDP shock in choleskey one standard deviation (Choleskey one Standard deviations examine the dynamic interactions among variables)

The low values recorded in interest rates are good signals to the agricultural investments which would consequently impact positively on output growth in agriculture as it would attract investors to come and invest into the sector.

To examine if a significant short-run relationship existed between financial sector reforms and the macroeconomic variables used in the study, an error correction modeling (ECM) analysis was employed as presented in Table 6. The parsimonious estimate showed that R^2 value of 0.97 indicates the variables explained about 97 percent of agricultural output growth. F-statistic of 31.62 ($P<0.01$) reveals that they are jointly significant and the Durbin Watson Statistic value of 2.05 implies that the model does not suffer from autocorrelation problem but has a very good fit. For significance variables, it was found out that financial sector reforms (LNFSRGDP), past value of financial sector reforms (proxy by LNFSRGDP), per capital income (LNPCI), labour force in agriculture (LNLFA) and interest rate (LNIR) were the significant determinants of agricultural output growth in Nigeria for the period of analysis. This result implies that the past financial sector reforms, per capital income, labour force in agriculture and interest rate significantly increases the current financial sector reforms, per capital income, labour force in agriculture and interest rate. Further result shows that the coefficients of other three variables (savings, exchange rate and agricultural investments) were not significantly different from zero. This suggests that past financial sector reforms, per capital income, labour force in agriculture and interest rate positively determine the current flow of financial sector reforms, per capital income, labour force in agriculture and interest rate in Nigeria while the previous savings, exchange rate and agricultural investments do not significantly affect the present savings, exchange rate and agricultural investments in Nigeria. As such, an increase in the previous volume of financial sector reforms, per capital income, labour force in agriculture and interest rate would result in an increase in the present level of financial sector reforms, per capital income, labour force in agriculture and interest rate to agricultural output in Nigeria. The result further reveals that the coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium was both correctly signed (negative) and statistically significant at 1% percent which shows a yearly correction of about 75% of the error with a different adjustable speeds to long-run equilibrium. Thus, correcting any deviations from the long-run equilibrium. The implication of this is that financial sector reforms had an impact on agricultural growth in the short-run.

Finally, a sensitivity analysis/ robustness check was carried out on VECM equation (15) to ascertain that the model was not spurious or outcome of chance. The results indicated that private sector credit (LNPSC) which replaced financial sector real gross domestic product as a proxy for financial sector reforms was stationary at first difference in Augmented Dickey-Fuller (ADF) for both intercept and when trend specification was added. The Johansen cointegration results of LNPSC and other variables (LNINV, LNAGRGDP1, LNSAV, LNPCI, LNLFA, LNER, LNIR) earlier specified indicated the presence of two and one cointegrating vectors in the system at 1 percent significant level for both Trace and Maximum Eigenvalues vectors as displayed in Tables 7 and 8 respectively. This confirms the existence of a long-run relationship between financial sector reforms and the policy variables in Nigeria.

Table 4. Variance decomposition of FSRGDP

Period	S.E	LNINV	LNAGRGDP1	LNFSRGDP	LNSAV	LNPCI	LNLFA	LNER	LNIR
1	0.396	88.336	10.223	0.000	0.000	0.000	0.000	0.000	0.000
5	0.725	0.582	81.492	5.078	0.300	0.702	6.676	5.108	0.062
10	0.946	0.426	79.893	4.080	0.599	1.821	9.341	3.763	0.077
15	1.124	0.341	78.846	3.838	0.951	2.493	10.530	2.917	0.083
20	1.279	0.286	78.328	3.688	1.163	2.839	11.169	2.443	0.086
25	1.417	0.251	78.022	3.585	1.289	3.047	11.567	2.151	0.089
30	1.542	0.226	77.812	3.515	1.374	3.189	11.841	1.952	0.091

Source: Computed by Author. Note: S.E (Standard Error), LNINV (log of Agric. Investment), LNAGRGDP1 (log of Agric. Growth), LNFSRGDP (Log of Financial Sector RGDP), LNSAV (log of total savings), LNPCI (Log of Per Capita Income), LNLFA (Log of Labour Force in Agric.), LNER (Log of Exchange Rate) and LNIR (log of Interest Rate)

Table 5. Variance decomposition of LNAGRGDP1

Period	S.E	LNINV	LNAGRGDP1	LNFSRGDP	LNSAV	LNPCI	LNLFA	LNER	LNIR
1	5.028	0.052	99.948	0.000	0.000	0.000	0.000	0.000	0.000
5	6.481	7.000	66.001	22.378	0.660	2.078	2.941	1.910	0.032
10	7.418	9.499	50.747	29.250	1.546	2.529	3.132	3.268	0.028
15	8.211	11.074	43.062	33.350	2.083	2.822	3.308	4.265	0.026
20	8.925	12.140	37.871	36.214	2.415	3.014	3.445	4.877	0.024
25	9.586	12.928	34.084	38.303	2.653	3.155	3.542	5.314	0.022
30	10.204	13.532	31.183	39.901	2.835	3.263	3.615	5.649	0.021

Source: Computed by Author. Note: S.E (Standard Error), LNINV (log of Agric. Investment), LNAGRGDP1 (log of Agric. Growth), LNFSRGDP (Log of Financial Sector RGDP), LNSAV (log of total savings), LNPCI (Log of Per Capita Income), LNLFA (Log of Labour Force in Agric.), LNER (Log of Exchange Rate) and LNIR (log of Interest Rate)

Table 6. Vector error correction model for short-run impact

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.695538	0.842285	-2.013022**	0.0613
D(LNAGRGDP1(-2))	0.160707	0.099081	1.621968	0.1243
D(LNFSRGDP)	9.746098	1.774025	5.493778***	0.0000
D(LNFSRGDP(-2))	-5.517377	1.671753	-3.300354***	0.0045
D(LNSAV)	3.561411	2.476003	1.438371	0.1696
D(LNSAV(-1))	1.763468	2.343236	0.752578	0.4626
D(LNPCI)	2.854077	1.655964	1.723514	0.1041
D(LNPCI(-1))	-5.845329	1.326259	-4.407382***	0.0004
D(LNPCI(-2))	1.599045	1.586716	1.007770	0.3286
D(LNLFA)	2.912682	1.724201	1.689294	0.1106
D(LNLFA(-2))	-2.028902	1.127346	-1.799715*	0.0908
D(LNER)	-1.863357	1.486112	-1.253846	0.2279
D(LNER(-1))	-1.678422	1.090944	-1.538505	0.1435
D(LNIR)	-1.206719	1.174977	-1.027015	0.3197
D(LNIR(-1))	-1.982491	1.023264	-1.937418*	0.0706
D(LNIR(-2))	-0.642033	0.764057	-0.840295	0.4131
D(LNINV)	0.828225	0.687123	1.205352	0.2456
D(LNINV(-1))	1.108967	0.642909	1.724920	0.1038
D(LNINV(-2))	1.006459	0.688385	1.462058	0.1631
ECM(-1)	-0.751859	0.140136	-5.365209***	0.0001
R-squared	0.974060	Mean dependent var		0.024444
Adjusted R-squared	0.943257	S.D. dependent var		5.895698
S.E. of regression	1.404400	Akaike info criterion		3.817279
Sum squared resid	31.55744	Schwarz criterion		4.697011
Log likelihood	-48.71101	Hannan-Quinn criter.		4.124329
F-statistic	31.62198	Durbin-Watson stat		2.050879
Prob(F-statistic)	0.000000			

*Source: Computed by Author. Note: *** ** and * =1%, 5% and 10% significance levels respectively.*

The impulse response function analysis in robustness test showed that variables responded in a similar pattern to the one time shock of financial sector reforms (LNPSC) as that of the baseline model (LNFSRGDP). This could probably be due to the order of integration of LNPSC which was stationary at first difference at 1 percent significance as earlier reported. The

Variance Decomposition Analysis (VDC) results revealed that the average values of 5.41 percent, 0.60 percent, 2.50 percent, 0.67 percent, 5.66 percent, 1.09 percent, 0.30 percent of LNAGINV, LNAGRGDP1, LNSAV, LNPCI, LNLFA, LNER and LNIR respectively contributed to the variations in financial sector reforms (83.82 percent) over the 30-years. The impact of financial sector reforms shock (proxy by LNPSC) on agricultural output growth was lower with 0.60 percent when compared with 78.85 percent of Table 4 (baseline Table). This is because a well structured, effective and efficient financial sector reforms is expected to impact more on agricultural growth at a lower value of 3.84 percent which is the case of financial sector reforms (LNFSRGDP) in the baseline model than the higher value of 83.82 percent LNPSC obtained in sensitivity analysis with agricultural growth value of 0.60 percent. This implies that the financial sector reform was not strong, effective and efficient to cause an astronomical growth in the agricultural sector. This result is in line with several theoretical and the empirical studies of [6, 7] at the international, national and provincial levels who affirmed that the financial sector could be a catalyst of economic growth if it is well developed and healthy. The result further agrees with the theoretical argument and is consistent with the results of VAR model; Cross-country/panel empirical studies of [50,74,75] which provided evidence that financial sector real gross domestic product used as proxy in financial sector reforms or financial development has greater significance and positive effect on long-term growth through its investment and productivity effects than proxies used in monetary aggregates such as private sector credit (PSC). This implies that financial sector reforms played a significant role in the growth of agricultural sector by increasing its productivity level and independently generated positive investments in the sector which was a converse of the sensitivity result (PSC). A similar trend was experienced for per capita income (0.67 percent), labour force in agriculture (5.57 percent) and exchange rate (1.09 percent) were lower in sensitivity test except for savings (2.46 percent) and interest rates (0.30 percent) that were higher in sensitivity test than that of the baseline test.

Furthermore, the shock of LNAGRGDP1 on LNPSC was lower in sensitivity analysis with 14.25 percent than 33.35 percent shocks on LNFSRGDP recorded in Tables 5 (baseline table) respectively. From the above results, it could be deduced that financial sector reforms shocks greatly influenced microeconomic policy variables in the baseline model especially agricultural output growth than those financial sector reforms shocks in sensitivity analysis in the long-run during the period under review. In the short-run, the coefficient of the error correction term was statistically significant and correctly signed (negative) indicating a different adjustable speed to long-run equilibrium. Thus, correcting any deviations from the long-run equilibrium. This affirms that financial sector reforms positively impacted on agricultural growth in the short-run just as in the base line analysis.

Table 7. Johansen cointegration trace test

Null hypothesis	Alternative hypothesis	Test statistic	Critical value 0.05
r = 0	r = < 1	216.539	159.530***
r = 1	r = < 2	130.879	125.615**
r = 2	r = < 3	86.672	95.754
r = 3	r = < 4	55.859	69.819
r = 4	r = < 5	34.548	47.856
r = 5	r = < 6	20.901	29.797
r = 6	r = < 7	9.524	15.494
r = 7	r = < 8	0.773	3.842

*Source: Computed by Author. Notes: r indicates the number of co-integrating vector. *** and ** are the significance levels at 1% and 5% respectively. P-values are obtained using response surfaces in [70]*

Table 8. Johansen cointegration maximum eigenvalue test

Null hypothesis	Alternative hypothesis	Test statistic	Critical value 0.05
r = 0	r = 1	85.660	52.363***
r = 1	r = 2	44.207	46.231
r = 2	r = 3	30.813	40.078
r = 3	r = 4	21.311	33.877
r = 4	r = 5	13.647	27.584
r = 5	r = 6	11.376	21.132
r = 6	r = 7	8.752	14.265
r = 7	r = 8	0.773	3.842

*Source: Computed by Author. Notes: r indicates the number of co-integrating vector. *** is the significance level at 1%. P-values are obtained using response surfaces in [70]*

5. CONCLUSION AND RECOMMENDATION

The vector error correction model (VECM) result revealed that financial sector reforms had significant effects on agricultural output growth in

Nigeria both in the long and short-run in the baseline model and the sensitivity analysis/robustness check respectively. Also, it was discovered that financial sector reforms in the baseline test impacted more on microeconomic policy variables especially growth in agricultural output than those in the sensitivity test in the long-run. Based on the outcome of this work, it is concluded that the assertions made by [50,46,49,76] regarding the use of financial sector real gross domestic product as a better indicator of financial sector reforms than monetary aggregates such as private sector credit commonly used as a proxy for financial sector reforms is true since it impacted more positively on agricultural investments and growth in Nigeria. It is therefore suggested that the Government adopts strong macroeconomic policies targeted to bring meaningful growth in the agricultural and financial sector against foreign-based economic policies since the results confirmed the significant impact of financial sector reforms on agricultural growth in Nigeria in the long and short-run.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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