On the Causality between Domestic Credit Aggregates and Economic Growth in a Multivariate VAR Framework: Evidence from Nigeria

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Abstract

The major objective of this paper is to empirically investigate the relationship between domestic credit and economic growth in Nigeria, using annual time series data from 1970 to 2012. In order to do this, the study employs KPSS unit root test, Johansen cointegration test, VAR modeling, impulse response function, variance decomposition and granger causality. Firstly, the findings reveal that there is a bi-directional causality and positive relationship between domestic credit and the economic growth in Nigeria. That is, domestic credit does not only contribute positively to economic growth in Nigeria, but the impact is strong and statistically significant. The findings have a strong implication on financial policy in Nigeria. The major implication is that an efficient financial system is one of the foundations for building sustained economic growth. Considering regulations, institutional constraints and other macro-economic factors militating against domestic credit in the economy, government should make the environment conducive and supportive so that performance is enhanced and good lending behaviour guaranteed.

1. Introduction

Mirdala (2011), Baltagi (2008), Abu-Bader and Abu-Qarn (2008), Demetriades and Andrianova (2004) and Godhart (2004) contend that a sound financial system is very essential and prime requirement for economic growth. Schumpeter (1911), Gurley and Shaw (1955), Goldsmith (1969) and Hicks (1969), all notable early works on finance and growth, also show that finance is crucially important in stimulating economic growth. Together with financial liberalization and international financial integration, financial intermediation was encouraged especially due to its potential effects on the real economy. Thus, the size of the financial sector is usually closely related to the overall economic performance of the country.

An efficient financial system is one of the foundations for building sustained economic growth and an open, vibrant economic system. In the early neoclassical growth literature, financial services played a role of channeling household savings to investors. Levine (2005) suggests that financial institutions and markets can foster economic growth through allocating savings to their most productive use. The finance-led growth hypothesis postulates the supply-leading relationship between financial and economic developments (Patrick, 1966). According to this view, the existence of a financial sector, as well as well-functioning financial intermediations that channel the limited resources from surplus units to deficit units, would provide efficient allocation resources, thereby leading other economic sectors in their growth process. This view has received considerable support from recent empirical studies (Habibullah and Eng, 2006)

According to CBN (2003), the amount of loans and advances given by the banking sector to economic agents constitute bank credit. Bank credit is often accompanied with some collateral that helps to ensure the repayment of the loan in the event of default. Credit channels savings into productive investment thereby encouraging economic growth. Thus, the availability of credit allows the role of intermediation to be carried out, which is important for the growth of the economy.

The broad consensus that credit from banks and other financial institutions play an important role in generating growth and reducing poverty is in no doubt. This is because availability of credit augments the purchasing power of individuals and households, and this has a multiplier effect on

the economy of any nation. Nigeria is a big economy and it poses as a very good window for investors to get started on the continent, which will benefit the whole of sub-Saharan Africa. Nigeria is gradually developing a full-blown consumer credit market. An efficient and functioning market for credit will stimulate business activity and support Nigeria‘s dynamic entrepreneurs. There is a prevalent feeling that following the banking sector crisis which erupted in August 2009, this process has stalled as commercial banks have curtailed their lending to the private sector causing a credit crunch or squeeze. However, the syndication by FirstBank, Zenith Bank, Access Bank, Fidelity Bank, United Bank for Africa, Bank PHB, Guaranty Trust Bank and Oceanic Bank was a major departure from that lull in lending that brought untold hardship to manufacturers. The $650 million loan to Etisalat in 2011 was the biggest loan so far syndicated by Nigerian banks after the global financial crisis which slowed lending activities drastically (Businessday, 2011).

Considering recent reforms and positive growth in macro-indices, Nigeria has a massive opportunity to lay the foundations for a strong financial sector. At an annual average growth rate above 7 percent over the past few years, the Nigerian economy is one of the fastest growing economies in the world. While the government is ambitious to make the country one of the world’s 20 largest economies by 2020, a weak financial sector, particularly with respect to credit services to individuals and households at the bottom of the pyramid, has remained an impediment.

Still smarting from the crippling impact of the global economic crisis, followed by the banking sector reform by the Central Bank of Nigeria (CBN) termed as ‘The Sanusi Tsunami’, banks have become lending-shy and a lot more cautious with the kind of projects they finance. For example, real estate, with its long gestation period is not always in the immediate loan consideration of most banks. The low level of supply of domestic credit aggregates in general and money stock in particular had been responsible for the fundamental failure of many African countries to attain growth and development. Various scholars have laid much of the blame for the failure of monetary policies to translate into economic growth on the government and its agencies as a result of poor implementation and insincerity on the part of policy executors (Ojo, 1993).

It is widely accepted that the private sector is the engine of growth. The creation of an enabling environment will make it achievable. One of the major challenges identified as constraints to doing business in Nigeria is lack of access to finance as well as the cost of finance. Providing finance to Nigeria‘s real sector especially the small and medium enterprises (SMEs) will be a key component of future job creation. Nigeria‘s banks have never successfully lent to the nation‘s SMEs. There is a consensus within the banking sector regarding the constraints on SME access to credit. These constraints fall into three broad categories: (a) infrastructure constraints, (b) supply-side constraints, which relate to the incentives for banks to lend to SMEs; and (c) environmental constraints, which reflect the combination of institutional, legal, infrastructure, and capacity problems which make SME lending cumbersome and risky (Radwan, 2010). Yet, the apathy of some banks towards small savers in the country as well as the declining credit to small businesses have been largely attributed to the amount of returns the financial institutions get from playing with public sector funds.

As a matter of fact, most banks in Nigeria have historically tended to concentrate lending to the corporate and commercial segments of the market, thereby locking-out the retail/consumer segment from the credit system; largely on account of the lack of credit information on individuals and persons in the country, which make up that segment. The sectors that are driving GDP growth have little exposure to credit. About 80 percent of Nigeria’s private credit goes to sectors of the economy that account for only 23 percent of real GDP growth, according to data from the CBN and NBS. Agriculture, for example, is responsible for almost 30 percent of real GDP growth; however, only 2 percent of credit extended goes to the agriculture sector. Two other important drivers of growth, trade and communications (and transport), which are responsible for 26 percent and 22 percent of growth respectively, also received relatively low shares of private credit – 11 percent and 10 percent, respectively.

Not until recently, with the recapitalization in the banking sector which resulted in mergers, acquisitions increased bank branches and innovations, the Nigerian financial system remained by and large relatively underdeveloped because of dearth of financial intermediation and financial deepening which the economy requires for sustained growth. Since the financial system performs the vital function of raising funds, and channelling funds to productive investment, successful

domestic credit is usually an important component of a country's strategy for economic growth. As well, considering the various financial restructuring programs in ensuring that private sector takes its place as the engine of economic growth, one still wonders if the domestic credit has actually made any significant impact. Therefore, studying the effect of domestic credit on economic growth is a vital one, considering the continuing progress in Nigeria's financial sector, especially at the aftermath of the global financial crisis. This study, therefore, combines an analysis of a set of domestic credit aggregates for Nigeria and an empirical investigation into the domestic credit–economic growth link.

2. Literature Review

This section gives an empirical review of domestic credit and its effect on economic growth. It gives a detailed explanation of various works being embarked upon by researchers in this field and a review that can be sited within the Nigerian context.

Muhsin and Eric (2000) find, in a study of Turkish economy, that when bank deposit, private sector credit or domestic credit ratios are alternatively used as proxies for financial development; causality runs from economic growth to financial development. They conclude that growth leads financial sector development.

Wa (2005) find, in a study of bank credit and economic growth in Macao, that the elasticity of output with respect to bank credit has fluctuated over time and exhibited a downward trend. As well, the contribution of domestic bank credit has been less significant in this growth process, as large-scale tourism projects have been largely financed by foreign funds.

Dey and Flaherty (2005), using a two-stage regression model, examines the impact of bank credit and stock market liquidity on GDP growth. They find that bank credit and stock market liquidity are not consistent determinants of GDP growth. On the contrary, banking development is a significant determinant of GDP growth.

Mishra et al (2009), using VAR, investigates the direction of causality between India credit market development and the economic growth between 1980 and 2008. He finds that economic growth has a positive impact on credit market development. As well, Granger Causality Tests indicate that credit market development spurs economic growth in India.

Cappiello et al (2010) find, in their study of the European Area, that contrary to recent findings for the US, the supply of credit, both in terms of volumes and in terms of credit standards applied on loans to enterprises, have significant impacts on real economic activity. That is to say, a change in loans growth has a positive significant impact on GDP.

Akpansung and Babalola (2011) examines the relationship between banking sector credit and economic growth in Nigeria over the period 1970-2008. They establish the causal links between the variable, using Granger causality test while using a Two-Stage Least Squares (TSLS) estimation technique for their regression models. The results of Granger causality test show evidence of unidirectional causal relationship from GDP to private sector credit (PSC) and from industrial production index (IND) to GDP. They find that private sector credit impacts positively on economic growth while lending rate impedes economic growth.

Iqbal et al (2012), using ARDL approach and error correction model (ECM), find that the national savings and credit to private sector plays important role in economic growth and development of Pakistan. The results indicate that increase in real gross domestic product was 5.59 percent due to one percent increase in credit to private sector. In this way, the credit to private sector has significant impact upon economic growth in the long run but also in the short run.

By and large, this review of related studies suggests that the causal relation between domestic credit and economic growth is still controversial in the literature. Apart from being not ample, the empirical literature is enfeebled by not covering the period after the recent global financial crisis. This paper endeavours to fill such gaps.

3. Theoretical Framework

Harrod-Domar growth model is about the conditions for stable growth in an economy. It assumes that aggregate demand and supply would be in balance when investment (I_t) in any period equals the change in national income ($Y_t - Y_{t-1}$) times the capital to output ratio (k). The capital to output ratio indicates the value of capital required to produce one unit of output in a single time period. At equilibrium in a closed economy, intended investment would equal intended savings (S_t), which gives the initial equilibrium condition.

$$I_t = S_t = k(Y_t - Y_{t-1}) \quad (1)$$

Divided by Y_t

$$\frac{I_t}{Y_t} = \frac{S_t}{Y_t} = \frac{(Y_t - Y_{t-1})}{Y_t} \quad (2)$$

Define:

$$s = \frac{S_t}{Y_t} \quad \text{Savings rate} \quad (3)$$

$$g = \frac{(Y_t - Y_{t-1})}{Y_t} \quad \text{Growth rate} \quad (4)$$

Focus:

$s = k \times g$ or $g = \frac{s}{k}$ Harrod-Domar growth equation (5)

The rate of growth is determined jointly by the national savings ratio and national capital to output ratio. The more a nation can save and invest the quicker it can grow!

Thus, it appears plausible that one of the underlying reasons that savings is less effective in spurring development than is expected may be due to the failure of the financial system in ensuring its efficient allocation as domestic credit. In other words, savings functions effectively when it is well-transformed into domestic credit in a sound financial system.

4. Model Specification and Estimation Techniques

4.1 Model Specification

The quest to examine the impact of domestic credit on economic growth gives rise to the model to be adopted. Various indicators of domestic credit abound but to really explain the impact of domestic credit on Nigerian economic growth, there is need to take cognizance of empirical works being carried out by various researchers in the field.

Following a detailed review of previous studies and improving upon the theoretical postulates described above, economic growth is expressed as a function of net domestic credit, CREDIT, and a set of control variables. This is expressed by equation (6) below;

$$GDPCAPITAL = f\{ CREDIT, MONEY, INVESTMENT, LENDING, INTEREST \} \quad (6)$$

$$GDPCAPITAL = \alpha_0 + \alpha_1 CREDIT + \alpha_2 MONEY + \alpha_3 INVESTMENT + \alpha_4 LENDING + \alpha_5 INTEREST + \xi \quad (7)$$

GDPCAPITAL = GDP per Capital

CREDIT = Net Domestic Credit

MONEY = Money and Quasi-Money (M_2)

INVESTMENT = Gross Capital Formation as a Percentage of GDP

LENDING = Lending Rate

INTEREST = Real Interest Rate

The a priori expectations are: $\alpha_1, \alpha_2, \alpha_3 > 0$ and $\alpha_4, \alpha_5 < 0$.

In using the Multiple Regression Model, the following assumptions are made:

- There is a linear relationship between the dependent variable – GDPCAPITAL and CREDIT, MONEY, INVESTMENT, LENDING and INTEREST. Hence, the functional relationship: GDPCAPITAL = f { CREDIT, MONEY, INVESTMENT, LENDING, INTEREST }.
- Both dependent and independent variables are continuous random variable which is normally distributed.

- The random terms of different observations (ξ_i, ξ_j) are independent. This means that all the covariances of any ξ_i, with any other ξ_j are equal to zero. The value which the random term assumes in one period does not depend on the value which it assumed in any other period.
- The explanatory variables are not perfectly linearly correlated. If there is more than one explanatory variable in the relationship it is assumed that they are not perfectly correlated with each other. Indeed the regressors should not be highly multicollinear.

The data for the empirical analysis are obtained from the World Bank database.

4.2 Estimation Techniques

This study employs KPSS unit root test, Johansen cointegration test, VAR modeling, impulse response function, variance decomposition and granger causality. No other study has gone to such extent to estimate the nexus between domestic credit and economic growth in Nigeria

4.2.1 Stationarity Test

This study uses the stationarity test to test if the given series has unit root. Stationarity of a series is an important phenomenon because it can influence its behaviour. If *x* and *y* series are non-stationary random processes (integrated), then modelling the *x* and *y* relationship as a simple OLS relationship as in the following equation will only generate a spurious regression.

$Y = \alpha + X + \xi_t$

Time series stationarity is the statistical characteristics of a series such as its mean and variance over time. If both are constant over time, then the series is said to be a stationary process (i.e. is not a random walk/has no unit root), otherwise, the series is described as being a non-stationary process (i.e. a random walk/has unit root). Differencing a series using differencing operations produces other sets of observations such as the first-differenced values, the second-differenced values and so on.

x level	x_t
x 1st -diferenced value	$x_t - x_{t-1}$
x 2nd -diferenced value	$x_t - x_{t-1}$

If a series is stationary without any differencing it is designated as I (0), or integrated of order 0. On the other hand, a series that has stationary first differences is designated I (1), or integrated of order one (1). KPSS test will be used to test the stationarity of the variables.

4.2.2 Johansen and Juselius Cointegration Test

This study uses two tests to determine the number of cointegration vectors: the Maximum Eigenvalue test and the Trace test. The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for r = 0, 1, 2…n-1. This test statistics are computed as:

$LR_{max}(r/n+1) = -T*\log(1-\lambda)$ (8)

Where λ is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Its equation is computed according to the following formula:

$LR_{\mathrm{tr}}\,(\mathrm{r/n}) = -\mathrm{T} * \sum_{i=r+1}^{n} log(1-\lambda_i)$ (9)

In some cases Trace and Maximum Eigenvalue statistics may yield different results. In this case the results of trace test should be preferred.

4.2.3 Vector Autoregression Model (VAR)

This study applies VAR in order to evaluate the short run properties of the model. If cointegration has been detected between series we know that there exists a long-term equilibrium relationship and we use VECM (VAR error correction model). In case of no cointegration, VAR is used. Then, one directly proceeds to Granger causality tests to establish causal links between the variables. The regression equation form for VAR is as follows:

$\Delta \mathrm{Y_t} = \propto_1 + \sum_{i=0}^{n} \beta_1 \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_1 \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_1 \Delta Z_{t-i}$ (10)

$\Delta \mathrm{Y_t} = \propto_2 + \sum_{i=0}^{n} \beta_1 Y_{t-i} + \sum_{i=0}^{n} \delta_1 \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_1 \Delta Z_{t-i}$ (11)

In VAR, the cointegration rank shows the number of cointegrating vectors. For instance a rank of two indicates that two linearly independent combinations of the non-stationary variables will be stationary.

4.2.4 Granger Causality test

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. The definition states that in conditional distribution, lagged values of Y add no information to explanation of movements of Xt beyond that provided by lagged values of Xt

itself (Green, 2003). In summary, one variable (Xt) is said to granger cause another variable (Yt) if the lagged values of Xt can predict Y and vice versa.

In this study, the Granger causality test was performed using the following vector autoregressive (VAR) models:

If causality (or causation) runs from CREDIT to GDPCAPITAL, we have:

$$GDPCAPITAL_t = \sum_{i=1}^{n} \alpha_i GDPCAPITAL_{t-i} + \sum_{j=1}^{n} \beta_j CREDIT_{t-j} + \xi_{1t} \quad (12)$$

If causality (or causation) runs from GDP to M2GDP, it takes the form:

$$CREDIT_t = \sum_{i=1}^{n} \gamma_i CREDIT_{t-i} + \sum_{j=1}^{n} \delta_j GDPCAPITAL_{t-j} + \xi_{2t} \quad (13)$$

It is assumed that the disturbance terms ξ_{1t} and ξ_{2t} are uncorrelated.

The decision rule:

From equation (3.8), $CREDIT_{-j}$ Granger causes GDPCAPITAL if the coefficient of the lagged values of CREDIT as a group (β_j) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (3.9), $GDPCAPITAL_{t-j}$ Granger causes CREDIT if δj is statistically significant.

5. Empirical Estimation and Analysis of Model Results

Empirical evidence justifies a belief in the truth or falsity of an empirical claim. This study requires empirical evidence for the hypothesis that domestic credit has significant impact on economic growth in Nigeria to be accepted. Therefore, this section aims at validating the a priori expectations of the variables by determining the causal relationship between the dependent and independent variables employing a series of tests including stationarity test, cointegration test, VAR, impulse response and variance decomposition.

5.1 Ordinary Least Square Estimation of the Model

GDPCAPITAL = 4.173830 - 0.011654*CREDIT + 0.085546*MONEY + 0.228371*INVESTMENT - 0.006030*LENDING - 0.000104*INTEREST

Durbin Watson = 0.598057 R-Squared = 0.717895

Durbin Watson statistic is much lower than R-Squared, suggesting evidence of spurious regression. We can, as well, re-estimate the equation, adding AR(1).

GDPCAPITAL = 4.207811 - 0.004877*CREDIT + 0.088661*MONEY + 0.048835*INVESTMENT - 0.001191*LENDING + 0.000789*INTEREST + [AR(1)=0.942033932639]

Durbin Watson = 1.464832 R-Squared = 0.920030

Now Durbin Watson statistic is much greater than R-Square. However, the estimate of ρ is very high indeed, 0.94, suggesting that there was very high autocorrelation in the original specification. Yet, this could be as a result of mis-specification of the model. The unsuitability of the application of the ordinary least square on a multiple linear regression model is due to the fact that some of the variables – dependent variables and independent variables – may be non-stationary at levels, thus, suggesting the possibility of spurious regressions.

5.2 Stationarity Test

Since most economic time series are not very informative about whether or not there is a unit root, it would be useful to perform tests of the null hypothesis of stationarity as well as tests of the null hypothesis of a unit root (Kwiatkowski, Phillips, Schmidt and Shin, 1992). Unit root test using the Kwiatkowski-Phillips-Schmidt-Shin test statistic (KPSS) to confirm stationarity is carried out at both 5 percent and 1 percent levels of significance. The choice of the KPSS test is motivated by the argument that tests designed on the basis of the ADF have low predictive power.

Table 1: KPSS Test

Null Hypothesis (KPSS): The Variable is Stationary.

	Intercept	Trend & Intercept
Levels		
GDPCAPITAL	0.328429**	0.179396
CREDIT	0.715248	0.087565**
MONEY	0.826420	0.111958**
INVESTMENT	0.654058	0.149624
LENDING	0.545525	0.156612
INTEREST	0.633710	0.110443**
First Difference		

ΔGDPCAPITAL		0.140005**	0.125717**
ΔCREDIT		0.097312**	0.086243**
ΔMONEY		0.107375**	0.104024**
ΔINVESTMENT		0.139461**	0.107168**
ΔLENDING		0.134319**	0.075227**
ΔINTEREST		0.209983**	0.108845**
Critical Values	1%	0.739000	0.216000
	5%	0.463000	0.146000
	10%	0.347000	0.119000

*Notes: An * indicates rejection of the null hypothesis of non-stationarity at the 5 percent level of significance, while ** indicates a stronger rejection at the 1 percent level. Number of lags was selected using the AIC criterion. For KPSS, Barlett-Kernel is used as the spectral estimation method. The bandwidth is selected using Newey-West method.*

Using KPSS test indicates that most of the economic variables included in the model are non-stationary at levels both @ intercept and @ trend. Further, all the variables maintain stationarity at an integration of order one, I(1). Hence, higher order of integration is needless.

The above unit root results validate the unsuitability of the application of the ordinary least square on a multiple linear regression model. This is due to the fact that some of the variables – dependent variables and independent variables – are non-stationary at levels, thus, suggesting the possibility of spurious regressions.

5.3 Test of Lag Length Selection

The Schwarz Information Criterion (SC) is used to select the optimal lag length. Based on the SIC, it is found that one lag is optimal. SC is used for model selection such as determining the lag length of a model, with smaller values of the information criterion being preferred.

Table 2: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDPCAPITAL CREDIT MONEY INVESTMENT INTEREST LENDING
Sample: 1970 2012
Included observations: 39

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-419.6607	NA	121.7000	21.82875	22.08469	21.92058
1	-209.9596	344.1250	0.016862	12.92100	14.71253*	13.56379*

2	-177.6303	43.10572	0.023304	13.10924	16.43637	14.30299
3	-126.1179	52.83321*	0.015430*	12.31374	17.17646	14.05844
4	-74.25459	37.23519	0.016566	11.50024*	17.89855	13.79590

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.4 Cointegration Test

The Johansen co-integration test procedure is used to determine the cointegrating relationships among the variables. This consists of the the Trace criterion and the Maximum Eigenvalue criterion.

Table 3 Multivariate Cointegration Test Results:The Johansen-Juselius Approach

Sample (adjusted): 1972 2012
Included observations: 41 after adjustments
Trend assumption: Linear deterministic trend
Series: GDPCAPITAL CREDIT MONEY INVESTMENT INTEREST LENDING
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.564737	105.2087	95.75366	0.0095
At most 1 *	0.483352	71.10469	69.81889	0.0394
At most 2	0.457054	44.02853	47.85613	0.1094
At most 3	0.239675	18.98793	29.79707	0.4938
At most 4	0.139871	7.753549	15.49471	0.4921
At most 5	0.037709	1.575958	3.841466	0.2093

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen	0.05

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.564737	34.10403	40.07757	0.2017
At most 1	0.483352	27.07616	33.87687	0.2593
At most 2	0.457054	25.04060	27.58434	0.1023
At most 3	0.239675	11.23438	21.13162	0.6239
At most 4	0.139871	6.177590	14.26460	0.5905
At most 5	0.037709	1.575958	3.841466	0.2093

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3 reveals the presence of no cointegrating vectors from the maximal eigenvalue statistic while the trace test statistic indicates the existence of 2 cointegrating equations at the 5% level. The maximal eigenvalue statistic forms the basis of the formulation of a one-vector model in order to investigate the direct effect of the domestic credit on real output. The non-existence of Cointegration is indicative of a short-run relationship between real output and the domestic credit variables.

5.5 Results of the VAR Model

Table 4 Vector Autoregression Estimates

Vector Autoregression Estimates
Sample (adjusted): 1971 2012
Included observations: 42 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GDPCAPITAL	CREDIT	MONEY	INVESTMENT	INTEREST	LENDING
GDPCAPITAL(-1)	1.196229	-15.38124	0.508535	1.078644	5.067536	-4.217118
	(0.09154)	(6.01717)	(0.26605)	(0.35777)	(24.2558)	(5.39058)
	[13.0680]	[-2.55622]	[1.91144]	[3.01488]	[0.20892]	[-0.78231]
CREDIT(-1)	0.007017	-0.164143	-0.007835	-0.003504	0.519619	0.089717
	(0.00257)	(0.16915)	(0.00748)	(0.01006)	(0.68186)	(0.15154)
	[2.72680]	[-0.97039]	[-1.04756]	[-0.34835]	[0.76206]	[0.59205]
MONEY(-1)	-0.022459	2.654293	0.961353	-0.076630	1.295500	0.133801
	(0.00924)	(0.60742)	(0.02686)	(0.03612)	(2.44857)	(0.54417)

	[-2.43043]	[4.36978]	[35.7952]	[-2.12175]	[0.52908]	[0.24588]
INVESTMENT(-1)	-0.095071	4.563653	-0.106635	0.540213	-5.335534	-1.512563
	(0.03167)	(2.08185)	(0.09205)	(0.12378)	(8.39215)	(1.86506)
	[-3.00181]	[2.19211]	[-1.15846]	[4.36414]	[-0.63578]	[-0.81100]
INTEREST(-1)	-0.000695	-0.038719	0.000554	-0.002886	-0.073694	-0.032454
	(0.00063)	(0.04165)	(0.00184)	(0.00248)	(0.16789)	(0.03731)
	[-1.09668]	[-0.92966]	[0.30091]	[-1.16561]	[-0.43895]	[-0.86981]
LENDING(-1)	-0.000858	-0.024160	0.010862	-0.005222	-0.772916	0.719175
	(0.00188)	(0.12358)	(0.00546)	(0.00735)	(0.49815)	(0.11071)
	[-0.45635]	[-0.19550]	[1.98787]	[-0.71066]	[-1.55157]	[6.49611]
C	-0.618192	50.93569	-1.815742	-3.784115	-54.76777	30.45441
	(0.42722)	(28.0824)	(1.24166)	(1.66974)	(113.203)	(25.1581)
	[-1.44703]	[1.81380]	[-1.46235]	[-2.26628]	[-0.48380]	[1.21052]
R-squared	0.919413	0.637910	0.997981	0.909949	0.184992	0.844893
Adj. R-squared	0.905598	0.575838	0.997635	0.894512	0.045276	0.818303
Sum sq. resids	0.079391	343.0397	0.670629	1.212765	5574.304	275.3158
S.E. equation	0.047627	3.130676	0.138423	0.186146	12.62006	2.804669
F-statistic	66.55181	10.27686	2883.183	58.94471	1.324058	31.77512
Log likelihood	72.09639	-103.6991	27.28596	14.84468	-162.2487	-99.08065
Akaike AIC	-3.099828	5.271387	-0.965998	-0.373556	8.059464	5.051460
Schwarz SC	-2.810217	5.560999	-0.676386	-0.083945	8.349075	5.341071
Mean dependent	6.577778	25.00809	25.60468	2.621490	-1.309395	15.30424
S.D. dependent	0.155010	4.806978	2.846203	0.573128	12.91583	6.579729

Determinant resid covariance (dof adj.)	0.007616
Determinant resid covariance	0.002551
Log likelihood	-232.1726
Akaike information criterion	13.05584
Schwarz criterion	14.79351

Since we are considering only the GDPCAPITAL vector among the system of equations, we re-estimate the GDPCAPITAL equation as OLS. This gives the results in table 5.

Table 5: Results of the VAR Model

Dependent Variable: GDPCAPITAL
Method: Least Squares
Sample (adjusted): 1971 2012

Included observations: 42 after adjustments

GDPCAPITAL = C(1)*GDPCAPITAL(-1) + C(2)*CREDIT(-1) + C(3) *MONEY(-1) + C(4)*INVESTMENT(-1) + C(5)*INTEREST(-1) + C(6)*LENDING(-1) + C(7)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.196229	0.091539	13.06798	0.0000
C(2)	0.007017	0.002573	2.726802	0.0099
C(3)	0.022459	0.009241	2.430428	0.0203
C(4)	0.095071	0.031671	3.001810	0.0049
C(5)	-0.000695	0.000634	-1.096677	0.2803
C(6)	-0.000858	0.001880	-0.456351	0.6510
C(7)	-0.618192	0.427216	-1.447025	0.1568

R-squared	0.919413	Mean dependent var	6.577778
Adjusted R-squared	0.905598	S.D. dependent var	0.155010
S.E. of regression	0.047627	Akaike info criterion	-3.099828
Sum squared resid	0.079391	Schwarz criterion	-2.810217
Log likelihood	72.09639	Hannan-Quinn criter.	-2.993674
F-statistic	66.55181	Durbin-Watson stat	1.965401
Prob(F-statistic)	0.000000		

As shown in Table 5, at the threshold of 0.05 level of significance, CREDIT, MONEY and INVESTMENT have positive statistically significant impact on GDPCAPITAL. As well, LENDING and INTEREST have negative statistically insignificant impact on GDPCAPITAL. The coefficient of determination (R^2) which gives 0.919413 indicates that the model explains 92 percent of the variations in GDPCAPITAL. This shows a very good fit as only about 8% variation in GDP is left accounted for by the model. The Durbin-Watson statistic of 1.965401 is within the bounds of non-autocorrelation. The F-statistic is 66.55181. This value is significant at 1%, 5% and 10% because the calculated Prob(F-statistic) = 0.000000. With this, we reject the null hypothesis that all the explanatory variables introduced in the model are not jointly significant in explaining the variations in GDPCAPITAL and conclude that they are simultaneously significant.

5.5 Granger Causality

Granger causality is applied to check for the direction of causation. The results of Pairwise Granger Causality between GDPCAPITAL and CREDIT are contained in Table 6. The results

reveal the existence of a bi-directional causality which runs from GDPCAPITAL to CREDIT and from CREDIT to GDPCAPITAL.

Table 6: VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 1970 2012
Included observations: 42

Dependent variable: GDPCAPITAL

Excluded	Chi-sq	df	Prob.
CREDIT	7.435451	1	0.0064
MONEY	5.906978	1	0.0151
INVESTMENT	9.010861	1	0.0027
INTEREST	1.202700	1	0.2728
LENDING	0.208256	1	0.6481
All	15.24514	5	0.0094

Dependent variable: CREDIT

Excluded	Chi-sq	df	Prob.
GDPCAPITAL	6.534283	1	0.0106
MONEY	19.09500	1	0.0000
INVESTMENT	4.805352	1	0.0284
INTEREST	0.864269	1	0.3525
LENDING	0.038222	1	0.8450
All	33.97186	5	0.0000

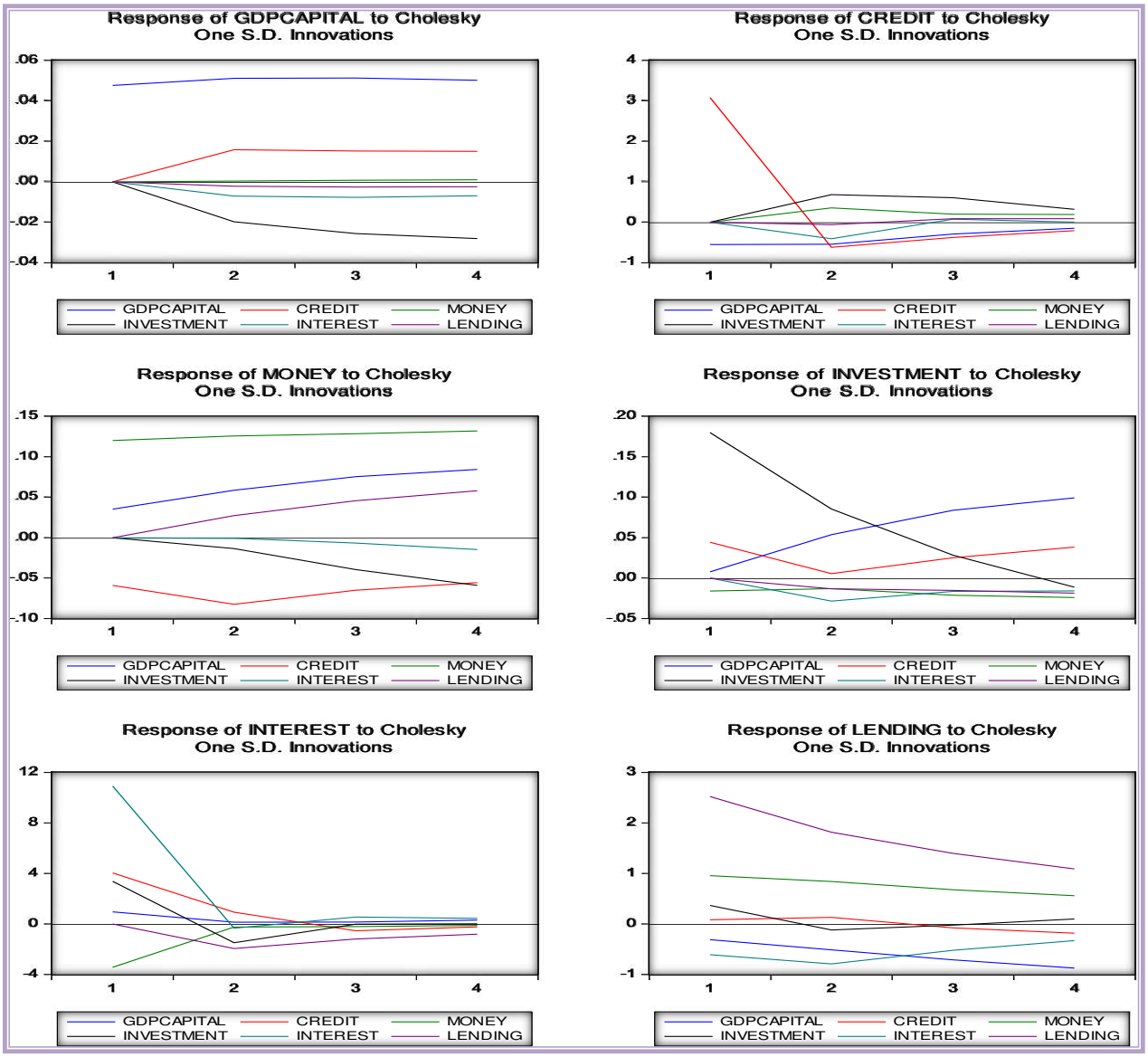
The null hypothesis that the variables are not significant in Granger-causing each other is rejected. The alternative hypothesis is accepted that the variables Granger-cause each other.

Our finding of bi-directional causality between GDPCAPITAL and CREDIT can be strengthened by the plots of 'Impulse Responses' and 'Variance Decomposition' as shown below.

5.6 Impulse Response Functions

The impulse response describes the reaction of the system as a function of time (or possibly as a function of some other independent variable that parameterizes the dynamic behavior of the system). The impulse response function for the variables is depicted in Table 6.

Table 7: Impulse Response Functions



It can be seen that a positive shock to CREDIT results in positive response of GDPCAPITAL. Conversely, a negative shock to GDPCAPITAL results in negative response of CREDIT. In fact,

variables exhibit evidence of a feedback causal-effect (bi-directional). This is in accordance with earlier conclusion of a bi-directional relationship between CREDIT and GDPCAPITAL.

5.7 Variance Decomposition

The variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables.

We employ a ten year forecasting time horizon and observed the relevance of the variables over time. However, only variance decomposition of GDPCAPITAL and CREDIT are shown.

Table 8: Variance Decomposition

Variance Decomposition of GDPCAPITAL: Period	S.E.	GDPCAPITAL	CREDIT	MONEY	INVESTMENT	INTEREST	LENDING
1	0.047627	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.074733	87.52240	4.508408	0.002524	6.991313	0.891686	0.083668
3	0.095771	82.03949	5.266476	0.008529	11.37484	1.187251	0.123422
4	0.112977	78.70974	5.562416	0.014669	14.35464	1.223932	0.134609
5	0.127259	76.41152	5.681972	0.025818	16.52819	1.217460	0.135043
6	0.139148	74.77106	5.703086	0.044261	18.15003	1.202070	0.129498
7	0.149084	73.56202	5.669559	0.071720	19.38884	1.187059	0.120804
8	0.157424	72.64322	5.604464	0.109573	20.35645	1.175185	0.111103
9	0.164457	71.92347	5.521047	0.158835	21.12765	1.166873	0.102126
10	0.170418	71.34188	5.427438	0.220208	21.75336	1.161810	0.095312
Variance Decomposition of CREDIT: Period	S.E.	GDPCAPITAL	CREDIT	MONEY	INVESTMENT	INTEREST	LENDING
1	3.130676	3.078353	96.92165	0.000000	0.000000	0.000000	0.000000
2	3.352511	5.306546	87.91570	1.130512	4.135801	1.478465	0.032971
3	3.447711	5.725337	84.30964	1.405246	7.016690	1.447556	0.095534
4	3.478246	5.805334	83.18828	1.684574	7.738618	1.422459	0.160730
5	3.492718	5.788616	82.70259	1.949214	7.910815	1.412446	0.236318
6	3.501648	5.759770	82.39855	2.196372	7.915958	1.408783	0.320567
7	3.509031	5.739417	82.12770	2.431100	7.884197	1.408042	0.409542
8	3.516181	5.727858	81.84919	2.656530	7.856795	1.408434	0.501193
9	3.523409	5.720941	81.55875	2.875021	7.841839	1.409140	0.594312
10	3.530715	5.714875	81.26174	3.088287	7.837104	1.409803	0.688196

Cholesky Ordering: GDPCAPITAL CREDIT MONEY INVESTMENT INTERESTN LENDING

Table 8 above gives the fraction of the forecast error variance for each variable that is attributed to its own innovation and to innovations in another variable. The own shocks of GDPCAPITAL constitute a significant source of variation in its forecast error in the time horizon, ranging from 100% to 71.3%. Ten years after, variation in GDPCAPITAL is accounted for by CREDIT (5.4%), MONEY (0.2%), INVESTMENT (21.7%), INTEREST(1.2%) and LENDING (0.1%) shock. It is clear that the predominant sources of variation in GDPCAPITAL are CREDIT and INVESTMENT. Similar explanations hold for the variations in growth in the other forecast periods.

6. Conclusion

This study gives empirical evidence on the nexus and the causality between domestic credit and economic growth in Nigeria using VAR and Granger Causality approach over the period 1970 - 2012. Firstly, the findings reveal that there is a bi-directional causality and positive relationship between domestic credit and the economic growth in Nigeria. That is, domestic credit does not only contribute positively to economic growth in Nigeria, but the impact is strong and statistically significant.

The fact that domestic credit does have positive significant relationship with economic growth reinforces the conclusion by earlier literature that an efficient financial system is one of the foundations for building sustained economic growth and an open, vibrant economic system.. Considering regulations, institutional constraints and other macro-economic factors militating against domestic credit in the economy, government should make the environment conducive and supportive so that performance is enhanced and good lending behaviour guaranteed. Banks need to start enforcing the most easily realizable policies as well as embrace good credit management. To further improve on their lending performance to the priority sectors of the economy, commercial banks should strategize on how to attract and retain more deposits. Closer consultation and cooperation between commercial banks and the regulatory authorities is necessary. This will enable the government to put into consideration the effect of regulatory measure on commercial banks at the stage of policy formulation.

With growing consumer spending power (not to mention a population of over 160 million), credit bureaus offer a unique opportunity to addressing the challenges of credit penetration and, by extension, financial sector deepening in Nigeria. To unlock this potential however, there needs to be in place an elaborate and robust country-wide identification system. A unique borrower's identity, the lack of which has hampered the effectiveness of the few licensed credit bureaus currently operating in the country, remains the foundation upon which a deep and robust credit and financial system can be built. If this is implemented, the entire lending environment will be dramatically transformed in a few years. Many more people will be granted access to credit, credit granting will be a lot more robust and scientifically based, and a lot more organizations will have much larger credit portfolios than they used to.

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APPENDIX

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 1970 2012
Included observations: 42

Component	Skewness	Chi-sq	df	Prob.
1	-0.971400	6.605323	1	0.0102
2	-4.000893	112.0500	1	0.0000
3	0.675115	3.190461	1	0.0741
4	-0.379173	1.006404	1	0.3158
5	-0.311197	0.677907	1	0.4103
6	0.040717	0.011605	1	0.9142
Joint		123.5417	6	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	5.594377	11.77888	1	0.0006
2	23.96910	769.4808	1	0.0000
3	2.721385	0.135846	1	0.7124
4	3.287188	0.144335	1	0.7040
5	3.001747	5.34E-06	1	0.9982
6	4.416682	3.512228	1	0.0609
Joint		785.0521	6	0.0000

Component	Jarque-Bera	df	Prob.
1	18.38421	2	0.0001
2	881.5308	2	0.0000
3	3.326307	2	0.1895
4	1.150739	2	0.5625
5	0.677912	2	0.7125
6	3.523833	2	0.1717
Joint	908.5938	12	0.0000

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 11/23/13 Time: 17:37
Sample: 1970 2012
Included observations: 42

Joint test:

Chi-sq	df	Prob.
280.3821	252	0.1058

OLS RESULT

Dependent Variable: GDPCAPITAL
Method: Least Squares
Date: 11/23/13 Time: 18:08
Sample: 1970 2012
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CREDIT	-0.011655	0.004299	-2.711342	0.0101
MONEY	0.085547	0.009424	9.077733	0.0000
INVESTMENT	0.228372	0.044240	5.162092	0.0000
LENDING	-0.006031	0.003298	-1.828560	0.0755
INTEREST	-0.000104	0.001159	-0.089707	0.9290
C	4.173831	0.301764	13.83144	0.0000

R-squared	0.717895	Mean dependent var	6.575052
Adjusted R-squared	0.679773	S.D. dependent var	0.154194
S.E. of regression	0.087256	Akaike info criterion	-1.911151
Sum squared resid	0.281704	Schwarz criterion	-1.665402
Log likelihood	47.08974	Hannan-Quinn criter.	-1.820526
F-statistic	18.83139	Durbin-Watson stat	0.598057

Prob(F-statistic)	0.000000

OLS RESULT

Dependent Variable: GDPCAPITAL
Method: Least Squares
Date: 11/23/13 Time: 18:41
Sample (adjusted): 1971 2012
Included observations: 42 after adjustments
Convergence achieved after 11 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.207812	1.278289	3.291753	0.0023
CREDIT	-0.004878	0.001741	-2.801029	0.0082
MONEY	0.088662	0.041599	2.131353	0.0402
INVESTMENT	0.048836	0.040401	1.208790	0.2348
LENDING	-0.001191	0.002692	-0.442487	0.6609
INTEREST	0.000790	0.000497	1.590142	0.1208
AR(1)	0.942034	0.051080	18.44234	0.0000

R-squared	0.920030	Mean dependent var	6.577778
Adjusted R-squared	0.906321	S.D. dependent var	0.155010
S.E. of regression	0.047444	Akaike info criterion	-3.107524
Sum squared resid	0.078782	Schwarz criterion	-2.817913
Log likelihood	72.25801	Hannan-Quinn criter.	-3.001370
F-statistic	67.11103	Durbin-Watson stat	1.464832
Prob(F-statistic)	0.000000		

Inverted AR Roots	.94