Contributions of Financial Sector Reforms and Credit Supply to Nigerian Agricultural Sector (1978-2009)

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This study analyzed the trends and pattern of institutional credit supply to agriculture during pre- and post-financial reforms along with their determinants. It then compared the effects of reform policies on access to institutional credits in Nigerian agricultural sector before and after the reforms (1978 - 1985; and 1986 -2009). Relying mainly on time series data from CBN and NBS, it used ordinary least squares method (linear, semi-log and double log) to model the determinants of banking sector lending to the agricultural sector during the review period. The models were subjected to several econometric tests before accepting one. Chow test was used to verify the presence of structural change in the selected equation before and after the reforms. Results indicated an exponentially increasing trend of agricultural credit supply in the economy after the reform began. Econometric analysis shows that stock market capitalization, interest rate and immediate past volume of credit guaranteed by ACGSF significantly influenced the quantity of institutional credit supplied to the agricultural sector over the period in review. There was a significant difference between the credit supply function during the pre-reform and post reform periods. It was recommended that government must consider interest rate regulation as a veritable tool for making credit accessible to farmers at affordable levels; increase fund allocation to ACGSF; boost monitoring capacity of CBN on banks generally and strengthen the microfinance banks to be more responsive to agricultural credit needs.

Keywords: Financial Reforms, credit supply, agricultural credit, agricultural credit policy, monetary policy, Nigeria.

JEL Classification: E22, E23

1.0   Introduction

The relationship between financial development and economic growth has been the subject of a growing literature in both developed and developing countries recently (World Bank, 2008). Agricultural sector, one of the sources of economic growth, is looked unto to pave way for economic development since it has the potentials of generating employment opportunities, alleviating food insecurity, encouraging agro-industrialization and improving entrepreneurship through capacity building. The realization of this fact led Nigerian government to embark on several agricultural development programmes, many of which, unfortunately, failed (Manyong et al, 2005; and Ogungbile, 2008). Of particular interest among these agricultural programmes was the establishment of the Nigerian Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1977. The scheme was established to mobilize funds from the banking sector for rural development by guaranteeing loans by the commercial banks for investment in agriculture to minimize risk involved in financing the sector. However, the vicissitudes of the financial sector appeared to be inseparable from the performance of the ACGSF in meeting up with its goals of mobilizing adequate credit for the agricultural sector. The Nigerian financial system is one of the largest and most diversified in Sub-Saharan Africa (Afangideh , 2010). The system became liberalized when structural adjustment programme was introduced in the 1980s. In recent years, the system had

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undergone significant changes in terms of the policy environment, number of institutions, ownership structure, depth and breadth of markets, as well as in the regulatory framework. According to Finance Maps of World (2012) the Central Bank of Nigeria (CBN) provided some incentives for the banks so that they could achieve the minimum capital base within 2005. These include allowing the banks to deal through foreign exchange by CBN, permitting the banks to take deposits from the public sector while the fiscal authorities were made responsible for the collection of revenue from the public sector. In addition to these some tax incentives were provided for the banks in the area of stamp duty and capital allowance; transaction costs were minimized and the government formed an expert panel to provide technical support to the banks.

Other steps in the reform process included merging the banking institutions and introduction of a regulatory framework based on some rules; establishment of a web portal for all the citizens so that they could share any confidential information with the Central bank regarding the banking systems; development of an automated process to report the bank returns; revision and updating of the banking laws to make the banking system more easy and effective. Several banks were able to increase their capital base through this reform. By merging some banks the government established an efficient and disciplined banking system. Many local banks were merged; therefore the Nigerian government had no need to depend on the foreign banks fully. In one word, it can be said that, through banking sector reform the government of Nigeria was able to move their economy forward.

However, in spite of the far-reaching reforms of the past two decades, the Nigerian financial system is not yet in a position to fulfill its potential as a propeller of economic growth and development. Although these reforms have been acclaimed to be necessary, it is however debatable if they yielded the anticipated results especially on agricultural lending growth in Nigeria. When one notes that the paucity of research outputs to portray the magnitude of the financial reforms' effects on agricultural sector can be a very big constraint towards appropriate policy derivation and implementation in agricultural finance policy of Nigeria, the need for this study becomes more evident. Such studies' need becomes more urgent when one reflects on the findings of Manyong *et al* (2005) who indicated that the rate of growth of number of credits guaranteed by ACGSF to agriculture showed high nominal growth rates but a negative real growth rate. It would therefore be appropriate to bridge this knowledge gap by finding out the present status of agricultural credit growth and its determinants so that one may see whether new policies can revert this negative trend or not. The first objective of this paper therefore, is 1) to chart and discuss the trend of agricultural credit supply in Nigeria before and after financial system reforms; 2) ascertain the influence of financial reform policy instruments/monetary policies on volume of credit accessed by the agricultural sector of Nigerian economy before and after the financial reforms; and 3) verify the differences (if any) on the agricultural credit supply functions in Nigeria before and after the financial sector reforms.

2.0 Justification of the Study

There is a need periodically to study the behavioural reactions of the developing countries to macroeconomic policy prescriptions in order to assess how "well" they respond to such policies and determine the necessary modifications that need be made to them so as to ensure that their implementation is successful. It may even be possible that the results of such empirical studies may lead to the reformulation of received theories to explain adequately the economic phenomena in these nations. Given the pervasive influence of the current reforms on the economy of Nigeria, and particularly the influence of the financial sector (e.g. exchange rate and interest rate) which drives the engine of growth of the agricultural and other sectors of the economy, there is an urgent need to study the response of the financial system *ex post* to the policies of regulation and deregulation of the banking sector. Such a study is hoped to be able to reveal the relevant determinants of successful implementation of financial sector reform policies and more efficient agricultural policy derivation in Nigeria.

3.0 Literature Review

According to Manyong et al (2005), the policies that were of relevance to agriculture are 1) direct credit to the agricultural sector on concessionary terms; 2) the launching of a Rural Banking Scheme in 1977 under which designated commercial banks were required to open a specified numbers of rural branches in different parts of the country and with at least 40% of the total deposit in these rural banks lent to borrowers within those rural areas; 3) ACGSF launched in 1977 to reduce the risk borne by commercial banks in extending credit to farmers. Under this scheme, the Central Bank of Nigeria guaranteed up to about 75%. 4) As a matter of policy, the Naira was allowed to appreciate in this period. In the period, three exchange rate systems were adopted; 5) the fixed rate system was adopted from 1960 to 1972, the managed floating system was adopted from 1973 to 1978, while the pegged system (i.e., pegged to a currency basket) was adopted from 1979 to 1985 (Iwayemi 1995a, b in Manyong et al, 2005). Relatively high crude oil prices have ensured improved government revenues and the new government has committed to a very optimistic target of making Nigeria one of the 20 largest economies by the year 2020 (this goal has been influenced in large measure by some forecasting work done by Goldman Sachs on possible levels for the world economy by that year). One of the broad policy frameworks for achieving this goal is the Financial System Strategy 2020 (FSS 2020), launched by the Central Bank of Nigeria in 2007. The FSS 2020 seeks to enhance Nigeria's economic growth through robust policy reforms in the financial sector including: consolidation of banking sector reforms; recapitalization and consolidation in the insurance sector and capital markets; creation of microfinance banks and the conversion of community banks; establishment of the African Finance Corporation; pension reforms to generate long term investible funds and solve the pension crisis; monetary policy reforms; and restructuring of the Nigeria Security Printing and Minting Company (CBN, 2005 & CBN, 2010).

The Central Bank of Nigeria (CBN) also issued new guidelines on bank mergers and acquisitions that are primarily directed towards regulating mergers and acquisitions and forestalling hostile bids that the CBN considers as damaging to the banking industry. However, they do not govern mergers or acquisitions between foreign and Nigerian banks. Consequently, the CBN stated that

foreign banks may establish banking business in Nigeria if they meet the current minimum capital requirement of N25 billion ($216 million) and other regulatory requirements for obtaining a banking licence. In addition, interested foreign banks may acquire or merge with local banks existing in Nigeria. A prerequisite for such participation would be the continued operation of such foreign bank in Nigeria for a minimum of five years and its establishment of branches in at least two-thirds of the states in the country, excluding the federal capital. It is also required that the shareholding of the foreign bank or investors, following the merger or acquisition, shall not exceed 40% of the total capital of the resultant entity. The Central Bank of Nigeria recently withdrew the licenses of 124 microfinance banks owing to sharp practices by their managers and financial insolvency (CBN, 2010).

Theoretical models infer that the development of the financial sector is essential for economic growth, but there is no consensus yet over the direction of causality. This is because economists sharply disagree about the role of the financial sector in economic growth (Afangideh, 2010). Schumpeter (1912), Mckinnon (1973), Fry (1988), Pagano (1993) and Levine (2004) among others, on the one hand, and Lucas (1988), Greenwood and Jovanovic (1990) and Arestis and Demetriades (1991), on the other hand corroborate this assertion. Financial institutions help mobilize savings and provide payments services that facilitate the exchange of goods and services. In addition, they produce and process information about investors and investment projects to enable efficient allocation of funds; to monitor investments and exert corporate governance after those funds are allocated; and to help diversify, transform, and manage risk (World Bank, 2008). When they work well, financial institutions and markets provide opportunities for all market participants to take advantage of the best investments by channeling funds to their most productive uses, hence boosting growth, improving income distribution, and reducing poverty. A well-functioning system needs broad access, as well as depth access to finance: lack of finance is often the critical element underlying persistent income inequality, as well as slower growth (especially in the agricultural sector) (World Bank, 2008). Though still far from conclusive, the bulk of evidence suggests that developing the financial sector and improving access to finance are likely not only to accelerate economic growth, but also to reduce income inequality and poverty.

4.0   Theoretical Framework

This study benefits from the credit channel theory and other theoretical literature which suggest that policy may have an effect on credit supply and demand in an economy. Dobrinsky and Markov (2003) noted that the recently advanced "credit channel view" implies that monetary policy shocks affect real economic performance through the supply of credit by financial intermediaries due to shifts in the supply schedule of the latter. In turn, they noted, the literature makes a distinction between a "bank lending channel" which pertains to banks only and is related to their dual nature of holders of deposits and generators of loans to firms and a "broad credit channel" which treats the supply of external funds to firms by all financial intermediaries (Oliner and Rudebusch, 1996 & Hu, 1999 as cited in Dobrinsky and Markov, 2003). The credit channel view is also consistent with the assumption of the existence of market imperfections, in

particular, information asymmetries between borrowers and lenders which give rise to the above mentioned monitoring cost premium (Gertler, 1988; & Hubbard, 1995). One implication of the existence of a credit channel in the monetary transmission mechanism is that it induces a heterogeneous response both of the credit market and of the firms due to which the increase in the cost premium for external finance will not be uniformly distributed across firms. The reason for this heterogeneity is the fact that the existing credit market imperfections are likely to impact in a different manner on various categories of firms in the event of a monetary shock. In particular, the credit channel view is consistent with the empirical finding that the effect of a monetary shock should be more severe for small firms (that are more likely to face information costs) than for large firms (Oliner and Rudebusch (1996)) or that the negative effect of a monetary contraction on investment is greater for highly leveraged firms (which are more likely to suffer a reduction in their collateralizable net worth due to the monetary shock) than for less leveraged firms (Rondi *et al.*, 1998 & Hu, 1999)). It is worth noting that Nigerian agricultural sector is largely dominated by small-scale farms (or firms) and going by the foregoing empirical findings it would not be out of place to expect monetary policies having some effects on their collaterizable networths and hence their credit requirements which banks tend to respond to when they supply credit to the agricultural sector.

The indicators of financial development which can influence credit supply used in empirical studies can be classified roughly into three broad categories: monetary aggregates, stock market indicators, and structural and institutional indicators. The disaggregated variables for financial variables used in the empirical model for this paper represent the monetary aggregates and stock market indicators. These were applied by Afangideh (2010)'s study which indicated that bank lending to agriculture equation was significantly influenced by *domestic credit to the private sector, stock market capitalization, real income and previous period bank lending to agriculture.* All had direct and positive effects on bank lending to agriculture except value traded ratio which had a direct but negative effect. According to Barran *et al* (1995), in a standard IS-LM model, the effects of monetary policy on real activity are felt through the demand for money and the (unique*) interest rate*. In reality, shocks in monetary policy will affect the relative structure of interest rates given imperfect substitution among financial instruments. Soyibo and Adekanye (1992) stressed the special influence of financial reforms on the financial sector and he exemplified the influence by the proxy of exchange rate and interest rate which were acknowledged as the drivers of growth of real sectors of the economy including agriculture. From the foregoing analyses we arrive at the choice of some variables as proxies for agricultural lending and it's banking sector and monetary policy variables determinants.

Three models that can be used to capture the relationship suggested by the foregoing credit supply theories are linear multiple regression function, growth model (semi-log model) and Cobb Douglas (double log) function (See Gujarati and Sangeetha, 2007 & Greene, 2008). These are various production functions. Linear regression attempts to model the relationship between two variables by fitting a linear equation to observed data. One variable (or set of variables as in multiple linear regression) is considered to be an explanatory variable, and the other is considered

to be a dependent variable. For example, a modeler might want to relate the weights of individuals to their heights using a linear regression model.

Before attempting to fit a linear model to observed data, a modeler should first determine whether or not there is a relationship between the variables of interest. This does not necessarily imply that one variable *causes* the other (for example, higher SAT scores do not *cause* higher college grades), but that there is some significant association between the two variables. A scatter plot can be a helpful tool in determining the strength of the relationship between two variables. If there appears to be no association between the proposed explanatory and dependent variables (i.e., the scatter plot does not indicate any increasing or decreasing trends), then fitting a linear regression model to the data probably will not provide a useful model. A valuable numerical measure of association between two variables is the correlation coefficient, which is a value between -1 and 1 indicating the strength of the association of the observed data for the two variables.

A linear regression line has an equation of the form

$$Y = a + bX \tag{1}$$

where X is the explanatory variable and Y is the dependent variable. The slope of the line is b, and a is the intercept (the value of y when $x = 0$).

The most common method for fitting a regression line is the method of least-squares. This method calculates the best-fitting line for the observed data by minimizing the sum of the squares of the vertical deviations from each data point to the line (if a point lies on the fitted line exactly, then its vertical deviation is 0). Because the deviations are first squared, then summed, there are no cancellations between positive and negative values.

The process of economic growth depends on the shape of the production function. The production function represents a mathematical equation that shows the combinations of production factors (e.g. capital and labor) necessary to produce a certain amount of output. One of the most common used production functions by economists is Cobb-Douglas production function. It represents a simple production function that gives a responsible description of actual economies (Josheski *et al* 2011). Cobb-Douglas production function can be written as:

$$Y(t) = F[K(t), L(t), A(t)] = AK^{\alpha}L^{1-\alpha} \tag{2}$$

where, $0 > A$, and it shows the level of technology and, α, is a number between 0 and 1.

Often it is assumed that the exponent α is 3/1, that means K in creation of Y participate with 3. Cobb-Douglas production function provides an opportunity to establish the participation of certain factors of productions (labor and capital) in creating the total output (income) in the economy. In a market economy, factors of production, labor and capital, are paid according to their marginal product. Thus, the marginal product of capital is equal to its cost districts R, and

the marginal product of labor equals the wage, as rental income from renting labour. The model, in its simplest form, according to Pragneshu (2008),when there is only one explanatory variable (U) and one response variable (Y), is given by Equation (3):

$$Y = a + bU \tag{3}$$

where, a is scale parameter and b is a measure of curvature. To estimate the parameters, the usual procedure is to assume a multiplicative error exp(ε) in Equation (3) so that the model may be linearized by means of logarithmic transformation, giving Equation 4

$$\ln(Y) = \ln(a) + b\ln(U) + \varepsilon \tag{4}$$

This equation is then fitted to data using "method of least squares" and goodness of fit is assessed by computing coefficient of determination R^2. Main drawback in this procedure is that a proper justification of assumption of multiplicative error is hardly ever provided and this assumption is usually made only for mathematical convenience. As pointed out by Ratkowsky (1990), the assumption tends to be valid only when variability of response variable Y increases with increasing values of explanatory variable U, which happens very rarely. Further, one frequent mistake occurs when goodness of fit of even the original nonlinear model given by Equation (3) is assessed by reporting the same value of R^2 as has been obtained for the linearized model given by Equation (4).

The semilog model is another model that was proposed for the relationship between macroeconomic explanatory variables and the credit supply to agricultural sector in this paper. The semilog equation is an econometric model given as:

$$Y = e^{a+bX+e} \tag{5}$$

or equivalently

$$lnY = a + bX + e \tag{6}$$

It is a model commonly used to describe exponential growth curves (Gujarati and Sangeetha (2007) The semi-log model also known as log lin (log-linear) model is a mathematical model that takes the form of a function whose logarithm is a first-degree polynomial function of the parameters of the model, which makes it possible to apply (possibly multivariate) linear regression. That is, it has the general form

$$\exp(c + \sum_i w_i f_i(X)) \tag{7}$$

in which the $f_i(X)$ are quantities that are functions of the variables X, in general a vector of values, while c and the w_i stand for the model parameters. The term may specifically be used for a log-linear plot or graph, which is a type of semi-log plot. In science and engineering, a semi-log graph or semi-log plot is a way of visualizing data that are changing with an exponential relationship. One axis is plotted on a logarithmic scale. This kind of plot is useful when one of

the variables being plotted covers a large range of values and the other has only a restricted range – the advantage being that it can bring out features in the data that would not easily be seen if both variables had been plotted linearly.

All functions of the form $y = \lambda a^{\gamma x}$ form straight lines, since taking logs of both sides is equal to

$$\log_a y = \gamma x + \log_a \lambda. \tag{8}$$

This can easily be seen as a line in slope-intercept form with γ as slope, $\log_a \lambda$ as the y-intercept. To facilitate use with logarithmic tables, one usually takes logs to base 10 or e:

$$\log(y) = (\gamma \log(a))x + \log(\lambda) \tag{9}$$

The term log-lin is used to describe a semi-log plot with a logarithmic scale on the *y*-axis, and a linear scale on the *x*-axis. Likewise, a lin-log graph uses a logarithmic scale on the *x*-axis, and a linear scale on the *y*-axis. A log-log graph uses the logarithmic scale for both axes, and hence is not a semi-log graph. On a semi-log graph the spacing of the scale on the y-axis is proportional to the logarithm of the number, not the number itself. It is equivalent to converting the Y values to their log, and plotting the data on lin-lin scales (Greene, 2008 and Wikipedia, 2012).

The Chow breakpoint test compares the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are fit to each subsample of the data. E Views (2002) reports two test statistics for the

$$F^* \frac{[\sum e_p^2 - (\sum e_1^2 + \sum e_2^2)]/K}{(\sum e_1^2 + \sum e_2^2)/(n_1 + n_2 - 2K)} \tag{10}$$

Chow breakpoint test. The F-statistic is based on the comparison of the restricted and unrestricted sum of squared residuals and in the simplest case involving a single breakpoint, is computed as Where, n = number of observation (sample size); $(\sum e_1^2 + \sum e_2^2)$ = total unexplained variation, $\sum e_p^2$ = pooled residual variance of the regression based on the two samples (n1 + n2) (i.e.$\tilde{Y} = b_0 + b_1 X$) = $\sum Y_p^2 - \sum \tilde{Y}_p^2$, with $(n_1 + n_2 - K)$ degrees of freedom. (p stands for 'pooled' and K = total number of coefficients including bo). The null hypothesis is $b_i = \beta_i$, that is, there is no difference in the coefficients obtained from the two samples. This formula can be generalized naturally to more than one breakpoint (EViews 2002, Gujarati and Sangeetha, 2007). The F-statistic has an exact finite sample F-distribution if the errors are independent and identically distributed normal random variables.

The log likelihood ratio statistic is based on the comparison of the restricted and unrestricted maximum of the (Gaussian) log likelihood function. The LR test statistic has an asymptotic distribution with degrees of freedom equal to under the null hypothesis of no structural change, where is the number of subsamples. Onoja *et al* (2009) applied this model in econometric

analysis of credit and farm resource technical efficiencies' determinants' differentials in cassava farms in Kogi State, Nigeria.

5.0. Method of Data Analysis

The dependent variable in this study is proxied by amount of loans guaranteed by the Agricultural Credit Guarantee Scheme Fund in the economy; while we selected exchange rate, interest rate, consumer price index of agricultural products, share of agriculture in real GDP, volume of domestic credit to the private sector by banks, stock market capitalization, and previous period financial sector lending to agriculture proxied by previous amount guaranteed by the ACGSF.

$$ACGSFCR = \beta_0 + \beta_{1t}AGRIPRICDF + \beta_{t2}Intrt + \beta_{3t}Stcmcp + \beta_{4t}Forex + \beta_{5t}Agrigdp + \beta_{6t}Privscrd + \beta_{7t}ACGSFpst + u \qquad \text{(Linear form)} \qquad (11)$$

$$\ln ACGSFCR = \beta_0 + \beta_{1t}AGRIPRICDF + \beta_{t2}Intrt + \beta_{3t}Stcmcp + \beta_{4t}Forex + \beta_{5t}Agrigdp + \beta_{6t}Privscrd + \beta_{7t}ACGSFpst + u \qquad \text{(Semi-log form)} \qquad (12)$$

$$\ln ACGSFCR = \beta_0 + \beta_{1t}\ln AGRIPRICDF + \beta_{t2}\ln Intrt + \beta_{3t}\ln Stcmcp + \beta_{4t}\ln Forex + \beta_{5t}\ln Agrigdp + \beta_{6t}\ln Privscrd + \beta_{7t}\ln ACGSFpst + u \quad \text{(Double LogForm)} \qquad (13)$$

Where,
ACGSFCR = Volume of loans guaranteed by ACGSF (in Millions of Naira)
AGRIPRICDF = Price Deflator for Agricultural commodities (index)
Intrt = Interest rate (minimum lending rate in %)
Stcmkcp = Stock market capitalization (Millions of Naira)
Forex = Nominal exchange rate of naira to dollar (Naira)
Agrgdp = value of agricultural output as share of total real GDP (Millions of Naira)
Privscrd = volume of credit advanced to core private sector (in Millions of Naira)
ACGSFpstcr = value of immediate past loans guaranteed by ACGSF (Millions of Naira).
$\beta_1 - \beta_7$ = coefficients of the respective variables.
t = period (year)
β_0 = intercept of the model
u = stochastic error term.
ln = log to base e.

We did diagnostics on the selected model using the model selection criteria which included use of Akaike Information Crtieria (AIC), Log likelihood criteria and Schwarz Criteria in addition to economic evaluation of number of coefficients based on theoretical expectations. We also tested for autocorrelation using Q-statistics from the Correlogram of residuals since Durbin Watson statistics may not give us a more robust result as this. Test for normality of residuals and overall fitness of the model for forecasting and policy making was done using Jacque Bera test and Theil's test. Heteroscedasticity's presence was also done using White Heteroskedasticity test and White Heteroskedasticity-Consistent Standard Errors & Covariance approach to correct (where it is present) to avoid spurious regression results. Following Gujarati (2006) and Greene (2008) we

applied Chow test on the pooled Cobb-Douglas function (estimated by least squares using double log production function). To test for differences in the slopes of the Cobb-Douglas regression in the two sub-groups of farmers by implicitly dividing the sample into two (at 1986 when bank Reforms formally started in Nigeria) representing cut off for the two groups. We used E Views computer programme to conduct this test and other analyses in this work.

6.0.   Results and Discussion

The trend of banking system credit supply to the agricultural sector is shown in the graph in Figure 1. The result shows a relatively sluggish and almost stagnant growth during the pre-reform era. After 2000, when the reform process had fully taken off we see the trend of institutional credit supply to the agricultural sector increasing at an exponential rate. This shows that the agricultural credit supply (proxied by volume of loans guaranteed by ACGSF) was responding to the doses of banking reform policy instruments during the post reform era to date.

Model Selection Criteria: The economic analysis of our findings was preceded by the econometric tests whose results presented in Table 1, which are discussed below. In terms of econometric criteria, we find the AIC recorded for the Cobb-Douglas model being lower than the other models. Its log likelihood ratio (LR ratio) was also higher relative to the other functional forms of the regression model. Thus it is evident that the model would be more suitable for our analyses having displayed better fittings. Besides the R^2 was very high, implying that the explanatory variables included in the selected model accounted for 97 percent variation in the volume of loan accessed by Nigerian farmers during the period in review.
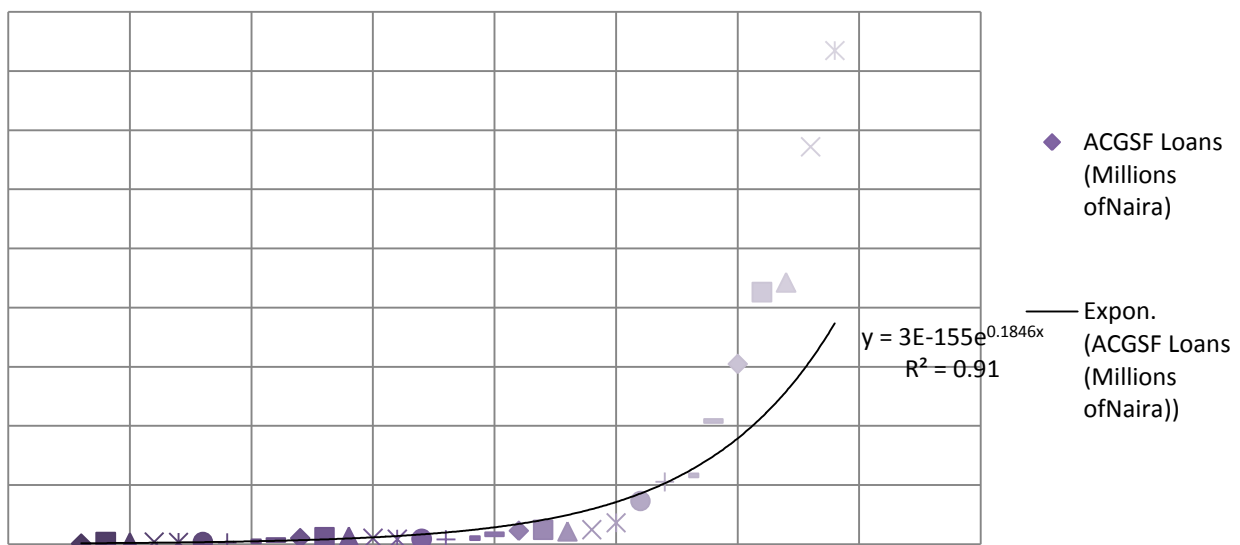

Figure 1: Trend Analysis of institutional loans supplied to the agricultural sector in Nigeria over the two periods of study.
Data Source: CBN and NBS (2010).

Table 1: Model Selection Criteria Showing Indices of Model Fitness

Model Type	R^2	Adjusted R^2	LR-Ratio	AIC	Remarks
Linear	0.992	0.99	-431.9	27.49	Reject
Semi-Log	0.964	0.953	-10.87	1.179	Reject
Cobb-Douglas	0.9763	0.969	-4.095	0.7559	*Accept*

Diagnostics: The estimated Jacque Bera (JB) Statistic is 0.908 with a p value 0.634, significantly different from zero, suggesting that the sample came from normal distributions. Test for autocorrelation was done using Breusch-Godfrey serial correlation LM test. The results had an F-statistic (0.25) and Observed R^2 change (0.72) with probabilities ($p < 0.78$ and $p < 0.70$ respectively). We therefore accept the null hypothesis of no residual serial correlation in our model. In addition to this the estimated Q-statistics (another index of autocorrelation in residuals) recorded for all the years in review did not exhibit any probability significantly close to zero. We therefore have no reason to suspect the presence of serial autocorrelation in our model. In a similar vein, our test for the presence of heteroscdasticity using White Heteroskedasticity Test, gave F-statistics and Log Likelihood estimates which were not significantly close to zero giving us the confidence to reject the hypothesis of presence of heteroscedasticity in our model. Using Theil's criteria for appraising the overall fitness of our selected model, we find the model also suitable for forecasting and policy analysis since, in econometric analysis, a model is generally considered a good predictor of historical series when it returns low values for both bias and variance proportions and high values for covariance proportion.
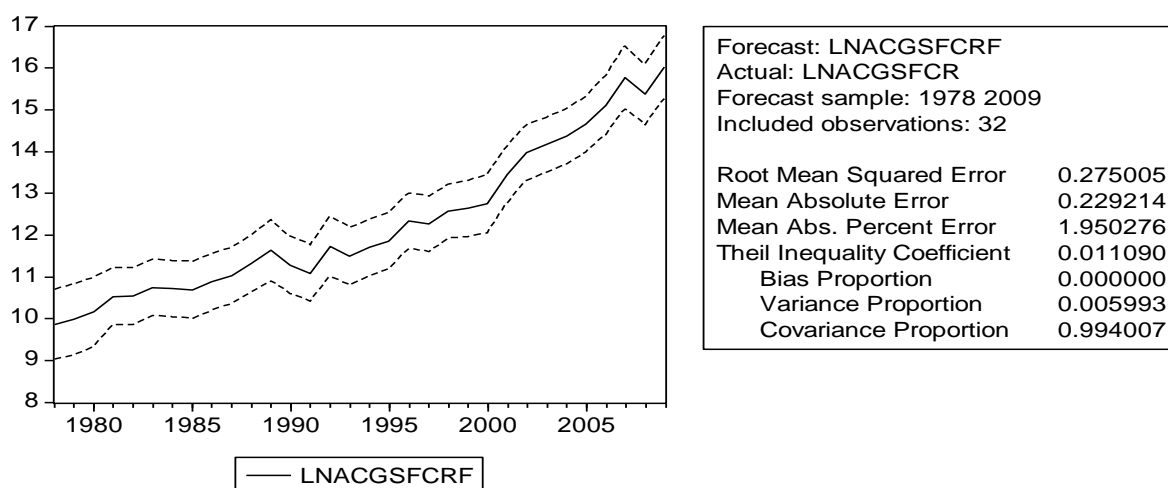

Figure 2: Residuals' Trend and Indices used to Test for Forecasting Power of the Cobb-Douglas Model Applied in this research

In addition, it must also have low roots mea square error (RMSE) and high correlation coefficients. These indices as shown have all shown that our model is good for forecasting and

policy formulation. The forecast as could be seen from the graph in Figure 2 indicates an upward trend in the volume of loans being advanced to the agricultural sector and guaranteed by the Agricultural Credit Guarantee Scheme Fund (proxied by lnACGSFcrf in the graph). This is a promising development as Nigerian farmers definitely need more access to financial services especially credit to be able to meet with their needs for investment on farm land, stocks, farm inputs and assets to be able to produce more efficiently.

Elasticities and Results of Chow Test: Our analyses indicate that three policy instruments significantly determined the level of loan supplied to the agricultural sector by the financial services sector of Nigerian economy before and after the financial system reforms. These include log of interest rate (lending rate), stock market capitalization and volume of loans guaranteed by the ACGSF. Their respective elasticities (shown in Table 2.0) were significant at less than 5 percent significance level. The three variables returned positive signs of their coefficients which are consistent with theoretical expectations. Our test for presence of structural break in the pooled Cobb-Douglas function used for the study indicated F-statistics and Log likelihood ratios whose p values were very close to zero. These imply that the hypothesis of no structural break in the model's slope coefficients stands rejected. See Table 3.

Table 2: Results of Parameter Estimates Applying Cobb-Douglas Model

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Intercept	5.737014	0.898119	6.387810	0.0000
lnFOREX	0.061340	0.042093	1.457230	0.1580
lnPRIVSCR	0.043171	0.389019	0.110973	0.9126
lnAGRIGDP	0.262108	0.387976	0.675578	0.5058
INTRT	0.040062	0.016933	2.365852	0.0264
lnACGSFPST	2.76E-07	9.41E-08	2.926613	0.0074
lnSTCKMCP	0.325275	0.101586	3.201985	0.0038
lnAGRIPRICDF	-0.179291	0.120022	-1.493814	0.1483
R-squared	0.976314	Mean dependent var		12.27120
Adjusted R-squared	0.969405	S.D. dependent var		1.815457
S.E. of regression	0.317549	Akaike info criterion		0.755947
Sum squared resid	2.420092	Schwarz criterion		1.122381
Log likelihood	-4.095145	F-statistic		141.3202
Durbin-Watson stat	1.640491	Prob(F-statistic)		0.000000

Table 3: Chow Breakpoint Test Output: (Break point : 1986)

F-statistic	3.492126	Probability	0.015923
Log likelihood ratio	32.32539	Probability	0.000081

The policy implication of these findings is that there is significant difference in the levels of loans granted by the sector of the economy before and after the financial sector reforms. The findings agree with the theories advocated by pro-financial sector reforms and World Bank (2008) adopted by Nigerian monetary authorities since 1986 to date.

7.0   Conclusion/Recommendations

This study has been able to chart the trend of agricultural credit supply in Nigeria from 1978 to 2009. It also compared the effects of reform policies on access to institutional credits in Nigerian agricultural sector before and after the reforms (1978 - 1985; and 1986 -2009). The OLS models used for the study were subjected to several econometric tests before accepting one. Chow test was used to verify the presence of structural change in the selected equation before and after the reforms. Results showed that an exponentially increasing trend of agricultural credit supply in the economy after the reform began. It was also found that stock market capitalization, interest rate and immediate past volume of credit guaranteed by ACGSF significantly influenced the quantity of institutional credit supplied to the agricultural sector over the period in review.

The trend of agricultural lending in Nigeria during the post financial sector reform era appears to be looking upwards, relative to the sluggish and almost stagnant trend in the pre-reform era thus suggesting that the financial sector reforms seem to be paying off after all through its multiplying effects filtering to the agricultural sector. For this increase in credit supply to have sustainable growth impact or positive real growth pattern, there is a need to improve on the policy variables which determined the growth rate of this sub-sector of the economy.

First, government must consider interest rate regulation as a veritable tool for making credit accessible to farmers at affordable levels where transaction costs will not be too high as to discourage farmers willing to invest or expand their investment to withdraw from doing so. Indeed governments need to ensure competition in financial markets in order to drive innovation and efficiency thus minimizing the risk of monopolistic practices. As liberalization of financial markets progresses competition increases. By encouraging innovation, the effects of strengthening the borrowing capacity of farmers or agricultural investors will ultimately be felt.

Secondly, we also find that immediate past (previous year's) credit volume guaranteed by ACGSF (ACGSFpst) exerted significant influence on the supply of current credit to the agricultural sector. This demonstrates the relevance of the ACGSF in improving agricultural finance level in Nigerian economy.

More funds need to be allocated to the ACGSF by the Central Bank of Nigeria to enable it expand its services to other farmers/agricultural investors denied access to fund because of fear of agricultural loan risks nursed by commercial and development banks. The relevance of stock

market capitalization as a stimulant to sectoral growth of developing and developed economies was reaffirmed by its significance in determining even the growth level of agricultural credit supply in Nigerian economy. Given the importance of the stock market, government must maintain a conducive environment for quoted companies on the stock market and the real sectors of the economy to thrive unperturbed. These include providing basic infrastructure such as adequate power supply, motorable roads, fiscal incentives like tax holidays for some priority sectors of the economy, security and lots more.

Governments must monitor, review and evaluate policies on an ongoing basis. In addition the Central Bank of Nigeria needs to increase its monitoring capacity on banks generally and strengthening of the microfinance banks with a view of encouraging them to advance more loans to the agricultural sector. Our econometric tests confirmed that the ongoing financial system reform is a right step in the right direction since its era favoured agricultural sector more than the status quo in terms of credit supply to the sector. If the reform policies are well implemented Nigeria should be on its way to realizing the goals set in Vision 2020.

Further research is recommended to probe into the supply and demand interactions that determine the credit supply to the agricultural sector in Nigerian economy using advanced dynamic econometric models.

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