

MULTIVARIATE CAUSALITY BETWEEN FINANCIAL DEPTH AND ECONOMIC GROWTH IN NIGERIA

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Abstract

The study adopts the multivariate VECM to investigate the causality between financial depth and economic growth in Nigeria from 1971 to 2008. The results suggest that financial depth and economic growth have a stable long-run relationship. The study supports the demand-following hypothesis for the banking sector's private sector credit and real broad money supply; while it supports the supply-leading hypothesis for loan deposit ratio and bank deposit liabilities. The major finding is that the financial depth indicator used has great influence on the causal inference. This result validates Agu and Chukwu (2008) which employed the Toda and Yamamoto (1995) causality testing approach.

JEL Classification: 011, 057.

Keywords: financial depth, economic growth, multivariate causality.

1. INTRODUCTION

Economic literature defines financial sector development as the improvement in quantity, quality and efficiency of financial intermediary services (Calderon and Liu, 2002). Financial sector development affects real growth of output in different ways: the volume of investment increases, and next to improve is the volume of savings (Goldsmith 1969; Bencivega and Smith, 1991). In recent times, finance-economic growth nexus has been attracted global attention especially in emerging and developing economies. There is still divergence in views regarding the role of financial intermedi-

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aries in facilitating sustainable economic growth in the long-term since Schumpeter (1911, 1934), Patrick (1966), Goldsmith (1969), Mckinnon (1973) and Shaw (1973).

The general belief in the literature is that developed, sound and functioning financial systems facilitate sustainable economic growth. This conforms to the reasoning of new endogenous growth theorists. The causal relationship between financial depth and economic growth remains controversial and unclear despite the fact that it has been investigated intensely in economic literature. Arguably, this divergence might emanate from alternative estimation techniques and data. In particular, results seem to be greatly determined by the choice of financial depth indicators. The policy relevance of this study is not in doubt given that the Central Bank of Nigeria recently launched the financial systems strategy (FSS) 2020 geared towards facilitating long-term growth of the Nigerian economy in general, and real sector development in particular.

The context, motivation and justification for this study derive from the diverging views of existing studies. First, Gurley and Shaw (1955), Goldsmith (1969), Mckinnon (1973) and Shaw (1973) and Levine and Zervos (1996) argue that financial systems do not promote economic growth, but rather respond to real sector development. Second, Jung (1986); and Levine, Loayza and Beck (1999) posit that financial development causes economic growth in less developed economies, while economic growth causes financial development in developed economies. Furthermore, King and Levine (1993a,b), Arestis and Demetriades (1997), Rosseau and Watchel (1998), Levine and Zervos (1998), Levine et al, (2000), Bell and Rosseau (2001) all diverge in views vis-à-vis the causality direction.

The recent development in establishing empirical evidence for finance-growth nexus is to use either cross-sectional or panel data techniques for a number of countries. These studies include Luintel and Khan (1999), Demetriades and Hussein (1996), Rubini and Sala-i-Martin (1992), and Jung (1986). An alternative way is country specific investigation of the causal hypothesis using time series technique like Guryay et al (2007) for North Cyprus, Agung and Ford (1998); Lyon and Murinde (1994) for Ghana, Murinde and Eng (1994) for Singapore, Wood (1993) for Barbados, Odedokun (1989) for Nigeria, Adam (1998) for Nigeria, and Agu and Chukwu (2008) for Nigeria.

This study empirically explores the causal relationship between financial depth and economic growth in Nigeria. Few empirical studies exist for Nigeria, namely Odedokun (1989), Adam (1998), Azege (2004), Agu and Chukwu (2008). With the exception of Agu and Chukwu (2008), the rest used only a single measure of financial deepening instead of considering alternative fi-

financial deepening variables. Also, they did not employ a multivariate cointegration and vector error correction model (VECM) approach by Johansen (1988, 1992) and Johansen and Juselius (1990) in ascertaining the direction of causality between financial deepening and economic growth. Specifically, Azege (2004) used aggregate credit to the economy which included credits to the public sector instead of focusing on bank credits to the private sector. These are the gaps that this study intends to fill. The specific objective of this study is to investigate whether the causality direction between financial depth and economic growth in Nigeria is sensitive to the choice of proxy used as financial depth. This paper is structured as follows: section 2 reviews the theoretical framework; section 3 reviews the empirical literature, section 4 describes data and methodology; section 5 discusses empirical results; and section 6 concludes.

2. THEORETICAL FRAMEWORK

The Mckinnon (1973) and Shaw (1973) financial development framework is the main underlying theory behind the study. The argument here is that financial repression decreases the real rate of growth and the real size of the financial sector relative to non-financial magnitudes. Economic theory postulates that financial liberalization facilitates financial sector development, while financial repression by way of government regulated restrictions and price distortions on the financial system retards financial sector development. Other obstacles to financial sector development are political constraints on the economy; government ownership of banks; weak legal framework and so on. The theoretical argument for linking economic growth with financial development is that a well developed and functional financial system performs crucial roles in enhancing the efficiency of financial intermediation by minimizing transactions and information costs as well as pool risks. A modern financial system mobilizes savings from the surplus sector of the economy and promotes investment by granting massive credits to the deficit sector of the economy. The basic questions to ask are: (i) what hinders financial sector development? (ii) what leads to financial sector development?

Most of the literature focuses on two main competing and diverging theoretical paradigms, namely the supply-leading hypothesis and demand-following hypothesis in line with Patrick (1966) which postulates a feed back relationship between economic growth and financial depth. Firstly, the 'supply-leading' hypothesis posits a unidirectional causation that runs from fi-

financial depth to economic growth, implying that new functional financial markets and institutions will increase the supply of financial services, and thus leads to real economic growth. This hypothesis performs two roles, namely to transfer resources from low marginal productivity sectors to high marginal productivity sectors, and to promote entrepreneurial response in the high marginal productivity sectors. Calderon and Liu (2002), King and Levine (1993a, b); Neusser and Kugler (1998) and Levine, Beck and Loayza (2000) all support the supply-leading hypothesis. Secondly, the 'demand-following' hypothesis posits a unidirectional causation from economic growth to financial development. This implies a passive response from the financial system to economic growth, suggesting that the increasing demand for financial services might lead to financial system expansion as the real sector of the economy grows. Studies that support this hypothesis include Gurley and Shaw (1955, 1967), Goldsmith (1969) and Jung (1986). In addition to the two extreme and diverging view points, Patrick (1966) suggests a third hypothesis known as the **stage of development hypothesis** which posits that the supply-leading financial development can induce real investment in the early stages of economic development. However, as the sustained economic development gets underway, the supply-leading impact becomes less and less important as the demand-following response takes over and becomes dominant.

3. EMPIRICAL EVIDENCE

The Nigerian evidence seem to be mixed, albeit specifically: Agu and Chukwu (2008), which employed the Toda and Yamamoto (1995) causality test concluded that the choice of proxy for financial depth influences the causal outcome. However, earlier studies like Azege (2004) and Adam (1998) seem to only to agree that a well functioning financial system facilitates economic growth. Adams (1998) employed the 2SLS method to show that the financial intermediation process is sub-optimal and caused by a high lending rate, high inflation rate, low per capita income, and inadequate bank branches. Azege (2004) employed data on aggregate deposit money bank credit over time and gross domestic product to establish that a moderate positive relationship exists between financial deepening and economic growth.

Unalmis (2002) investigates the direction of the causality between financial depth and economic growth in Turkey using Granger non-causality in the context of VEC model. Annual data from 1970 to 2001 were used. The study finds that in the short run, except for one of the proxies used, causality

runs from financial development to economic growth in the short-run. The study also finds that in the long run there exists bidirectional causality between financial deepening and economic growth.

Kar and Pentecost (2000) examines the causal relationship between financial development and economic growth in Turkey. The study developed five alternative proxies for financial deepening. The Granger causality tests were employed using the cointegration and vector error correction methodology developed by Johansen (1988) and Johansen and Juselius (1990). Their results show that the direction of causality between financial development and growth is highly sensitive to the choice of proxy used for financial development. They conclude that economic growth seems to lead financial sector development in Turkey.

Wadud (2005) examines long-run causal relationship between financial development and economic growth for 3 South Asian countries namely India, Pakistan and Bangladesh. He disaggregated financial system into "bank-based" and "capital market" based categories. The study conducted cointegrated vector autoregressive modeling to assess the long-run relationship between financial development and economic growth. The study concludes that the results of error correction models indicate Granger causality between financial development and economic growth running from financial development to economic growth.

Calderon and Liu (2002) examines the direction of causality between financial development and economic growth by using the Geweke (1982) decomposition test on pooled data of 109 developing and industrial countries from 1960 to 1994. The study finds that financial development generally leads to economic growth; the Granger causality from financial development to economic growth and the Granger causality from economic growth to financial development coexist. The study concludes that financial deepening contributes more to the causal relationships in developing countries than in industrial countries.

Hondroyannis et al (2004) empirically assesses the relationship between the development of the banking system and stock market and economic performance for the case of Greece over the period 1986-1999. Using VAR model, the empirical results show that a bi-directional causality exists between finance and growth in the long-run. The empirical findings, using error correction models suggest that both bank and stock market financing can promote economic growth.

Ndebbio (2004) investigates financial deepening, economic growth and development for Sub-Saharan African countries. The study employed two financial deepening variables namely the degree of financial intermediation

measured by M2 as ratio to GDP, and the growth rate of per capita real money balances. The study finds that a developed financial sector spurs overall growth of an economy.

Guryay et al (2007) empirically examines the relationship between financial development and economic growth. The study employed the Ordinary Least Squares technique to show that financial development has an insignificant positive effect on economic growth for Northern Cyprus. They conclude that causality runs from economic growth to financial development, without feedback.

Mohammed and Sidiropoulos (2006) investigate the effect of financial development on economic performance in Sudan from 1970 to 2004. The study estimated the short-run and long-run relationship between financial development and economic growth and other conditioning variables on economic growth using the autoregressive distributed lag (ARDL) model to co-integration analysis proposed by Pesaran and Shin (1999). Their results indicate a weak relationship between financial development and economic growth in Sudan due to the inefficient allocation of resources by banks, along with the absence of an appropriate investment climate required to foster significant private investment and promote growth in the long run, and to the poor quality of credit disbursal of the banking sector in Sudan.

Odiambho (2004) investigates the role of financial development on economic growth in South Africa. The study uses three proxies of financial development namely the ratio of M2 to GDP, the ratio of currency to narrow money and the ratio of bank claims on the private sector to GDP against economic growth proxied by real GDP per capita. He employed the Johansen and Juselius cointegration approach and vector error correction model to empirically reveal overwhelming demand-following response between financial development and economic growth. The study totally rejects the supply-leading hypothesis. However, Odiambho (2005) replicated this study for Tanzania and found the contrary result. He used the same model to empirically reveal a bi-directional causality between financial development and economic growth.

Waqabaca (2004) examines the causal relationship between financial development and growth in Fiji using time series data from 1970 to 2000. The study employed unit root test and cointegration technique within a bivariate VAR framework. Empirical results reveal a positive relationship between financial development and economic growth for Fiji, with the direction of causality running from economic growth to financial development. He posits that this outcome is consistent with results found for countries with less sophisticated financial systems.

4. DATA AND METHODOLOGY

Annual data from 1971 to 2008 sourced from the Central Bank of Nigeria Statistical Bulletin (50th Anniversary Edition) were employed. The macroeconomic variables included in the model are per capita income which proxies economic growth. This was computed by dividing the GDP with population figures (PCI), while the proxies for financial depth are the ratio of bank sector's credit to private sector to GDP (PSC), the ratio of broad money to GDP (M2Y), the ratio of bank deposit liabilities to GDP (BDL) and the loan deposit ratio (LDR). All the variables are seasonally unadjusted and are not in logarithmic form.

We first examine the time series properties of model variables using the Augmented Dickey-Fuller (ADF) test in a regression equation with a drift but no trend.

The estimated equations for the ADF test are:

$$\Delta PCI_t = \alpha_0 + \alpha_t PCI_{t-1} + \sum_{t=1}^k aiDP_{t-1} + \varepsilon_t \quad [1]$$

$$\Delta M2Y_t = \beta_0 + \beta_t M2Y_{t-1} + \sum_{t=1}^k biDM_{t-1} + \varepsilon_t \quad [2]$$

$$\Delta PSC_t = \lambda_0 + \lambda_t PSC_{t-1} + \sum_{t=1}^k ciDP_{t-1} + \varepsilon_t \quad [3]$$

$$\Delta BDL_t = \omega_0 + \omega_t BDL_{t-1} + \sum_{t=1}^k diDBDL_{t-1} + \varepsilon_t \quad [4]$$

$$\Delta LDR_t = \nu_0 + \nu_t LDR_{t-1} + \sum_{t=1}^k eiDLDR_{t-1} + \varepsilon_t \quad [5]$$

Where Δ is the first difference operator, ε_t is the error term which is iid~N(0, s_{ii}^2). The null hypothesis is that unit root exists, that is, $\alpha_1 = \beta_1 = \lambda_1 = \omega_1 = \nu_1 = 1$ against the alternative hypothesis that there exists no unit root i.e. $\alpha_1 \neq \beta_1 \neq \lambda_1 \neq \omega_1 \neq \nu_1 < 1$.

To determine whether there exists a long run relationship between financial development and economic growth, we employ the multivariate Jo-

hansen approach (Johansen 1988, 1992) and (Johansen and Juselius, 1990) cointegration procedure in line with Kar and Pentecost (2000). The Johansen approach utilizes two statistic tests namely: the trace test and the maximal eigenvalue test. First, the likelihood Ratio (LR) test based on the trace statistics (λ trace) which tests the $H_0 : r \leq q$ against the $H_1 : q = r$ is calculated thus:

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^p \ln(1 - \hat{\lambda}_i) \quad [6]$$

where $\lambda_{r+1}, \dots, \lambda_n$ are the least value eigenvectors ($p-r$).

The second test is the maximal eigenvalue test (λ_{max}) which tests the H_0 : there are r -cointegrating vectors against the H_1 : there are $r + 1$ cointegrating vectors and is calculated thus:

$$\lambda_{\text{max}}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad [7]$$

The relationship between financial deepening and economic growth can be represented in a dynamic vector – error correction model (VECM) framework thus:

$$\begin{aligned} \Delta pci_t = & \alpha_0 + a_1 \sum_{i=1}^P Dp ci_{t-1} + a_2 \sum_{i=1}^P Dm2y_{t-1} + a_3 \sum_{i=1}^P Dpsc_{t-1} \\ & + a_4 \sum_{i=1}^P Dbdl_{t-1} + a_5 \sum_{i=1}^P Dldr_{t-1} + a_5 ecm_{t-1} + \varepsilon_{1t} \end{aligned} \quad [8]$$

$$\begin{aligned} \Delta m2y_t = & \alpha_0 + a_1 \sum_{i=1}^P Dp ci_{t-1} + a_2 \sum_{i=1}^P Dm2y_{t-1} + a_3 \sum_{i=1}^P Dpsc_{t-1} \\ & + a_4 \sum_{i=1}^P Dbdl_{t-1} + a_5 \sum_{i=1}^P Dldr_{t-1} + a_5 ecm_{t-1} + \varepsilon_{1t} \end{aligned} \quad [9]$$

$$\begin{aligned} \Delta psc_t = & \alpha_0 + a_1 \sum_{i=1}^P Dp ci_{t-1} + a_2 \sum_{i=1}^P Dm2y_{t-1} + a_3 \sum_{i=1}^P Dpsc_{t-1} \\ & + a_4 \sum_{i=1}^P Dbdl_{t-1} + a_5 \sum_{i=1}^P Dldr_{t-1} + a_5 ecm_{t-1} + \varepsilon_{1t} \end{aligned} \quad [10]$$

$$\begin{aligned} \Delta bdl_t = & \alpha_0 + a_1 \sum_{i=1}^P Dpci_{t-1} + a_2 \sum_{i=1}^P Dm2y_{t-1} + a_3 \sum_{i=1}^P Dpsc_{t-1} \\ & + a_4 \sum_{i=1}^P Dbdl_{t-1} + a_5 \sum_{i=1}^P Dldr_{t-1} + a_5 ecm_{t-1} + \varepsilon_{1t} \end{aligned} \quad [11]$$

$$\begin{aligned} \Delta ldr_t = & \alpha_0 + a_1 \sum_{i=1}^P Dpci_{t-1} + a_2 \sum_{i=1}^P Dm2y_{t-1} + a_3 \sum_{i=1}^P Dpsc_{t-1} \\ & + a_4 \sum_{i=1}^P Dbdl_{t-1} + a_5 \sum_{i=1}^P Dldr_{t-1} + a_5 ecm_{t-1} + \varepsilon_{1t} \end{aligned} \quad [12]$$

where ε_t 's are iid errors that are $N(0, \sigma^2)$ and ECM's are the error correction terms (which capture the speed of convergence back to steady state). VECM specifications restrict the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics (Unalmis, 2002).

5. EMPIRICAL RESULTS

The result of the unit root test shows that economic growth proxied by per capita income (PCI) and financial development variables, namely bank credit to private sector as ratio to GDP (PSC), M2 as ratio to GDP (M2Y), loan deposit ratio (LDR) and ratio of bank deposit liabilities to GDP (BDL) exhibited mean reversion after first difference in an Augmented Dickey-Fuller test, with a lag length of six and with a drift but no trend. At 1%, 5% and 10%, the null hypothesis of unit root is rejected for all model variables.

In order to investigate the causal relationship between economic growth and financial depth in a multivariate framework, a long run relationship between economic growth and financial development variable is established using the Johansen multivariate cointegration approach proposed by Johansen (1988, 1992); and Johansen and Juselius (1990). The results of the Johansen multivariate cointegration test are shown in table 2 below.

Table 1: ADF Unit Root Test Result (1st Difference)

Model Variable	ADF statistic	critical value
DPer Capita Income (DPCI)	-6.75	1% -3.69 5% -2.97
DPrivate Sector Credit (DPSC)	-5.28	1% -3.64 5% -2.95
DBroad Money Supply (DM2Y)	-6.84	1% -3.63 5% -2.95
DLoan Deposit Ratio (DLDR)	-5.78	1% -3.63 5% -2.95
DBank Deposit Liabilities (DBDL)	-4.26	1% -3.63 5% -2.95

* Mckinnon critical values for rejection of hypothesis of a unit root

Table 2(a) Unrestricted Cointegration Rank Test (Trace Test)

Null	Alternative	Trace Statistic	5% Critical Value
$r = 0$	$r = 1$	74.08	67.93
$r < = 1$	$r = 2$	35.18	44.82

Table 2 (b) Unrestricted Cointegration Rank Test (Maximal Eigenvalue Test)

Null	Alternative	Maximum Eigenvalue Test	5% Critical Value
$r = 0$	$r = 1$	45.96	33.84
$r < = 1$	$r = 2$	16.09	28.52

Note: r indicates the number of cointegrating vectors.

The trace test result in table 2(a) above suggests one cointegrating equation at the 0.05 level of significance thus confirms the rejection of the null hypothesis of no cointegrating vectors. The maximal eigenvalue test result in table 2(b) suggests one cointegrating equation at the 0.05 level of significance thus confirms the rejection of the null hypothesis of no cointegrating vectors. The results above are based on the assumptions of linear deterministic trend and lag interval in first difference of 1 to 1. Overall, the Johansen cointegration test suggests that there exists a cointegration relationship between eco-

economic growth proxied by PCI and financial development variables proxied by PSC, M2Y, LDR and BDL. Hence, the long-run relationship between economic growth and financial development is found to be positive in each cointegrating vector.

The result of the pairwise Granger causality test between economic growth and each of the “bank-based” financial development variables based on Snedecor’s F-Statistic at lag length 6 is shown in table 3 below:

Table 3 Multivariate Causality Test

Null Hypothesis:	Decision	F-Statistic	Probability
PSC does not Granger Cause PCI	Accept	0.82640	0.55411
PCI does not Granger Cause PSC	Reject	3.97735	0.06705
M2Y does not Granger Cause PCI	Accept	0.63422	0.70568
PCI does not Granger Cause M2Y	Reject	4.34403	0.00881
LDR does not Granger Cause PCI	Reject	2.34927	0.07267
PCI does not Granger Cause LDR	Accept	0.35342	0.95109
BDL does not Granger Cause PCI	Reject	3.34228	0.02223
PCI does not Granger Cause BDL	Accept	1.17529	0.37729

The pairwise multivariate Granger causality test suggests that economic growth is proxied by per capita income (PCI). Granger causes financial development (PSC) without a feedback. Also, economic growth Granger causes financial development (M2Y) without a feedback. These two outcomes suggest growth led “bank-based” financial sector development. This result contradicts Jung (1986) and Levine et al (1999) which posit that growth causes financial development in developed countries. It further supports, however, the findings of Kar and Pentecost (2000) for Turkey and Waqabaca (2004) for Fiji, which posit that economic growth seems to lead financial sector development. Furthermore, financial development proxied by loan deposit ratio (LDR) Granger causes economic growth without a feedback. Also, financial depth proxied by bank deposit liabilities (BDL) Granger causes economic growth without a feedback, thus suggesting financial depth led growth.

6. CONCLUSION AND POLICY IMPLICATIONS

The results imply that financial depth and economic growth are positively cointegrated, and that there is only one cointegrating vector, indicating a stable long-run relationship between financial depth and economic growth.

The results also suggest that there is a unidirectional causality between financial depth and economic growth, running from economic growth to financial depth (for private sector credit and broad money). This suggests that higher economic growth would lead to financial development. Besides, unidirectional causality exists between financial depth and economic growth, running from financial depth (for loan deposit ratio and bank deposit liabilities) to economic growth. This suggests that higher financial sector development would lead to economic growth in Nigeria. Thus, the performance of financial intermediaries influences real sector as well as real economic activity. Recent developments vis-à-vis aggressive banking sector reforms have shown that a healthy banking system contributes to economic growth. This is the main rationale behind the Central Bank of Nigeria's aggressive plans to sustain the improvements in the banking sector and the economy at large with the financial systems strategy (FSS) 2020 framework.

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Résumé

La présente étude utilise le modèle de Johansen et Juselius (1990) et Juselius (1988, 1992) et adopte VECM pour comprendre le lien de causalité entre la profondeur financière et la croissance économique du Nigéria de 1971 à 2008. Les résultats suggèrent que la profondeur financière et la croissance économique ont une relation stable à long terme. L'étude soutient l'hypothèse demand-following en fonction de macro-variables liées au secteur bancaire qui concernent le crédit au secteur privé et de l'offre de monnaie au sens large, tout en soutenant l'hypothèse supply-leading sur la base d'autres variables (loan deposit ratio et bank deposit liabilities). Les résultats indiquent que l'indicateur de la profondeur financière influence le rapport de causalité et le résultat confirme l'étude de Agu et Chukwu (2008) qui emploie l'approche de causality testing de Toda et Yamamoto (1995).

Mots clés: profondeur économique, croissance économique, causalité multivariée.

