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MEASURING PRODUCTIVITY FOR OPTIMAL PERFORMANCE IN THE NIGERIAN INDUSTRIAL SECTOR A CO-INTERGRATION APPROACH

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Abstract

The Industrial sectors play a catalyst role in a modern economy and has many dynamic benefits that are crucial for economic transformation. The objective of this study is to empirically investigate the macroeconomic factors affecting industrial performance in Nigeria over the period of 1979-2010 by employing the co-integration and an error correction model. The study revealed that, interest rate spread and exchange rates have negative impact on the growth of manufacturing sub-sector in Nigeria. Results shows that a rise in the index of manufacturing sub-sector is a reflection of high inflation rate and cannot be interpreted to mean a real growth in the sector. Liberalization of the Nigerian economy has promoted manufacturing growth for the period under study. A long-run equilibrium relationship exists amongst the variables, as evidenced by the co-integration. The study recommends that government must create "enabling environment" for manufacturers in the area of infrastructures, financial, legal and property rights. High cost of borrowing is due to high interest rate spread therefore this paper advocates a cut in margin between lending and deposit rates. For a resounding performance the establishment of the Microfinance Banks, Small and Medium industries Equity Investment Scheme (SMIEIS), amongst other agencies should be overhauled.

Keywords: Co-integration approach, Industrial sector, Measuring Productivity, Optimal performance, Error Correction Model.

INTRODUCTION

The Industrial sectors play a catalyst role in a modern economy and has many dynamics benefits that are crucial for economic transformation. In advanced countries, the industrial sector is a leading sector in many respects. It is an avenue for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment, promoting the growth of investment at a faster rate than any other sector of the economy as well as wider and more efficient linkage among different sectors (Fakiyesi, 2005). But its capacity utilization is also low, this is in spite of the fact that industrial sector is the fastest growing sector since 1973 (Obadan, 1994). The sector has become increasingly dependent on the external sector for import of non labour input (Okigbo, 1993). Inability to import, therefore, can impact negatively on industrial production.

However, The downturn of the global oil market from the early l980s and the sharp decline in foreign exchange earnings have adversely affected economic growth and development in Nigeria coupled with the global financial crisis that rocked the world economies in year 2008 and early 2012. Other problems of the economy include excessive dependence on imports for consumption and capital goods, dysfunctional social and economic infrastructure, unprecedented fall in capacity utilization rate in industry and neglect of the agricultural sector, among others. These have resulted in fallen incomes and devalued standards of living amongst Nigerians (Anyanwu, 2004). Although the structural adjustment programme (SAP) was introduced in 1986 to address these problems, no notable improvement has taken place. From a middle income nation in the l970s and early 1980s, Nigeria is today among the 30 poorest nations in the world. Putting the country back on the path of recovery and growth will require urgently rebuilding deteriorated infrastructure and making more goods and services available to the citizenry at affordable prices. This would imply a quantum leap in output of goods and services. The path to economic recovery and growth may require increasing production inputs - land, labour, capital and technology - and or increasing their productivity. Increasing productivity should be the focus because many other countries that have found themselves in the same predicaments have resolved them through productivity enhancement schemes.

For instance, Japan from the end of the World War II and the United States of America from the 1970s have made high productivity the centre point of their economic planning and the results have been resounding (Anyanwu, 2004). The study investigates the relationship between index of manufacturing production and determinants of productivity for optimal performance in the industrial sector. Second, the paper, among other thing, shall attempts to address other conceptual issues on productivity measurement in Nigerian industrial sector in order to allow us to assess its performance to date.

LITERATURE REVIEW & CONCEPTUAL FRAMEWORK

Definition of Productivity

There is no universal definition of the term, productivity. It has been defined by Economists as the ratio of output to input in a given period of time. In other words, it is the amount of output produced by each unit of input (Anyanwu, 2004, Udo-Aka, 1983). Business Managers, on the other hand, see productivity not only as a measure of efficiency, but also connotes effectiveness and performance of individual organizations (Anyanwu, 2004). For them, productivity would incorporate quality of output, workmanship, adherence to standards, absence of complaints, customer satisfaction, etc (Udo-Aka, 1983). The administrator is more concerned with organizational effectiveness, while the industrial engineer focuses more on those factors which are more operational and quantifiable, work measurement and performance standards (Adekoya, 1987). Productivity can be computed for a firm, industrial group, the entire industrial sector or the economy as a whole. It measures the level of efficiency at which scarce resources are being utilized. Higher or increasing productivity will, therefore, mean either getting more output with the same level of input or the same level of output with less input. The least controversial definition of productivity is that it is a quantitative relationship between output and input (Iyaniwura and Osoba,1983, Antle and Capalbo,1988). This definition enjoys general acceptability because of two related considerations. One, the definition suggests what productivity is thought of to be in the context of an enterprise, an industry or an economy as a whole.

Two, regardless of the type of production, economic or political system, this definition of productivity remains the same as long as the basic concept is the relationship between the quantity and quality of goods and services produced and the quantity of resources used to produce them (Prokopenko, 1987). Eatwell and Newman (1991) defined productivity as a ratio of some measure of output to some index of input use. Put differently, productivity is nothing more than the arithmetic ratio between the amount produced and the amount of any resources used in the course of production. This conception of productivity goes to imply that it can indeed be perceived as the output per unit input or the efficiency with which resources are utilized (Samuelson and Nordhaus, 1995).

By way of analogy, Amadi (1991) explained that an example of productivity ratio is kilometers driven per gallon of petrol where petrol is the input and kilometers covered constitute the output. However, input measure of petrol is not used to determine the efficiency of the car's performance. Other related factors such as speed, traffic flow, the engine's efficiency and the fuel's efficiency are equally involved in the computation of the input index. The output measure

of kilometres driven therefore becomes a gauge of the magnitude or effectiveness of the results achieved. Expressed simply:

Productivity = total output/total input which is identical to total results achieved/total resources consumed or effectiveness / efficiency.

In effect, productivity becomes the attainment of the highest level of performance with the lowest possible expenditure of resources. It represents the ratio of the quality and quantity of products to the resources utilized.

Productivity can now be simply summarized as the rate of real output per unit of input. It can also be largely referred to as the relationship between production of an output and one, some, bundle or all of the resource inputs (labour, equipment, capital and technology) used in accomplishing the assigned task. It is measured as a ratio of output per unit of input over time. It is a measure of efficiency and is usually considered as output per person-hour. Equation (a) summarizes the expression above as indicated below:

$$\text{Productivity} = \frac{\text{Real Output}}{\text{Input}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(a)}$$

An increase in productivity is said to occur when more output is produced either with the same amount of input, or with less input, or with little increment in input.

Measurement of Productivity

Productivity measurement is the quantification of both the output and input resources of a productive system. The intent is to come up with a quantified monitoring index. The goal of productivity measurement is productivity improvement, which involves a combination of increased effectiveness and a better use of available resources. While productivity can be given the sort of shorthand definition as the ratio between output and input, what productivity really is as well as how it can be measured has always provoked a great deal of controversy among experts. In essence, it can be said that the measurement of productivity is only simple conceptually. In practice, however, both measurement of outputs and inputs involves aggregation problem, and this problem alone has situated productivity measurement in the realm of complexity. For example, the question of how to aggregate different products that do not have constant quality or characteristics constitutes the veil to be removed from output measurement. In the same vein, the problem of how to aggregate the different types of inputs into a well-defined composite unit remains a critical one on the side of input measurement.

To solve output and input aggregation problem, particularly when heterogeneous inputs and outputs are combined, some authors have suggested that inputs should be added up in 'constant price' money values. The same thing should be done for output (Iyaniwura and Osoba, 1983, David, 1972). The loophole in this approach is that the resultant productivity index will be economic productivity and not physical productivity, which, obviously, should convey more meanings to most of the users of productivity measures. Added again to the input measurement problem is the question of how to measure capital input. Consequently, preference is often expressed for a single factor measure of productivity, and it is common to see emphasis being placed on labour input. Three reasons, are sometimes put forward to justify the use of labour input for purposes of partial productivity measurement, these are:

(i) labour is regarded as the most important factor of production;
(ii) labour is the most easily quantified factor of production;
(iii) labour is the only factor of production that has conscious control over its contribution to output.

A measure or index of aggregate output divided by the observed quantity of a single input thus became the earliest approach to productivity measurement. This index-number approach based upon the use of single or partial factor productivity measures has one unique advantage: computational simplicity and feasibility save that the required aggregate labour input data are available. The greatest shortcoming of partial factor productivity measures, particularly labour productivity measures is its inability to identify the causal factor accounting for observed productivity growth. For instance, substitution of capital for labour, the introduction of more (labour) efficient vintages of capital, the realization of economies of scale and the employment of better-trained manpower will all show up in an index of output per man-hour. Emerging literature on productivity measurement of late indicate that early productivity measures revolve around the value of aggregate output per man hour of labour input despite the problems associated with measuring labour input.

At the moment, productivity research has focused more on total factor productivity (TFP) measures where comprehensive aggregates of outputs and inputs are of interest. It is helpful to note that production theory remains the basis for analyzing the factors that explain output level changes. It is known from available literature that, the rate of output depends on three factors: Labour input *(Labour input itself is also difficult to measure. For example, it is sometimes suggested that labour must be defined and classified along the line of mental and physical efforts, It is fundamentally wrong to assume homogeneity for labour when differences are evident in terms of sex, age and attitude)* itself is also difficult to measure. For example, it is

sometimes suggested that labour must be defined and classified along the line of mental and physical efforts, It is fundamentally wrong to assume homogeneity for labour when differences are evident in terms of sex, age and attitude.

(i) the state of technology or kind of production process that is in use;
(ii) the quantities and types of resources put into the production process;
(iii) and the efficiency with which those resources are utilized.

Arising from these three factors behind productivity changes are three possible explanations for differences in total factor productivity. These are differences in productive efficiency, the scale of production, and the state of technology, depending on the specific assumptions *(The assumption of competitive equilibrium suggesting that factor of production is paid by the value of their respective marginal products and constant return to scale are often made)* that are made with respect to the production function and the market conditions.

Beyond the level of partial factor productivity measurement, the growth of output can be decomposed into two: the contribution of changes in inputs and in total factor productivity.
The production function indicates the contribution of additional inputs to increases in output and the residual otherwise called 'multi factor productivity growth' or less formally the Solow residual is attributed to total factor productivity change.

Under the assumptions of constant returns to scale and competitive markets, the rate of growth of output can be summarize as shown by equation (b):

$$gy = agb + (1-a)\, gk + q \quad \text{……………………………………………………} \quad (b)$$

Where gy, gb; and g are the growth rates of output, labour, and capital respectively, and a is the share of labour in output; while q measures that part of growth that cannot, under the maintained assumptions, be explained by either growth of labour or capital. To this end, recent productivity debate has been concerned with total factor productivity (TFP) measures that are based on comprehensive aggregates of output and inputs. According to Anyanwu (2004), the productivity of labour can be measured either as output per operator or output per man-hour, expressed in money value (economic productivity) or in quantities (physical productivity).

Because of the heterogeneity of output, it is more usually expressed in value terms which, for the manufacturing sub-sector, are easily calculated from ex-factory prices of finished products, estimated value of semi-finished products and other works and services of an industrial nature.

When productivity is measured in physical units, the following formulae can be used to calculate productivity index:

$$X_t = \frac{Q_t}{Qo} \div \frac{L_t}{Lo} \quad \text{..............................} \quad (1)$$

Given that:

Xt= productivity index

Q = Output in physical units

L = labour

t and o are current and base periods, respectively.

On the other hand, if the value of output is used to measure productivity, the following Formula is used:

$$X_t = \frac{PoQ_t}{PoQo} \div \frac{L_t}{Lo} \quad \text{..............................} \quad (2)$$

Where Po is the base period unit price of output and other variables are as defined above.

Background of the Nigerian Economy

Since independence in 1960, Nigeria has witnessed one civil war (1967-1970), six coups and counter coups, substantial economic mismanagement and widespread and persistent poverty. As at 1999, Nigeria was ruled by the military for all but eight years since 1966; Nigeria has thus failed dismally to take full advantage of fertile soil, massive oil resources and a relatively well-educated population (Mans and Francis, 2002). With the democratic dispensation transited from the former Head of State. Gen. Abubakar Abdulsalam to Olusegun Obasanjo in 1999, the first in almost a score years ago, there was some signs of economic recovery by implementing Millennium Development Goals, MDGs capped it up by the Obasanjo’s National Economic Empowerment and Development Strategy, NEEDS in connection with the SEEDS and LEEDS at state and local levels respectively capped up with Yar’Adua/Jonathan Seven Point Agenda.

The Three Erratic Decades (1960s-1990s)

Since the late 1960s the Nigerian economy has been based mainly on the petroleum industry. In the 1970s a series of increases in the international oil price generated substantial windfall revenues for the government. It soon became apparent that these oil price shocks were, at best,

a mixed blessing. Like many other African countries, Nigeria's early independence years had seen an industrial strategy that relied heavily on import substitution. At first this had appeared to work relatively well, with the share of manufacturing to GDP increasing from 2 per cent in 1957 to 7 per cent in 1967 (Utomi, 1998). The massive oil revenues meant that this strategy could be intensified; consequently the l970s witnessed huge investments in state-owned enterprises. While this implied rapid expansion of the industrial sector, subsequent returns on investment projects were typically much below expectations. Once oil prices fell in the late 1970s and early 1980s the economy went into a period of rapid economic decline. In 1983 the economy came close to a virtual collapse, real per capita income being about 30 per cent lower than at the onset of the oil price boom, ten years earlier.

The subsequent couple of years witnessed political instability, with two coups in 19 months during 1983-85 (Mans and Francis, 2002). Towards the end of the 1980s the government introduced a number of economic reforms, involving deregulation of the foreign exchange market, abolition of import licenses and devaluation of the Naira. However, implementation of the new policies was slow, fiscal discipline remained weak, and substantial budget deficits therefore emerged in the early 1990s. In 1993 the government initiated the Nigerian Economic Summit, seeking to identify policy measures to reverse the poor economic performance. One outcome of the Summit was the Economic Action Agenda, which contained a blueprint for growth engineered by the private sector. Central to this Agenda was the deregulation of.ne economy. Little of this was implemented by the previous regime, and most of the market-oriented reforms were reversed in favour of protectionist policies (Mans and Francis, 2002).

Industrial Sector Performance (1999-2009)

Democratic elections in 1999 gave the presidential mandate to Olusegun Obasanjo, Nigeria's first democratically elected president since 1983. Subsequent years have been associated with a certain degree of economic recovery, relaxed exchange controls and considerable privatization and deregulation policies.

Preliminary estimates from the Economist Intelligence Unit Country Data suggest that per capita GDP grew by about two per cent in 2000 and about four per cent in 2001. Obasanjo administration improved performance of manufacturing sector through National Economic Empowerment and Development Strategy (NEEDS), State Economic Empowerment and Development Strategy (SEEDS) and Local Economic Empowerment and Development Strategy (LEEDS) at Federal level, State and Local Government levels between spanned 2003 to 2007

while Yar'Adua administration incorporated and priotized manufacturing sector in his Seven-Point Agenda (NEEDS, 2004).

Determination of Productivity in Nigerian Industrial Sub-Sector

Many variables put together to determine productivity in the Nigerian Industrial sub-sector. The variables include index of manufacturing production (IMP), rate of growth of gross domestic product (GDP); interest rate spread (IRS); Foreign Direct Investment (FDI); banks' credit to the manufacturing sub-sector (CMS); inflation rates (INF); exchange rates (EXR); Quantity of Graduates' Employment (QGE); Structural Adjustment Dummy variable (SAD) and Political Crisis Dummy variable (PCD) (Alao, 2005). Enterprises produce goods and services for sale with the aim of making returns on their investments. The goods and services are the output of the enterprises. In the process of production, an enterprise makes use of scarce resources which are called factors of production, namely land, labour and capital. These factors of production are generally referred to as inputs in the production process and their owners are rewarded from the returns generated by the enterprise. In Nigeria, the performance of industrial sub-sector has been hindered by high interest rates, particularly the interest rate spread (IRS) which is the difference between lending and borrowing rates. It is alleged that this rate is partly responsible for high cost of production in the Nigerian industrial sub-sector Adebiyi (2001), Adebiyi and Babatope-Obasa, 2004).

Overview of the Nigerian Industrial Sub-Sector

The structure of manufacturing production has been a derivative of the various development plans (Alao, 2006). The First National Development Plan (1962-1968) emphasized light industry and assembling activities. The second plan (1970-1975) had a somewhat similar thrust and focus, but the emphasis shifted in the third plan (1975-1980) towards heavy industries. Major projects were initiated in the steel and petroleum refinery sector. For the fourth plan (1980-1985), the broad direction as in consonance with the third: it retained the stress on heavy industries. But several of the grandiose plans were short changed with the onset of the profound economic crisis in the early l980s. Players in the Nigerian industrial and manufacturing sector can be classified into four, namely: (a) Multinational (b) National (c) Regional (d) Local groups. Apart from the multinational operators, most of the other players have disappeared in the last two decades, due to unpredictable government policies, lack of basic raw materials, most of which are imported.

The Nigerian Industrial Policy Stages

The development of the Nigerian industrial policy involved through two key stages as concurred by (Alao, 2006). They are as follows:

(a) **The first period (1970—1985):** The period covers the state-led import substitution industrialization strategy. The main focus is on the economic role of government through direct investments, administration of a protectionist trade regime, and the introduction of schemes such as indigenization and preferential credit to nurture indigenous entrepreneurs. It is argued that the roles assumed by the government, gave it a leadership role in the economy and direct control over the welfare of individual private businesses. The government's strategy during this period simply involved attracting and encouraging foreign capital to engage in manufacturing activities.

(b) **The second period (1986—present):** The period lays emphasis on the economic liberalization policies that replaced the state-led import substitution industrialization strategy and nationalization policy. Government's policy in this period focuses on privatization, deregulation of foreign investments, trade liberalization, deregulation of credit policy and the introduction of the Foreign Exchange Market (FEM). Privatization and deregulation has resulted in the reliance of market, rather than state regulation, and is reducing the role and power of government relative to the private sector.

METHODOLOGY

Specification of Model

This study takes Index of Manufacturing Production (IMP) as the dependent variable because changes in the manufacturing sub-sector, arising from government monetary and fiscal policies, can easily be observed in this variable. From the literature review, the explanatory variables include: rate of growth of gross domestic product GDP); interest rate spread (IRS); Foreign Direct Investment (FDI); banks' credit to the manufacturing sub-sector (CMS); inflation rates (INF); exchange rates (EXR); Quantity of Graduates' Employment (QGE); Structural Adjustment Dummy variable (SAD) and Political Crisis Dummy variable (PCD). These variables are essential for the following reasons.

The impact of reforms on manufacturing growth is proxied with dummy variable (SAD). It is alleged that economic regulation in developing countries has hindered growth and development through high interest rate. Deregulation of interest rate, according to them, will not only raise the real returns on savings but, promote investment and economic growth in developing countries.

On above basis, the study uses Structural Adjustment Programme Dummy (SAD) variable one (I) for the period of economic reforms and zero (0) for the non-SAP periods. The study also uses political stability factor - Crisis Dummy (CD) variable zero (0) for crisis-free periods and one (1) for crisis-enveloped years.

IMP = f (DP)……..… (1)

DP = f (GDP, INF, IRS, CMS, EXR, FDI, QGE, SAD, CD ……(2)

Substituting (2) into (1)

IMP_t = f (GDP,INF,IRS, CMS, EXR, FDI, QGE, SAD, $PCD)_t$……...(3)

Against this background, the model for the study is specified as:

IMP_t =

$$a_0 + a_1\sum_{j=1}^{n} GDP_t + a_2\sum_{j=1}^{n} INF_t + a_3\sum_{j=1}^{n} CMS_t + a_4\sum_{j=1}^{n} FDI_t + a_5\sum_{j=1}^{n} EXR_t + a_6\sum_{j=1}^{n} IRS_t + a_7\sum_{j=1}^{n} QGE_t + a_8\sum_{j=1}^{n} SAD_t + a_9\sum_{j=1}^{n} PCD_t + U_t$$

…….... (4)

The expected signs are: $a_0 > 0$; $a_1 > 0$; $a_2 > 0$; $a_3 > 0$; $a_4 > 0$; $a_5 < 0$; $a_6 < 0$, $a_7 > 0$, $a8 > 0$, $a_9 < 0$. The above sign ($a > 0$) implies a positive relationship between IMP and the coefficients of the independent variables, while the sign ($a<0$) indicate negative relationship.

where: IMP - Index for Manufacturing Production;

DP - Determinants of productivity;

GDP - rate of growth of gross domestic product;

IRS - Interest Rate Spread;

CMS - Banks' Credit to the Manufacturing sub-sector:

INF - Inflation Rates;

FDI — Foreign Direct Investment;

EXR - Exchange Rate;

QGE - Quantity of Graduates' Employment;

SAD - Structural Adjustment Dummy;

PCD - Political Crisis Dummy.

THE ENGLE-GRANGER METHODOLOGY

Recall that the paper investigate the relationship between index of manufacturing production and determinants of productivity using annual time series data from 1979-2010. The data were

all sourced from Central Bank of Nigeria statistical bulletin 2007, 2008 and 2009. In order to investigate the relationship that exists between dependent variables and independent variables, the paper adopts the following procedures:

First, the time series characteristics of the variables are investigated. The purpose is to determine order of integration. The Paper conduct unit root test on the variable included in the regression by employing the Ng and Perron (2001) modified unit root tests. The objective here is to determine underlying properties of the process that generate the present result and discussion of the analysis while the conclusion is presented in the study time series variables employed. The choice of the Ng and Perron (2001) modified unit root test is based on the fact that the test are more suitable for small samples than the traditional tests. In addition, as observed by Sinna (2007), the null hypothesis of a unit is not over – rejected when Ng and Perron (2001), modified unit root tests are employed.

Second, to capture both the long run and the short run dynamics of the Nigerian Industrial sub-sector performance, we employed an error correction model (ECM) using the Engle-Granger Methodology. In order to avoid spurious regression results, stationarity and co-integration among the variables, the data should be tested prior to estimation of error correction model. Papers by Granger (1969), and Engle and Granger (1987) show that for non-stationary and co-integrated variables, a comprehensive test of causality between two variables should allow for an additional channel through which causality could emerge. Formally, we may have to use the information from the co-integration regression between two or more variables via the error correction model. Therefore, prior to performing Granger causality tests, the long run behavior of the variables should be examined using co-integration tests for stationary variables would be meaningless because variables have to be integrated individually in order to be co-integrated.

Thus, before explaining this test in detail, we examine the stationarity of variables. If the variables are non-stationary, we can induce stationarity by performing ADF unit root test. We expect that there is a long-term equilibrium relationship between the variables. We therefore test for the existence of a co-integrating relationship. This is done using the above ECM methodology. In the first step we estimate the coefficients by OLS and test for the existence of a unit root in the residuals.

The deviations from the long run path are captured at the second stage. When the coefficients of the lagged residual terms from the first stage is negative, it suggests that the system comes back to the long run path or adjusts. Therefore, exists an error correction mechanism.

ANALYSIS & FINDINGS

As a result of the proposed model, Index of Manufacturing Production (IMP) is taken as the dependent variable and to measure the productivity and the performance of the Nigerian Industrial sub-sector while the explanatory variables included are: rate of growth of Gross Domestic Product (GDP); interest rate spread (IRS); structural adjustment dummy variable (SAD); socio-cultural crisis dummy variable (CD); banks' credit to the manufacturing sub-sector (CMS); inflation rates (INF); exchange rates (EXR); and quantity of graduates' employment (QGE). In literature, most time series variables are non-stationary variables in the model that may lead to spurious regressions (Granger and Newbold, 1977). The first or second differenced terms of most variables will usually be stationary (Ramanathan, 1992). All the variables are tested at levels and differenced for stationarity using the Augmented Dickey-Fuller (ADF) test. All the variables except inflation rates are not stationary at level. All the variables except Credit to Manufacturing Sector (CMS) and Foreign Direct Investment are stationary at first-order difference while all the variables are stationary at the second-order difference. (See Table 1)

TABLE 1: AUGMENTED DICKEY-FULLER UNIT ROOTS TEST: 1979-2010.

Variables	At Level	1st Difference	2nd Difference	Level of Integration
IMP	-2.03095	-3.106019**		I (1)
INF	-3.68520**			I (0)
EXR	1.143114	-3.063890**		I (1)
GDP	1.202760	-3.411810**		I (2)
FDI	1.891546	-1.775144	-4.189500***	I (2)
CMS	1.516586	-0.881987	-4.557372***	I (1)
IRS	-0.754155	-5.66372		I (1)
QGE	1.432565	-3.632323***		I (1)

*Note: *** stationary at 1%; *** stationary at 5%; * stationary at 10%*

TABLE 2: CO-INTEGRATION TEST (GRANGER PROCEDURE)

Adf Test Statistics	-3.5567	1% Critical Value	-3.7497
		5% Critical Value	-29969
		10% Critical Value	-2.6381

TABLE 3: STAGE I: ORDINARY LEAST SQUARES (OLS) ESTIMATE

Variable	Co-efficient and t-value
Intercept (C)	80.75241
(t)	(9.143203)
EXR	0.233953
(t)	(0.531889)
GDP	0.0000008
(t)	(0.028100)
IRS	-0.347554
(t)	(-0202693)
CMS	0.0034801
(t)	(0.383283)
FDI	0.000064
(t)	(0.188187)
INF	-0.169041
(t)	(-0.546357)
QGE	0.435674
(t)	(0.542364)
SAD	76.61657
(t)	(5.119442)
PCD	0.564355
(t)	(0.564656)

t-values are in parentheses

R-square	0.712697
Adjusted R-square	0.621228
S.E of Regression	5.52027
Durbin-Watson Stat.	2.228599
F-Statistics	8.79631

TABLE 4: STAGE II: ERROR CORRECTION MECHANISM BASED IN CO-INTEGRATION REGRESSION ON EAGLE-GRANGER PROCEDURE

Variable	Co-efficient and t-value
Intercept (C)	5.183572
(t)	(0.037091)
d (EXR)	-0.164596
(t)	(-2.602500)
d (GDP)	0.00001
(t)	(0.716123)
d (IRS)	-0.194539
(t)	(-1.995971)
d (CMS)	9.002156
(t)	(2.364403)
d (FDI)	0.0000869
(t)	(1.502003)
d (INF)	1.205218
(t)	(2.093918)
d (QGE)	1.243456
(t)	(2.542311)
ECM(-1)	-0.805247
(t)	(-2.051221)
SAD	23.23413
(t)	(1.934243)
PCD	-12.64931
(t)	(-2.35523)

t-values are in parentheses

R-square	0.841010
Adjusted R-square	0.777414
S.E. of Regression	16.52634
Durbin-Watson Stat	2.198572
F-Statics	9.293686

The estimation of the long run co-integrating relationship, or step 1 of the Engle-Granger procedure reveals that exchange rate, deficit government financing and interest rate spread have the expected impact and thus a negative sign, while inflation and other variables have the expected positive signs. All coefficients are found to be significant at the 10% level of significance. From the table 3, Interest Rate Spread (IRS) and Exchange Rates (EXR) have a negative but significant relationship with Index of Manufacturing Production (IMP). This is not surprising in Nigeria since high lending rate without corresponding increase in deposit rate (that is high interest rate spread) has been identified as a principal factor responsible for high cost of production in industrial and manufacturing sector.

Economic reforms are proxy using SAD variable. It has a positive and significant relationship with IMP. This implies that the deregulation of the Nigerian economy has a positive impact on productivity and performance of the Nigerian Industrial sub-sector.

Therefore the staged deregulation during SAP period down to Yar'Adua administration depicted positive (23.23) while inflation rate has a positive and significant relationship with IMP. The implication of this finding is that high inflation rate exerts a substantial impact on IMP. The speed of adjustment to equilibrium in IMP is very fast at 81% (See Table 4). The second step of the Engle-Granger procedure suggests the existence of an error correction mechanism as the coefficient of the lagged residual term is negative. A negative coefficient is to be expected if there exists a co-integrating relationship between the variables (Engle-Granger Theorem). The results are summarized in table 2.

CONCLUSION AND RECOMMENDATIONS

The study was an attempt to investigate the relationship between index of manufacturing production and determinants of productivity for optimal performance in the industrial sector. From the error correction model, the following conclusions were drawn. First, interest rate spread and exchange rates have negative impact on the growth of manufacturing sub-sector in Nigeria. This collaborates with other earlier studies on manufacturing performance. Second the study shows that rising in the index of manufacturing sub-sector is a reflection of high inflation rate and cannot be interpreted to mean a real growth in the sector. Thirdly, the study empirically reveals that liberalization of the Nigerian economy has promoted manufacturing growth between 1981 and 2010. Lastly, the findings are further reinforced by the presence of a long-term equilibrium relationship, as evidenced by the co-integration. The coefficient of the error correction term is negative, significant and less than one, which is appropriate. The result justifies the use of ECM specification of the model.

On the basis of these findings, the following recommendations are hereby proffered. Government must create “enabling environment” in the area of infrastructures and other rights for manufacturers and industrialists. The establishment of Microfinance Banks (former Community Banks), Small and Medium Industries Equity Investment Scheme (SMIEIS), Small and Medium Enterprises Development Agencies of Nigeria (SMEDAN), Bank of Industry (BOI) should be overhauled for development and improvement in the local production. Central Bank of Nigeria through Bankers Committee should ensure that the disbursement of the SMIEIS’ fund for manufacturing firms and industries are not diverted to private purses. High cost of borrowing is due to high Interest Rate Spread. There should be a cut in IRS that is reduction in the margin between lending and deposit rates. Jonathan administration need to extend the lapsed five-year (2003-2007) scheduled National Economic Empowerment and Development Strategy (NEEDS) to 2015 in order to fully open the Nigerian Industrial sub-sector to the world and set a straightforward roadmap for Nigeria to be highly industrialized by 2020. Loans from the Nigerian Industrial Development Bank (NIDB) and the Nigerian Export-Import Bank (NEXIM) need to be softened for local and infant manufacturer/exporter’s assessment. The Nigerian quality control body, Standard Organization of Nigeria (SON) needs double efforts to maintaining best quality products. The Association of Nigerian Exporters must be empowered to penetrate foreign markets.

Finally, recommendations for further research can be done in the following areas; macroeconomic variables and the productivity of the manufacturing sector: a panel data analysis, productivity in the Nigeria manufacturing sub-sector and corporate governance and industrial performance in the manufacturing sub-sector.

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