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Interaction Between Real And Financial Sectors In Nigeria: A Causality Test

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Abstract

This study investigates the interrelationship between industrial productivity and money supply as proxies for the real and financial sectors by testing for causality under a Vector Auto-Regression (VAR) structure. In the study, it was revealed that Nigeria over the 35-year period between 1970 and 2005 like many other LDC's has a unidirectional causality running from the financial sector to the real sector growth. This indicates that the country still operates in the short-run and to take advantage of long-run changes, such variables as technology and factor productivity should to be taken into cognizance.

Keywords: Industrial Productivity; Money Supply; Vector Auto-Regression; Causality.

1.1 Introduction

Nigeria like every other economy in the world seeks to maximise her macro-economic objectives by introducing appropriate policies to channel her economy in the path of growth and stability. Prominent among the issues of concern are industrialisation and the bid to tackle inflation and hence the control of money supply. The industrial sector has always been recognized as the main sector to speed up the rate of development such that in Rostow's (1960) theory of economic development, also known as the stage theory. He recognised the industrial sector as the leading sector to economic development path calling it the "core sector", to lead the economy to development in the "take-off" stage while citing Britain's leading sector in her take-off period as the cotton textile industry. Thus, the state of industrialisation or development consist of having accumulated established efficient and economic mechanism for maintaining and increasing large stock of capital per head in the various firms, similarly, the condition of underdevelopment is characterised by possession of

relatively small stack of various kinds of capital (Chete, 1995). Monetary authorities on another hand seek to control the amount of money in circulation and, hence, money supply, since it is exogenously determined, it is generally accepted in the quantity theory of money that if there is an increase in money supply, the price level would raise, if however some resources were idle the output could increase, as classified into three categories: factors that give rise to productivity of existing factors; an increase in the available stock of factors of productivity; and technological change.

In recent years, Nigeria like other less-developed nations has been experiencing substantial slack in the use of her productive potential such that output/growth had remained disquietingly low. In order to redress this undesirable state of affairs, Nigeria has been and particularly under the Structural Adjustment Programme (SAP), using and emphasising monetary policy, this is in line with the financial literature made popular by Mackinnon (1973) and Shaw (1973), which suggest that financial liberalisation is what is needed to release the finance necessary to promote growth. Unfortunately, the proceeding economic problem persists and even in some cases seemingly worsened. In the light of this development, public confidence in the ability of government to manage the economy has waned and belief in the likelihood of continuing economic growth weakened. In effect, questions are being raised as to the effectiveness of monetary policies adopted by government over these years. The need however arises to understand the direction of the relationship between finance and growth as was highlighted by Patrick (1960) when he posed the question, "Is it financial sector or the real sector that leads to other?"

The deregulation of the financial sector under the SAP which gave way to liberal interest rates and licensing of banks together with the recent recapitalisation process which left in its trail the emergence of 25 mega banks and other non-bank financial institutions show a belief in the "supply leading hypothesis". Reversal of deregulation in January 1994 with return to what the government called "managed deregulation", that is, administratively determined interest rate and a halt to liberal bank licensing could suggest a weakening in earlier belief. Could that reflect a belief in the "demand following hypothesis"? This study intends to use data for Nigerian economy to establish the direction of relationship between industrial productivity and money supply in Nigeria and verify previous studies from other countries.

This paper is concerned with investigating the interrelationship between industrial productivity and money supply using Nigerian data and it is organised in this sequence. What follows this introductory section is the literature review, section three reviews industrial productivity and money supply in Nigeria. Section four discusses the estimation techniques and model specification while section five discusses the result of data analysis and section six concludes.

2.1 Literature Review

In a bid to raise the standard of living and quality of life of her people, the primary focus of economic management, particularly in developing countries, becomes effective economics development transformation. According to Todaro (1971), "raising people's living levels so much so that their incomes and consumption levels of food, medical services, education, utilities and social services expand through relevant economic growth process is the focus of economic management." In other words, therefore, to expedite the pace of the process of this attainment, He proposes the need for government to provide for the prevalence of some socio-economic transformation conditions which involve "increasing people's freedom to choose by enlarging the range of their choice variables, for example, increasing the varieties of consumer goods and services of reasonable costs." This view presupposes increased industrial productivity which is generally accepted by economic planners, researchers, policy makers irrespective of their desirable means of raising the standard of living of the populace. In a supportive mood, Lewis (1967) opined that "in any economy one or more sectors serve

as a prime mover, driving the rest of the economy forward. This role of "engine of growth" or leading sector has usually been played by the industrial sector under the industrialization process". Though small in relative sizes as compared to GDP, especially in developing countries, nonetheless, the industrial sector is seen as potential leading sector with latent resources and expansions that could pull u the rest of the economy through backward and forward linkages. Therefore, it is considered as a leading paradigm grossly because of its dynamism in technological transmission and organisational stimuli.

However, the economic regulatory approach under which industrialisation strategies were adopted in Nigeria up to the mid-1980s did not yield any remarkable result the near total collapse of the global crude oil prices in the early 1980's and the subsequent economic crisis that followed it coupled with some internal factors such as economic mismanagement of natural resources, resulted in accumulation of huge external and internal debts, chronic budget deficits with the attendant inflationary pressures and resources economic declines in all its ramifications as well as high unemployment rates. These created some transformation challenges which prompted Nigeria to adopt the World Bank/IMF endorsed Structural Adjustment Programme (SAP) in July 1986, in order to among several objectives: achieve fiscal and balance of payment viability; evolve a private sector-led economic development process; lessen the dominance of unproductive investments; and restructure and diversify the productive base of the economy (Philips, 1987).

Towards these ends, there was a reversal of Nigeria development approach from economic regulation to economic deregulation and liberalisation-relying on market forces to allocate available resources. Within this new paradigm are such policies as: adoption of appropriate pricing policies for products; adoption of measure to stimulate production and broaden the supply base of the economy; deregulation and greater reliance on market forces; rationalisation and privatisation of public enterprises; strengthening of existing demand management policies; trade and payment mobilization; tariff reform and rationalisation to promote industrial diversification (Philips, 1987). According to Ajakaiye and Ayodele (2001), in spite of these elaborate strategies which would have favoured effective industrialisation process in an economically conducive environment, most of the results were socio-economically undesirable. This is not unconnected with some SAP associated development problems such as chronic budget deficit, huge external debt burden and serious economic decline." Against the background of this disappointment, Nigeria's Vision 2010 Report (1998) aims at creating a stable macroeconomic environment that will provide a conducive atmosphere for dynamic, long-term self-sustaining growth and development within the sustainable economic development paradigm as proposed in the 1980 Lagos Plan of Action. Towards this and economic planning and policy instruments seem to be currently directed at the development of the key productive sectors of the economy such as agriculture, industry and particularly manufacturing and commerce for the promotion of the pace of industrialisation in Nigeria. In this regard, there is an urgent need for policy instruments to be properly focused on energising the past executed industrial transformation process in the country.

3.1 Nigeria in Perspective

Before the discovery of crude oil in commercial quantity in Nigeria, the country was grossly dependent on the proceeds of agricultural (primary) products for foreign exchange. However, at independence, the government saw need for import-substitution and thus reduce the level of reliance on the external sector for the supplies of manufactured products and equipment. In essence, through the lure of incentives foreign investors were technically and strategically invited to champion Nigeria's industrialisation because of the scarcity of investible funds in the country. The incentives adopted by the government were broadly classified into five (5) groups which are: effective protection with import tariff; export-promotion of products produced in Nigeria; fiscal measures of taxation and interest rates to make for cheap

production costs; foreign currency facility for international trade; and the evolution of development banks for resource mobilization. However, by '72/'73, oil price had a consistent increase from $2pb to close at $40pb and crude oil production to 2.5mpd in 1980 signifying an increase of about $76million per day in the nation's capacity to spend, which of course, gave rise to the declining emphasises on agricultural sector and thus, the reduction in her contribution to total GDP from 65% in 1960s to 20% in the late 1970s.

In the early 1970s, the manufacturing sector had depended mainly on the external sector for foreign exchange to purchase equipment, spare parts and intermediate input and there was phenomena increase in the performance of the sector in the mid-1970s and 1980s occasioned principally by the massive inflow of foreign exchange from crude oil sales. However, the near total collapse of the economy's driving force (crude oil prices) which started in 1981 reversed the phenomena increase in the performance of the manufacturing sector in Nigeria. As from 1975, the sector witnessed a persistent decline due to discovery and subsequent reliance on crude oil. For example, the manufacturing sector grew at 4.8percent in 1960s, this rose to 7.2percent in 1970s but declined in 1975 and 1980 to 5.6 and 5.4percent respectively and further rose again in 1985 at about 10.5% before it entered into a period of steady decline (Ajakaiye and Ayodele, 2001). The decline in this performance can rightly according to them be attributed to three major factors, which are: a weak demand due to the sharp fall in real income arising from the economic recession and high product prices; low export market production due to poor quality control and the high cost of production due to the high cost of imported inputs; and the sector's dependence on the external sector for the supply of inputs. In recent years, manufacturing as a percentage of GDP has declined to as low as 2% (CBN, 2005).

4.1 Method of Analysis

This study employs the econometric technique of Co-integration and Vector Auto Regression (VAR) which most analysts have found to be very adequate for handling economic data especially for less developed countries LDC's like Nigeria. Core to the values of this analysis is the examination of the variables in the econometric model for stationarity. Basically, the idea is to ascertain the order of integration of the variables and the number of time the variables have to be differentiated to arrive at stationarity. This enables us to avoid the problems of spuriousity on inconsistent regression that are associated with non-stationary time series models; particularly, ordinary least square (OLS) (Engel and Yoo, 1987). The traditional econometric method only assumes stationary data around a deterministic trend by including a time trend in the regression equation. It is however known that many economic variables have tendencies to trend through time, so that the level of these variables can be characterised as non-stationary. The independent variable cannot act significantly on the dependent variables individually but collectively, the relationship between the dependent and independent variables acting collectively may be insignificant. This problem is generated due to the fact that the data has not been tested to confirm its satisfaction of the condition for OLS lists and needs to be resolved. The mean variance computed from variable that have series that are stationary will be unbiased estimates of the unknown population mean and variance (Eguwaikhide, 1999). However, economic variables that are non-stationary series in a regression equation would generate estimates that are biased.

4.2 Causality (VAR)

Since the objective of the study includes examining the direction of relation between industrial productivity index (Indpx) and money supply (Ms). The co-integration says nothing about the direction of the causal relationship between the two variables are co-integrated, it follows that there must be causality in at least one direction. In this study, VAR causality test

was employed to examine the causal linkage between industrial productivity and money supply.

Granger (1969) test regresses a variable Y. If X is significant; it means that it explains some of the variance of Y that is not explained by lagged values of Y itself. This indicates that X is causally prior to Y and is said to dynamically cause or Granger cause Y cases of unilateral, bilateral and independent causalities are explained in chapter one of this work and therefore are not repeated in this chapter. However, when two variables are both co-integrated, the joint process as indicated in Engel and Granger (1987) and restated by Keke, Olomola and Saibu (2005) can be written in the error-correction mechanism from given by:

$$\Delta_t Y_t = b_t ECM_{t-1} + \sum_{i=1}^{n} b_2 AY_{t-1} + \sum_{i=1}^{n} b_3 \Delta X_{t-1} + \varepsilon_{1t} \quad \ldots \quad 4.1$$

$$\Delta_t X_t = d_t ECM_{t-1} + \sum_{i=1}^{n} d_2 AY_{t-1} + \sum_{i=1}^{n} d_3 \Delta X_{t-1} + \varepsilon_{2t} \quad \ldots \quad 4.2$$

Equation (4.1) and (4.2) were used for testing the causality between the variables of interest. The ECM term shows the size of error in the preceding term. Keke *et al* (2003) has cautioned against the exclusion of the ECM term from equation 4.1 and 4.2. He opined that if the ECM term is neglected, an important error is induced in the empirical analysis and the F-test are no longer valid (Keke *et al*, 2003).

4.3 Model Specification

This paper uses Granger causality model in which two variables, Ms and Indpx are taken to represent money supply and industrial productivity index respectively.

Let At; t=1,2,3,… be the set of given information including at least (Ms_t, $Indpx_t$) the bi-variate process of interest. Also, let At=(A_s:s<t). Ms_t and $Indpx_t$ are defined similarly, for example, Ms_t represents all past values of Ms_t and $Indpx_t$ represents all past values of $Indpx_t$.

Granger's definition of causal relationship between Ms and Indpx are as follow:

1. Ms causes Indpx if $\delta^2\left(Indpx/\overline{A}\right) < \delta^2\left(Ms/\overline{A} - \overline{M_s}\right)$ ... *i*

   Where ___ (Indpx/Z) represents the minimum prediction error variance of Indpx, given an information period Z, a reduction in the minimum prediction error variance when past values of Ms are included in the information set on which the prediction of Indpx is conditioned, signifies Ms causes Indpx.

2. Similarly, for Indpx causes Ms we have:

   $\delta^2\left(Ms/\overline{A}\right) < \delta^2\left(Ms/\overline{A - Indpx}\right)$ ... *ii*

   Bi-directional causality (feedback) occurs when Indpx causes Ms and Ms causes Indpx. That is:

3. $\delta^2\left(Ms/\overline{A}\right) < \delta^2\left(Ms/\overline{A} - \overline{Indpx}\right)$ *and* $\delta^2\left(Indpx/\overline{A}\right) < \delta^2\left(Ms/\overline{A} - \overline{Ms}\right)$ ... *iii*

   Ms and Indpx are independent of one another, if neither causes the other, that is inclusion of values of past data set does not reduce the minimum prediction error variance of the other; thus:

4. $\delta^2\left(Indpx/\overline{A}\right) = \delta^2\left(Indpx/\overline{A} - \overline{Ms}\right)$ *and* $\delta^2\left(Ms/\overline{A}\right) = \delta^2\left(Ms/\overline{A} - \overline{Indpx}\right)$ ... *iv*

   In addition, on undergoing the unit root test for stationary, A=(Indpx, Ms) and Indpx and Ms are taken as a pair of linear covariance stationary time series, thus, the

Granger causality between industrial productivity (Indpx) and money supply (Ms) can be modeled as follows:

$$\Delta_t Indpx_t = b_t ECM_{t-1} + \sum_{i=1}^{n} b_2 Indpx_{t-1} + \sum_{i=1}^{n} b_3 Ms_{t-1} + \varepsilon_{1t} \quad \ldots \quad v$$

$$\Delta_t Ms_t = d_t ECM_{t-1} + \sum_{i=1}^{n} d_2 Indpx_{t-1} + \sum_{i=1}^{n} d_3 Ms_{t-1} + \varepsilon_{2t} \quad \ldots \quad vi$$

Where ε_{1t} and ε_{2t} are serially uncorrelated with zero mean and finite covariance matrix. The decision rule for i, ii , iii and iv will be the test of the null hypothesis that the estimates coefficients are equal to zero at an appropriate level of significance; thus:

A. Ms causes Indpx if HO_2:b_3=0, i=1,2,3, … *n* is rejected

B. Indpx causes Ms if HO_1:d_2=0, i=1,2,3, … *n* is rejected

C. Ms and Indpx are dependent if *a* and *b* above holds

D. Ms and Indpx are independent if both *a* and *b* are not rejected

5.1 Presentation and Analysis of Result

Being a time series data with the usual flow of spurious result, any successful research on such must commence on the test for stationarity on the data. On the recommendation of Hamilton (1994) and Hayashi (2000) a stated in Dauda (2005), it was accepted to investigate carefully the nature of any probable non-stationarity, testing each series individually for unit root and then testing for possible co-integration among the series, thus, analysis of causality using the typical VAR model is preceded by the unit root and co-integration test.

5.2 Unit Root Test

To avoid spurious rejection or acceptance of no causality in the results, it was necessary to confirm stationarity of the variables of interest as investigated using the ADF (Augumented Dickey-Fuller) tests. The result is presented in table 1.

Table 1: Unit Root Test (ADF)

Variables	*(With intercept only)*			*Lag length*	*Order of integration*
	Levels	1st difference	2nd difference		
Indpx	-1.58527	-3.188599	-4.076669	2	I (0)
Ms	1.043672	0.936757	-2.208719	2	I (0)
	(with intercept and trend)				
	Level	1st difference	2nd difference		

Indpx	-2.890306	-4.337425	-7.545803	1	I (1)
Ms	1.834180	-0.962222	-4.851390	1	I (0)

Using intercept only, Indpx was stationary at 5% critical level on the first and second difference while Ms was not stationary at either levels or first and second differencing. However, since the two series were trended, the analysis of ADF using intercept and trend showed Indpx to be stationary at 5% critical levels on the first and second differencing while Ms was stationary only after the second difference at 5% critical values. Since the stationary of the variables had been confirmed, a simple co-integration test was conducted using the Johansen's technique (Johansen and Juselius, 1990). As stated in Dauda (2006), Hamilton (1994) and Hayashi (2000), argues that testing and analysing co-integration in a VAR model is superior to the Engle-Granger simple equation.

5.2 Johansen's Co-integration Test

Table 2: Series: Indpx, Ms

Lags interval: 1-4

Eigen values	***Likelihood ratio***	***5% critical value***	***1% critical value***	***Hypothesised N^0 of CE(S)***
0.637625	39.75192	25.32	30.45	None**
.234513	8.284543	12.25	16.26	At most 1

(**) denote projection of the hypothesis at 5% (1%) significant level. L.R. test indicates one co-integration equation at 5% significant level.

The co-integration test indicates one co-integrating equation at 1-4 lags suggesting the existence of long-run relationship between money supply and industrial productivity. The choice of appropriate lag length for the VAR model plays a critical role in determining causality, thus, using the Akaike information criterion (AIC), and Schwarz information criterion (SIC) the optimal lag length of ten (10) lags was chosen. The Granger causality equation was estimated using ordinary least square technique within a VAR structure in E-views version 3.1. The results are presented below:

Table 3: Result of causality running from Ms to Indpx

Included observation: 26 after adjusting end points

Independent variable	Coefficients	Standard error	t-statistics
Indpx (1-)	0.218732	0.3335	0.65617

Indpx (2-)	0.005200	0.30634	-0.01698
Indpx (3-)	-0.344753	0.32503	-1.06068
Indpx (4-)	-0.649665	0.35033	-1.85444
Indpx (5-)	-0.026547	0.38127	-0.6963
Indpx (6-)	0.368365	0.37550	0.98101
Indpx (7-)	-0.382565	0.36096	-1.05985
Indpx (8-)	-0.161459	0.35693	-0.45236
Indpx (9-)	-0.205445	0.45196	-0.45456
Indpx (10-)	0.851862	0.45196	1.93761
Ms (-1)	0.016109	0.00622	2.58896
Ms (-2)	-0.27721	0.01073	-2.58420
Ms (-3)	0.008779	0.00344	2.54999
Ms (-4)	-0.004961	0.00196	-2.52958
Ms (-5)	0.014646	0.00569	2.57503
Ms (-6)	-0.005964	0.00234	-2.54490
Ms (-7)	-0.001112	0.00129	-0.86317
Ms (-8)	-0.000655	0.00114	-0.57609
Ms (-9)	-0.001100	0.00143	-0.77113
Ms (-10)	0.001491	0.00100	1.49354
ECM (-1)	-0.015817	0.00612	-2.58494

R^2=0.928065; R^2=0.640323; F-statistic=3.925340

From analysing the Indpx regression, we discovered that only the first to sixth lags of Ms were significant judging by their respective standard error which was less than half of the coefficient of their respective cases. Also, of the six significant lagged values, 3 conformed to the apriori expectations of a positive relationship while the second fourth and sixth lag period yielded a negative relationship which means an adverse effect of money supply on industrial productivity. The R^2 was 93% and the adjusted R^2 was 64% which shows that 93% of the variations in Indpx are explained by the variables in the model. Correspondingly, the F-statistic that checks the significance of the R^2 was significant at 5% level of significance. The negative sign in the ECM shows that it was currently signed though not prompting adequate feedback from long-run trend as indicated by its low value (2%).

Table 4: Result of causality Indpx to Ms

Included observation: 26 after adjusting end points

Independent variable	Coefficients	t-statistics
Indpx (1-)	493.1702	0.90022
Indpx (2-)	740.9661	1.47178
Indpx (3-)	520.6822	0.97476
Indpx (4-)	-431.9268	-0.75020
Indpx (5-)	-404.7310	-0.64592
Indpx (6-)	998.6761	1.61832
Indpx (7-)	329.5950	0.55560
Indpx (8-)	-172.7511	-0.29450
Indpx (9-)	-966.4992	-1.30120
Indpx (10-)	238.5283	0.392411
Ms (-1)	-15.37683	-1.50377
Ms (-2)	28.22666	1.60112
Ms (-3)	-7.911610	-1.39831
Ms (-4)	3.058081	0.94873
Ms (-5)	-16.46770	-1.76180
Ms (-6)	11.6360	3.02156

Ms (-7)	1.036140	0.48953
Ms (-8)	-1.345473	-0.72060
Ms (-9)	-3.929832	-1.67652
Ms (-10)	4.116349	2.50843
ECM (-1)	15.92098	1.58325

R^2=0.999905; R^2=0.999523; F-statistic=2622.320

In the money supply regression result presented in table 4, however, we see that none of the lagged values of Indpx was significant judging by the standard error test. Though, some of the lagged values conform to apriori expectation, their statistical insignificance condemn their relevance in this analysis. The R^2 and adjusted R^2 surprisingly show a 100% relevance of the variables in the model in explaining changes in money supply. The large F-statistic (2622.326) also reveals the significance of the R^2 while the positively signed ECM shows that correction of past disequilibria is not possible in the model. The gross insignificance in the individual parameter estimates and high significance of the F-statistic is consistent with the submission of Gujarati who says "with several lags of the same variable, each estimated coefficient will not be statistically significant, possibly because of multi-collinearity. But collectively, they may be significant on the basis of standard F-test (Gujarati, 2004:850).

6.1 Summary and Concluding Remarks

The study has examined the degree of inter-relationship and independence between industrial productivity and money supply in Nigeria. The empirical analysis has led to the discovery that the Nigerian economy shows a uni-directional causality that runs from money supply to industrial productivity. This conforms to the quantity theory of money that an increase in money supply either by mobilizing savings, increase in government expenditure or through foreign private investment (FPI), causes an increase in price level which also lead to an increase in output if there are some idle resources.

It also affirms the postulation of Mackinnon (1973) and Shaw (1975) which suggest that financial liberalisation is what is needed to release the finance necessary for growth. Expressed in another way, Porter (1966) agrees that development and expansion of the financial sector precede the demand for its services. This evidence is consistent with the conclusion of Aigbokhan (1995) who states a causality running from financial to real sector growth (demand following hypothesis). The importance of managing money supply, that is, inflation control is however shown in section five where two of the six significant lags of money supply yielded a negative result, indicating a disincentive to industrial productivity caused by adverse inflationary spirals. This is adequately explained by the near hyper-inflationary trends recorded in the country between the late 70s and the late 90s which arose from the oil boom, more recently termed "oil money". Question however arises on the inability of the industrial sector to yield adequate feedback by simultaneously increasing money supply and thus creating a circle of perpetual growth in both the financial and real sectors. This slack in industrial productivity is seen to be caused by a myriad of factors ranging from the inflationary spiral indicated by the near zero contribution of money supply to industrial productivity as shown in table 3. The market attitude towards home-made goods and the rampant corruption in the system which has hampered the results of the policies which would have brought desired results.

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