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EXAMINATION OF CAUSAL RELATIONSHIP BETWEEN TRADE OPENNESS, EXCHANGE RATE CHANGES AND MANUFACTURING CAPACITY UTILIZATION

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Abstract

A major policy challenge for open developing economies is determination of an optimal exchange rate consistent with their economic development objectives. These economies are characterized by heavy dependence on commodity exports while relying extensively on consumer and industrial goods imports. This translates to massive outflow of foreign exchange from developing economies to industrialized nations thereby impeding the capacity of developing nations to build a robust domestic production base. This study examines the channel of transmission of impact between manufacturing capacity utilization, exchange rate and trade openness using the Granger causality estimation technique. Interest rate and inflation rate were introduced as control variables. The study covers the period 1986-2013. The study did not produce evidence of causal relationship between exchange rate andmanufacturing capacity utilization and between trade openness and manufacturing capacity utilization. However, there is evidence of unilateral causation from inflation rate to manufacturing capacity utilization. The study recommends that policies which support moderate levels of inflation be implemented.

Keywords: Manufacturing Capacity Utilization, Trade Openness, Exchange Rate Changes, Manufacturing Sector
JEL Classification Code: E60; O11; O14

1. Introduction

The basic objectives of developing the manufacturing sub-sector of an economy include the need to reduce the level of unemployment, satisfy local consumption and thereby stabilize foreign exchange rate through reduction in the importation of goods and expansion of manufactured goods export. In Nigeria however, none of these has been accomplished partly because the sub-sector is heavily dependent on the importation of inputs (machinery and equipment, raw materials, technology and spares) for the maintenance and expansion of its operations and partly because of lack of domestic capacity to support domestic consumption. Lack of capacity for domestic production leads to massive importation of all manner of foreign products and by implication massive outflow of foreign exchange required to support domestic manufacturing.

The manufacturing sub-sector in Nigeria has remained largely underdeveloped and has therefore not effectively delivered on its growth and development functions in spite of various government policy initiatives aimed at promoting its performance. Government efforts at revamping the manufacturing sub-sector and reposition it as the bedrock of industrial development through policy initiatives like the establishment of the Bank of Industry (BOI), Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), etc. and even the recent establishment of intervention funds like the N200 billion Small and Medium Scale Enterprises Credit Guarantee Scheme (SMECGS) in 2010, the N200 billion Restructuring/Refinancing Facility (RRF) to the manufacturing sub-sector also in 2010, etc. have not impacted significantly on capacity utilization in the sub-sector. Interest and exchange rate reforms have also not enhanced the operations of manufacturers in Nigeria.

Evidence on the performance of the sub-sector in Nigeria shows that since the attainment of political independence, it has, on the average, contributed less than 7 per cent annually to the Nigerian economy (National Bureau of Statistics, 2011). Average capacity utilization in the sub-sector stood at an annual average of about 50.08 per cent over the period 1975-2013but declined to 44.22 per cent in the post-reform period of 1986-2013(Central Bank of Nigeria, 2014).

Being largely dependent on trade flow, which is largely foreign-oriented, for the sustenance and expansion of its operations, it has often been argued that the sub-optimal performance of manufacturing in Nigeria may be linked to movements in key indicators of trade flow like exchange rate and trade openness. Economic theory, for instance, lends support to the argument that for an open economy, changes in exchange rate affect the performance of domestic manufacturing. Also, theory suggests that trade policy equally affects the capacity of an economy to produce.

This paper provides empirical evidence on the causal relationshipbetween these macroeconomic indicators and manufacturing performance in Nigeria. Specifically, it examines the nature of causation between the key variables (exchange rate and trade openness) and manufacturing capacity utilization in Nigeria. Interest and inflation rates were adopted as control variables. Empirical studies related to the subject area largely based on regression analysis. See for example Okoye, Okorie, and Nwakoby (2017), Modebe, Okoye, and Ahmed (2017), Adedokun (2012), Ehinomen and Oladipo (2012), Opaluwa, Umeh and Ameh (2010), Maduabuchi and Ajudua (2014), etc. for the link between exchange rate and manufacturing capacity utilization; Okoye, Okorie, and Nwakoby (2017), Modebe, Okoye, and Ahmed (2017), Umer and Alam (2013), Ehinomen and Da 'Silva (2014), Wong (2009), Umoh and Effiong (2013), etc. for relationship between trade openness and manufacturing capacity utilization; Okoye (2006), Ehinomen and Da 'Silva (2014), Obamuyi (2009), etc. for the link between interest rate and manufacturing capacity utilization; Simon and Bulman (2003), Faria and Carneiro (2001), Umaru and Zubairu (2012), etc. for inflation-manufacturing capacity utilization nexus.

Also, studies that explored causal relationships between these economic indicators are not only scant but present mixed results. For instance,Okoye and Nwakoby (2015) present evidence of uni-directional causality from manufacturing capacity utilization to exchange rate and from manufacturing capacity utilization to interest rate with no causal relationship between manufacturing capacity utilization and trade openness, as well as between inflation and manufacturing capacity utilization. With regard to inflation and output, while Hussain and Malik (2011) present evidence of uni-directional causal impact of inflation on output growth, Umaru and Zubairu (2012) report that output growth causes movement in inflation but not vice versa.

2. Review of Related Literature

Prior to the introduction of the structural adjustment programme (SAP) in 1986, Nigeria operated a fixed exchange rate policy regime. The

period was characterized by relative stability of exchange as well as high rates of manufacturing capacity utilization. Between 1975 when the compilation of the manufacturing capacity utilization dataset commenced in Nigeria up to 1982, annual capacity utilization in the manufacturing sub-sector averaged 73.01 per cent (Central Bank of Nigeria, 2015). It is argued that the domestic currency during this period was over-valued relative to tradable currencies like the US dollar in order to promote rapid industrialization through cheap importation of manufacturing inputs (Obadan, 2006). There was however a significant drop in manufacturing capacity utilization between 1983 and 1985 due, largely, to the crash in the international oil market during the period which drastically reduced inflow of foreign exchange into the country.

Following thederegulation of the mechanism for determination and management of exchange ratethrough the introduction of the structural adjustment programme, exchange rate was based on the dynamics of demand and supply conditions. Under the deregulated regime exchange rate fluctuates according to demand and supply conditions and the behaviour of exchange rate during the period can bedescribed as volatile (Mordi, 2006). It is argued that exchange rate volatility distorts demand and supply conditions thereby impeding the capacity of manufacturers to plan and optimize capacity utilization. Adoption of the floating or variable exchange rate generated adjustments in foreign exchange rates which led to generalized increases in prices because of the high import content of our domestic manufacturing facilities (Federal Government of Nigeria, 1989). Under the emerging scenario, locally produce goods became expensive relative to their foreign counterparts and consumer patronage shifted to cheap imported brands.Secondly, the devalued exchange rate under the regime rendered domestic exports cheaper but Nigeria could not profitably exploit the situation due to lack of domestic capacity to produce for export at the cheaper export prices (Ude, 1996).What a double jeopardy? Sanger and Wine (2010) contend that China adopted currency devaluation as a strategy for boosting domestic production and that following from its success, Brazil and Japan also adopted the same strategy.

Okafor (2000) explains that the high import content of manufacturing in Nigeria is strongly linked to issues of industrialization strategy adopted in the post-independence period which favoured the adoption of the large-scale industrialization instead of the small-scale industrialization strategy. The chosen strategy Okafor argues, involves the establishment of fully integrated, strategically located large scale industries that were unduly dependent of imported raw materials and technology which rather than achieve the objective of high value-added industrialization became heavy foreign exchange guzzlers. Also, these industries were based on sophisticated technology which existing industrial infrastructure could not sustain.

Nwankwo (1984) however argues that the inability to develop the manufacturing sub-sector of the economy stemmed from the manner of allocation of foreign exchange among competing uses. According to Nwankwo (1984), available foreign exchange was exhausted through indiscriminate allocation among competing uses such that continued inflow of essential raw materials could not be maintained.

It is also argued that trade openness constitutes an impediment to optimal manufacturing capacity in Nigeria. Abdul (2011) contends that the Nigerian economy is too open to sustain local production because indigenous companies cannot compete favourably with their foreign counterparts. Unbalanced competition may not only force some firms out of business but may also discourage new entrants. Yaqub (2010), for instance, contends that the decline in the real GDP in 1978 is strongly linked to the liberalization of import controls in 1976 which threatened the domestic production of the agricultural and manufacturing sub-sectors.

The Manufacturers Association of Nigeria (2006) attributes the low capacity utilization in Nigeria to, among others factors, the ECOWAS Common External Tariff (CET) which took effect during the period and opened the market unduly to foreign goods thereby creating stiff competition for local industries which are already cost disadvantaged. The lack of patronage for locally produced goods is identified as a factor in low capacity utilization in Nigeria.

Sanni (2009) contends thattrade liberalization has not yielded positive resultsin most developing countries, including Nigeria, owing to obvious challenges posed to real sector growth by weak infrastructure, policy inconsistency, hostile operating environment, all of which manifest in the high cost of production and thereby uncompetitive output. Shafaeddin (1994) adds that developing nations are marginalized in international trade because they are unduly dependent on primary production and exports. They depend largely on commodity exports while relying extensively on imports of consumer and industrial goods (Okafor,

2011). These arguments point to the fact that trade openness may likely not benefit all nations equally.

However, proponents of trade liberalization argue that openness to trade promotes rapid industrial growth through increased competition. Edwards (1998) argues that countries with lower degrees of protection (higher degree of openness) tend to grow faster than those with higher degrees of restriction. Also, Harrison (1996) contends that trade openness enhances access to imported production inputs (raw materials, machinery, spare parts, labour, etc.), increases the scope of market for domestic products thereby raising return on innovation and facilitating a country's specialization in research-intensive production.

Scholars have over the years engaged in this area of research to develop manufacturing and re-position it as the engine of growth and economic development. However, these studies have produced mixed results. Adedokun (2012) and Ngandu (2008) studied exchange rate fluctuations and manufacturing employment in Nigeria and South Africa. The results show significant positive effect of exchange rate on manufacturing employment.On the other hand, Frenkel (2004) examined the effect of exchange rate fluctuations on manufacturing employment using data for Argentina, Brazil, Chile and Mexico. The study presents evidence of significant negative effect of movements in exchange rate on manufacturing employment for all the countries. Also, Branson and Love (1998) report a negative effect of exchange rate variations on manufacturing employment for United States of America. These studies relate to the current study because capacity utilization creates employment. Higher rate of capacity utilization creates more jobs.

Ehinomen and Oladipo(2012) examined the relationship between exchange rate management and manufacturing performance in Nigeria. They find that exchange rate appreciation significantly promotes manufacturing in Nigeria. This result is valid because currency appreciation makes imports cheaper. This enhances the capacity of home industries to import inputs needed for production, leading to increase in capacity utilization.

Opaluwa, Umeh and Ameh (2010) studied the effect of exchange rate fluctuations on the Nigerian manufacturing sector over the period 1986-2005. The study finds non-significant negative effect of exchange rate on manufacturing GDP. Another study by Maduabuchi and Ajudua (2014) on exchange rate and manufacturing performance in Nigeria however reveals significant negative impact of exchange rate on manufacturing GDP.

Okoye, Okorie, and Nwakoby (2017), examined the effect of economic liberalization on the performance of the industrial sector in Nigeria. Data for the period 1986-2013 were analyzed using the vector error correction model regression technique. The study shows that exchange rate changes and trade openness have significant positive effect on industrial output growth.

Lawal (2016) examined the effect of exchange rate fluctuations on manufacturing output in Nigeria. The study produced evidence of non-significant positive effect of exchange rate fluctuations on the output of the manufacturing sector in Nigeria. A similar study, though based on aggregate output, conducted by Dada and Oyeranti (2012) also did not produce evidence of a positive relationship between exchanges and output growth.Adeniran, Yusuf and Adeyemi (2013) also present evidence of non-significant positive relationship between exchange rate and GDP growth.

Okoye and Nwakoby (2015) examined the influence of finance and macroeconomic variables on manufacturing capacity utilization using the econometric technique of vector auto-regression (VAR). The variance decomposition result shows that exchange rate, interest rate and term of trade have significant negative effect on manufacturing capacity utilization. Also, the granger causality test shows uni-directional causal effect of manufacturing capacity utilization on exchange rate and manufacturing capacity utilization on interest rate.

Rodriguez and Diaz (1995) estimated a six-variable VAR model using data on output, real wage growth, exchange rate depreciation, inflation, monetary growth and the Solow residuals to decompose the movements of national output in Peru. They find that output growth is driven by its own shocks but was also negatively affected by movements in exchange rate.

In another Latin American study, Rogers and Wang (1995) analyzed movements in Mexican output, estimating a five-variable VAR model using data on output, government expenditure, inflation, exchange rate and monetary growth. They find their most variations in Mexican output arise from its own shocks. They also find that exchange rate depreciation contracts output.

Akpan and Atan (2012) examined the effects of exchange rate movements on economic growth in Nigeria using quarterly data over the period 1986-2010. They estimate a relationship between output, exchange rate, inflation rate and money supply using both the simultaneous equation model and a generalized method of movements. They find that there is no evidence of a strong relationship between output growth and exchange rate movements. They observe, rather, that Nigeria's economic growth has been directly affected by monetary variables.

Okonkwo (2012) studied the determinants of capacity utilization in the Nigerian manufacturing sub-sector using data over the period 1980 to 2009. Inflation rate, exchange rate, ratio of government expenditure to GDP, commercial bank loans and advances to the manufacturing sub-sector and electricity generation and consumption in the sub-sector were used as the independent variables while average manufacturing capacity utilization was the dependent variable. Employing the OLS estimation technique, evidence presented in the study shows that exchange rate, government capital expenditure in relation to GDP, and commercial bank loans and advances to manufacturing have positive influences on manufacturing capacity utilization.

Modebe, Okoye, and Ahmed (2017), examined the nexus between exchange rate movements and manufacturing capacity utilization in Nigeria using the econometric technique of vector error correction model. The study shows that trade openness and exchange rate have significant positive effect on manufacturing capacity utilization in the short and long-run estimation periods. The study also produced evidence of long-run significant positive effect of interest rate and inflation rate on capacity utilization in the manufacturing sector but their short-run estimates were not significant.

Ndebbio (1990) examined the determinants of absorptive capacity in the oil-based Nigeria economy over the period 1960-1980. Employing the OLS method of estimation, he finds that availability of foreign exchange, labour, infrastructure; among other factors, are major determinants of manufacturing capacity utilization.

Fabayo (1981) investigated the determinants of industrial capacity utilization in the Nigerian economy. A descriptive analysis of the primary data generated shows that weak domestic demand, inadequate power supply, spare parts constraints, raw material constraints and problems associated with shift work significantly account for capacity underutilization in the Nigerian manufacturing sub-sector.

Yaqub (2010) studied the effect of exchange rate changes on the output performance of the agricultural, manufacturing and services sectors of the Nigerian economy. Data for the period 1970-2007 were analyzed using the modified IS-LM (goods market-money market) framework, estimating the behavioural equation as a system using the seemingly unrelated regression estimation (SURE) technique. The results indicate that exchange rate has significant contractionary effects agricultural and manufacturing sectors while it has an expansionary effect on the services sector

Berman, Martin and Mayer (2012) examined the reactions of manufacturers to changes in exchange rate over an 11-year period, 1995-2005. They find that high performance firms react to depreciation by increasing significantly their mark-up and at the same increasing less their export volume. The implication of the finding is that not only is there an increase in output price but there is also a contraction of production capacity.

Umer and Alam (2013) examined the effect of trade openness and foreign direct investment on industrial sector growth in Pakistan over the period 1960-2011. The study presents evidence of significant negative effect of trade openness on industrial sector growth as well as significant positive impact of foreign direct investment on industrial growth.

Ehinomen and Da'Silva (2014) investigated the impact of trade openness on output growth in Nigeria. The result of the study indicates a significant positive impact of trade openness on output growth in the short-run. However the squared term of the openness ratio (a proxy introduced to capture the long-run impact) shows negative impact in the long-run. The implication of this result is that in the short-run, trade openness promotes output growth but it becomes an impediment to output growth in the long-run.

Wong (2009) examined the relationship between productivity and openness to determine whether Ecuador's trade liberalization in the 1990s promoted growth of productivity. The study shows significant positive effect of trade openness on production of export-oriented industries in the post reform period. However, productivity was shown to decline after 2000.

Umoh and Effiong (2013) studied the impact of trade openness on the performance of the

manufacturing sub-sector in Nigeria over the period 1970-2008. They find significant positive impact of trade openness on manufacturing performance in Nigeria.

Edwards (1992) investigated the relationship between trade orientation and economic growth in developing economies. He finds evidence of positive relationship between trade openness and economic growth. Krueger (1997) examined the relationship between trade policy and economic development. The study also documents evidence of positive relationship between trade openness and economic development,

Rodriguez (2000) studied the effect of trade openness on the output of an open economy using 1996 data from 106 countries. According to the author, 1996 was chosen for the study because it was the nearest period of which complete data for a large number of countries existed. Employing the ordinary least square (OLS) regression of trade openness on the logarithms of GDP and GDP per capita, he finds strong empirical support for a positive relation between per capita GDP and trade openness based on the assumption that GDP per capita and protection are negatively related. The study also shows a strong negative association between GDP (size) and trade openness.

Okoye (2006) studied the effect of interest rate on the productive activities ofselected manufacturing industries in Nigeria. Major findings of the study include evidence of significant positive relationship between interest rate and saving, as well as evidence of significant negative relationship between interest rate and bank credit. The negative relationship between interest rate and bank credit implies that high interest rate contracts manufacturing capacity.

Obamuyi (2009) investigated the relationship between interest rate and economic growth in Nigeria using times-series data covering the period 1970-2006. He finds that real lending rates have significant positive effect on economic growth.Ehinomen and Da'Silva (2014) also find significant positive impact of interest rate on output growth in Nigeria.

Adebiyi and Obasa (2004) examined the impact of interest rate policy on the financing of the Nigerian manufacturing sub-sector using annual data over the period 1970-2002. They find that high interest rate impacts negatively on the growth of the sub-sector in Nigeria. Another study by Maduabuchi and Ajudua (2014) also presents evidence of negative impact of interest rate on manufacturing GDP in Nigeria.

Akpokerere (2012) examined the effect of bank lending rates on the profitability of manufacturing companies in Nigeria using secondary data on six manufacturing companies. He finds that bank lending rates have no negative effect on the operations on the selected companies as they still declare huge net profits in spite of prevailing high interest rates.

Gbadamosi (1989) studied the effect of high interest rates on economic development in a deregulated Nigerian banking system. He finds that even though high interest rates stimulate the supply of deposits (savings), it discourages borrowing for productive investment.

Hussain and Malik (2011) investigated the relationship between inflation and economic growth in Pakistan using annual data over the period 1960-2006. Employing Granger causality test, they find a unidirectional influence from inflation to economic growth.

Paul, Kearney and Chowdhury (1997) examined the link between inflation and economic growth using annual data over the period 1960-1987 on 70 countries (48 developing and 22 developed nations). They find evidence of negative relationship in some countries and evidence of positive relationship in others.

Faria and Carneiro (2001) investigated the relationship between inflation and economic growth using data from Brazil. They find that in the short-run, inflation impairs economic growth. Evidence of negative relationship between inflationand economic growth exists also in Smyth (1992) which estimates that each of percentage point increase in theUSAinflation rate reduces the country's annual growth rate by 0.223 per cent. Smyth (1994) also shows that each one percentage increase in inflation rate reduces America's output growth by 0.158 per cent. Smyth (1995) also shows that a 10 per cent increase in inflation rate reduces total factor productivity growth in Germany by 0.025 per cent.

Simon and Bulman (2003) studied the effect of inflation on productivity growth in Australia adopting an industry-level approach. They find clearly significant results, with industry-level inflation explaining industry productivity. The authors find, however, that the relationship varies by industry, with the strongest evidence of a negative relationship being found in the cases of

industries dominated by large firms (concentrated industries). Finally they find that the negative effects of inflation do not operate solely through a reduction in capital accumulation but also through a reduction in multifactor productivity growth.

Umaru and Zubairu (2012) investigated the effect of inflation on the growth and development of the Nigerian economy using time-series data for the period 1970 to 2010. A single equation, bivariate regression model was employed with GDP as the dependent variable and inflation as the independent variable. Causality test was also conducted to determine evidence of causation between inflation and economic growth. Evidence presented in the study shows that inflation exerts a positive influence on output though the magnitude of the influence is not significant. The causality test also shows that GDP granger-causes inflation but not vice versa.

From the above review, it was observed that results of previous studies on the subject area are mixed. Some studies report positive effect of exchange rate fluctuations on manufacturing capacity utilization (see, Modebe, Okoye, and Ahmed, 2017; Adedokun, 2012; Ngandu, 2008; Ehinomen and Oladipo, 2012; Okonkwo, 2012) while some others document evidence that fluctuations in exchange contract capacity utilization in manufacturing industries (Frenkel, 2004; Branson and Love, 1998; Maduabuchi and Ajudua, 2014; Berman, Martin, and Mayer, 2012; Okoye and Nwakoby, 2015). Studies by Opaluwa, Umeh, and Ameh (2010) and Lawal (2016) show non-significant impact of exchange rate on manufacturing capacity utilization. Also while Umoh and Effiong (2013); Modebe, Okoye, and Ahmed (2017),Okoye, Okorie, and Nwakoby(2017) find positive impact of trade openness on manufacturing capacity utilization, Umer and Alam (2013) present evidence of negative impact of trade openness on manufacturing capacity utilization.

With regard to the link between interest rate and manufacturing capacity utilization, while Akpokerere (2012) and Modebe, Okoye, and Ahmed (2017) report positive impact of interest rate on manufacturing capacity utilization, Okoye (2006), Okoye and Nwakoby (2015), and Maduabuchi and Ajudua (2014) find that interest rate and manufacturing capacity utilization move in opposite directions.

For studies based on aggregate output (GDP), Rodriguez and Diaz (1995), Rogers and Wang (1995) and Yaqub (2010) find negative impact of exchange rate on output while the result of Adeniran, Yusuf and Adeyemi (2013) is not significant. Somestudies show short-run positive and long-run negative effect of trade openness on output (Wong, 2009; Ehinomen and Da 'Silva, 2014). Also, Edwards (1992) and Krueger (1997) present positive impact of trade openness on output while Umer and Alam (2013) report negative impact.

The review also shows that studies by Obamuyi (2009) and Ehinomen and Da 'Silva (2014) find positive effect of interest rate on aggregate output while Adebiyi and Obasi (2004) and Gbadamosi report negative impact of interest rate on output.Similarly, while Umaru and Zubairu (2012) show positive impact of inflation on national output, studies by Faria and Carneiro (2001), Smyth (1992, 1994, and 1995), Simon and Bulman (2003) produce evidence of negative impact of inflation on national output.A cross country study by Paul, Kearney and Chowdhury (1997) reports positive effect of inflation on output for some countries and negative effect for some others.

Review of empirical literature suggests paucity of research works with respect to causal relationships between these economic indicators. Available evidence however showsuni-directional causality from manufacturing capacity utilization to exchange rate and from manufacturing capacity utilization to interest rate with no causal relationship between manufacturing capacity utilization and trade openness, as well as between inflation and manufacturing capacity utilization (Okoye and Nwakoby, 2015). With regard to inflation and output, the results are mixed.While Hussain and Malik (2011) present evidence of uni-directional causal impact of inflation on output growth, Umaru and Zubairu (2012) report that output growth causes movement in inflation but not vice versa.

3.0 Methodology

The study examines the relationship between manufacturing capacity utilization, exchange rate, trade openness, interest rate and inflation so as to determine evidence of causation among these indicators of economic performance. Quantitative research technique based on ex-post facto research design was adopted for the study. Time series data on the selected macroeconomic variables covering the period 1986-2013 shall be sourced essentially from the publications of the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS) and the Manufacturers Association of Nigeria (MAN). Essentially the decision on the variables to be included in the study was guided by data availability as well as theoretical justification.

A vector analysis of the data was conducted using the Granger causality technique in order to determine which variable influences the behaviour of the other.

3.1 Model Specification

The Granger causality model comprises of a series of equations designed to test for causation between the dependent and independent variables. The model tests the hypothesis thatthere is no causality between manufacturing capacity utilization in Nigeria andthe macroeconomic variables namely, exchange rate, interest rate, inflation rate and trade openness. It is specified in the generic form as follows:

$$\Delta Y_{t-1} = \propto_0 + \sum_{J=1}^{m} \beta_i \, \Delta x_{t-i} + \mu_t$$

The model is further decomposed into its constituent parts as follows:

$$\Delta MCUR_t = \propto_0 + \sum_{J=1}^{m} \beta_1 \, \Delta MCUR_{t-i} + \sum_{J=1}^{m} \lambda_1 \Delta EXR_{t-i} + \sum_{J=1}^{m} \Psi_1 \Delta IR_{t-i} + \sum_{J=1}^{m} \theta_1 \Delta INF_{t-i} + \sum_{J=1}^{m} \gamma_1 \Delta OPEN_{t-i} + \mu_t$$

$$\Delta EXR_t = \propto_0 + \sum_{J=1}^{m} \beta_2 \, \Delta MCUR_{t-i} + \sum_{J=1}^{m} \lambda_2 \Delta EXR_{t-i} + \sum_{J=1}^{m} \Psi_2 \Delta IR_{t-i} + \sum_{J=1}^{m} \theta_{21} \Delta INF_{t-i} + \sum_{J=1}^{m} \gamma_2 \Delta OPEN_{t-i} + \mu_t$$

$$\Delta IR_t = \propto_0 + \sum_{J=1}^{m} \beta_3 \, \Delta MCUR_{t-i} + \sum_{J=1}^{m} \lambda_3 \Delta EXR_{t-i} + \sum_{J=1}^{m} \Psi_3 \Delta IR_{t-i} + \sum_{J=1}^{m} \theta_{31} \Delta INF_{t-i} + \sum_{J=1}^{m} \gamma_3 \Delta OPEN_{t-i} + \mu_t$$

$$\Delta INF_t = \propto_0 + \sum_{J=1}^{m} \beta_4 \, \Delta MCUR_{t-i} + \sum_{J=1}^{m} \lambda_4 \Delta EXR_{t-i} + \sum_{J=1}^{m} \Psi_4 \Delta IR_{t-i} + \sum_{J=1}^{m} \theta_4 \Delta INF_{t-i} + \sum_{J=1}^{m} \gamma_4 \Delta OPEN_{t-i} + \mu_t$$

$$\Delta OPEN_t = \propto_0 + \sum_{J=1}^{m} \beta_5 \, \Delta MCUR_{t-i} + \sum_{J=1}^{m} \lambda_5 \Delta EXR_{t-i} + \sum_{J=1}^{m} \Psi_5 \Delta IR_{t-i} + \sum_{J=1}^{m} \theta_5 \Delta INF_{t-i} + \sum_{J=1}^{m} \gamma_5 \Delta OPEN_{t-i} + \mu_t$$

Where:
MCUR = Manufacturing capacity utilization rate
EXR = Exchange rate
IR = Interest rate
INF = Inflation rate
OPEN = Trade openness

α = Constant

$\beta, \lambda, \psi, \theta, \gamma$=Coefficients to be estimated

μ_{it}= Error term

4.0 Data Analysis and Discussion of Results

4.1 Basic Statistical Description of Data

Table 1: Descriptive Statistics

	MCU	EXRV	INTR	INFL	OPEN
Mean	44.21750	14.53714	20.80107	21.01429	41.67286
Median	42.55000	7.295000	20.17000	12.70000	41.78000
Maximum	58.92000	68.89000	30.50000	78.00000	78.36000
Minimum	29.29000	0.020000	11.25000	5.400000	11.14000
Std. Dev.	9.468692	19.06519	3.916372	18.72020	16.78073
Skewness	-0.024483	1.530367	0.466801	1.594381	0.034805
Kurtosis	1.611443	4.238585	3.832782	4.645805	2.367819
Jarque-Bera	2.252236	12.71922	1.825995	15.02303	0.471914
Probability	0.324290	0.001730	0.401319	0.000547	0.789815
Sum	1238.090	407.0400	582.4300	588.4000	1166.840
Sum Sq. Dev.	2420.716	9813.995	414.1253	9462.034	7603.010
Observations	28	28	28	28	28

Source: Compiled by the Authors

From table 1, it was observed that average manufacturing capacity utilization in Nigeria during the period of this study (1986-2013) was about 42.22 per cent. During this same period, the mean values of exchange rate changes as well as movements in interest rate, inflation rate and trade openness are 14.54 per cent, 20.80 per cent, 21.01 per cent and 41.67 per cent respectively. During the period, manufacturing capacity utilization fluctuated between 29.3 per cent and 58.9 per cent while exchange rate fluctuated between 2 per cent and 68.9 per cent. Also, the table shows that lending rate hovered between 11.3 per cent and 30.5 per cent while inflation rate was lowest at 5.4 per cent highest at 78 per cent. During the period, trade openness had the minimum value of 11.1 per cent and maximum value of 78.4 per cent. A trend analysis of data on the research variables is presented below:

4.2: Trend Analysis

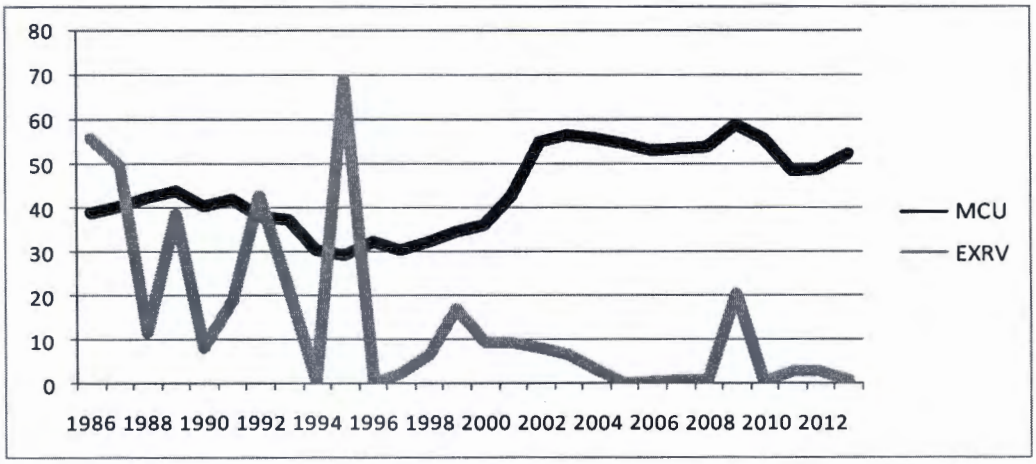

Figure 1: Manufacturing capacity utilization and Exchange rate

The trend analysis of the movements in manufacturing capacity utilization and exchange rate shows high fluctuations in exchange rate between 1986 and 1994 with the most remarkable exchange rate variability recorded in 1995 at 68.8 per cent followed by a sharp decline in 1996. However, manufacturing capacity utilization maintained a smooth decline over these years as shown in the graph. Between 1996 and 2013 exchange rate fluctuation was significantly lower except for 1999 (16.79 per cent) and 2009 (20.42per cent). Within these periods manufacturing capacity utilization witnessed a consistent increase until 2008 when it peaked at almost 60 per cent.

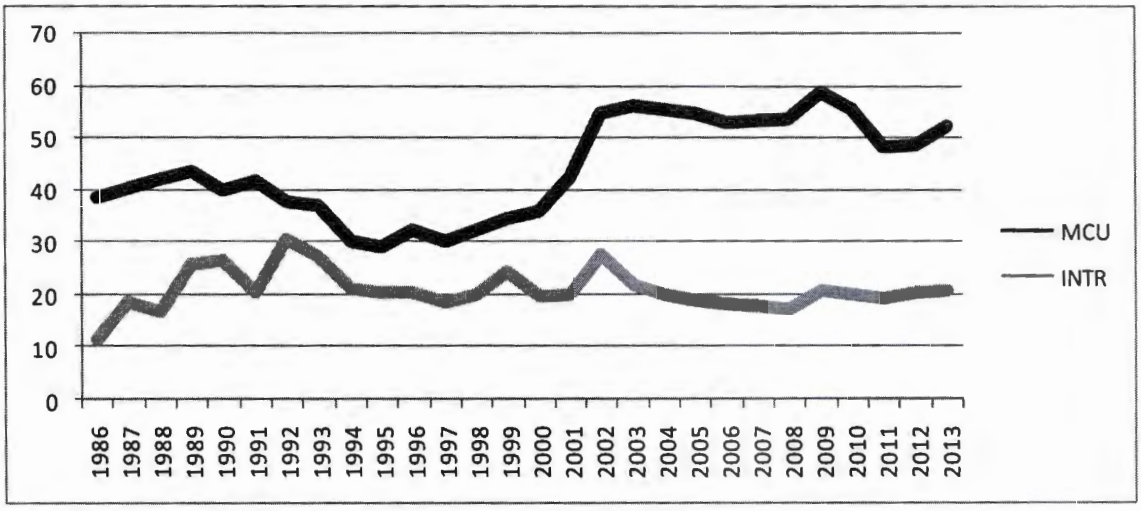

Figure 2: Manufacturing capacity utilization and Interest rate

Figure 2 shows the trend in the behavior of manufacturing capacity utilization and interest rate over the period 1986-2013. The figure shows that between 1990 and 1999 manufacturing capacity utilization, on the average, recorded a steady decline while interest rate showedan upward movement. The figure also shows an increase in manufacturing capacity utilization between 2000 and 2013 while interest rate maintained a downward movement during the period.

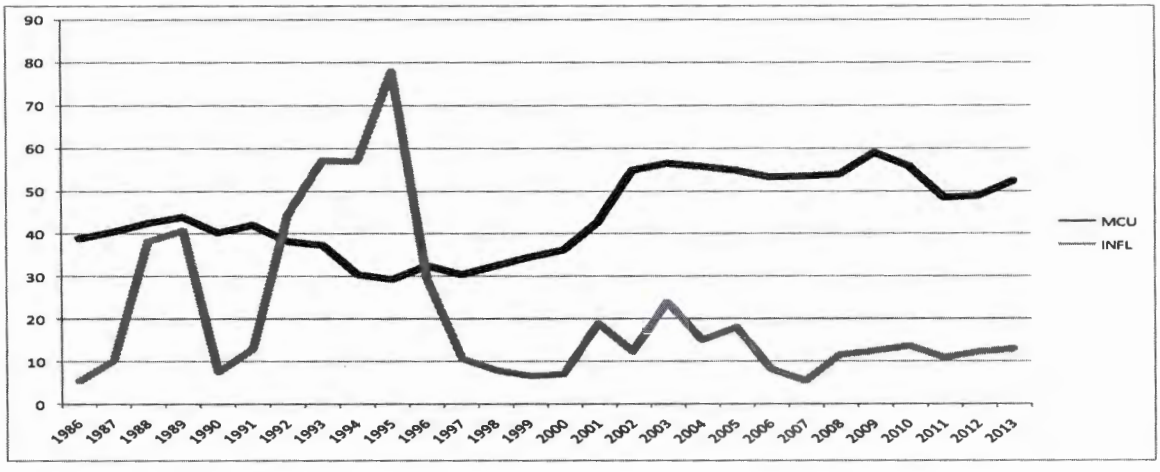

Figure 3: Manufacturing capacity utilization and Inflation rate

The graphical illustration of the relationship between manufacturing capacity utilization and inflation rateshown in figure 3 suggests a negative association between inflation rate and manufacturing capacity utilization. The figure shows that the highest level of inflation attained in 1995 (78 per cent) coincides with the lowest level of manufacturing capacity utilization rate of about

30 per cent Between 2000 and 2013, manufacturing capacity utilization maintained, on the average, a rising trend while the reverse was the case for inflation rate.

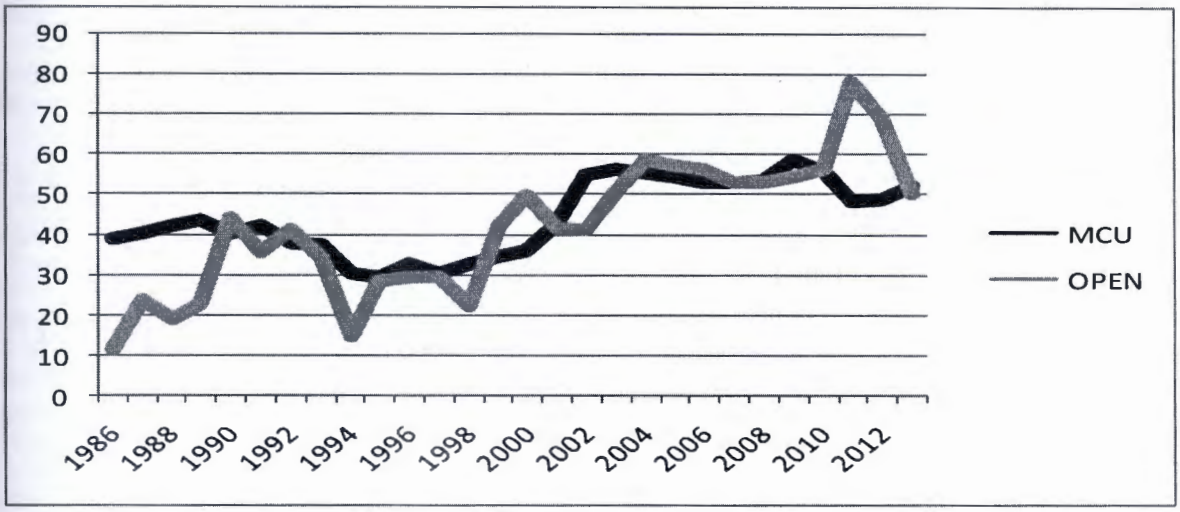

Figure 4: Manufacturing capacity utilization and trade openness

Figure 4 shows that the relationship between manufacturing capacity utilization and trade openness is largely inter-woven. It suggests a negative association between them because higher levels of one coincide with lower levels of the other. Higher openness ratios correlate with lower rates of manufacturing capacity utilization and vice versa.

4.3 Econometric Analysis

The results of the econometric tests are presented and interpreted in this section.

4.3.1 Unit Root Analysis

The unit root test was carried out using techniques of the Augmented Dickey Fuller and Phillip Perron tests in order that the data are suitable for policy decisions. The results are presented below:

Table 2: Unit root result derived from Augmented Dickey Fuller test.

Variable	ADF Test @Levels	ADF Critical values at 5% level	Test @ First Difference	ADF Critical values at 5% level	Remark
LMCU	-1.227749	-2.981038	-3.701864	-2.981038	Integrated of order 1
LEXRV	-4.058340*	-2.981038	-9.584792	-2.981038	Integrated of order 0
LINTR	-4.837530*	-2.981038	-4.836890	-2.981038	Integrated of order 0
LINFL	-2.827535	-2.981038	-4.703239	-2.981038	Integrated of order 1
LOPEN	-3.094394*	-2.981038	-5.020677	-2.981038	Integrated of order 0

Source: Author's computation, 2015

Table 3: Unit root result derived from Phillip Perron test

Variable	PP Test @Levels	PP Critical values @ 5%	Test @ First Difference	PP Critical values @ 5%	Remark
LMCU	-1.155508	-2.981038	-3.701864	-2.981038	Integrated of order 1
LEXRV	-4.063298*	-2.981038	-12.93123	-2.981038	Integrated of order 0
LINTR	-4.832721*	-2.981038	-9.890596	-2.981038	Integrated of order 0
LINFL	-2.827535	-2.981038	-5.440659	-2.981038	Integrated of order 1
LOPEN	-3.097207*	-2.981038	-11.08968	-2.981038	Integrated of order 0

Source: Author's computation, 2015

Results of the unit root tests presented in tables 2 and 3 show that for both the Augmented Dickey Fuller and Phillip Perron tests, exchange rate, interest rate and trade openness are stationary at levels while manufacturing capacity utilization and inflation rate show evidence of stationary trend at their first difference.

4.3.2 Co-integration Analysis

Table 4: Co-integration result based on trace and maximum-eigen statistics

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.724290	86.80236*	69.81889	0.0012	None	33.49854	33.87687	0.0554
At most 1 *	0.659246	53.30382*	47.85613	0.0141	At most 1 *	27.99148	27.58434	0.0444
At most 2	0.454694	25.31234	29.79707	0.1506	At most 2	15.76661	21.13162	0.2388
At most 3	0.285545	9.545735	15.49471	0.3173	At most 3	8.742126	14.26460	0.3082
At most 4	0.030435	0.803609	3.841466	0.3700	At most 4	0.803609	3.841466	0.3700

Source: Author's computation, 2015

From the perspective of trace statistics, the co-integration result shows evidence of 2 co-integrating equations while the max-eigen statistic shows the at most 1 co-integrating equation exists. There is therefore evidence of co-integrating relationship in the model, an indication that the variables do not have a tendency to drift apart.

4.3.3 Granger Causality Analysis

Table 5: Granger Causality Result

Null Hypothesis:	Obs	F-Statistic	Prob.
LEXRV does not Granger Cause LMCU	26	1.56965	0.2316
LMCU does not Granger Cause LEXRV		0.91840	0.4146
LINTR does not Granger Cause LMCU	26	2.14669	0.1418
LMCU does not Granger Cause LINTR		0.97175	0.3948

LINFL does not Granger Cause LMCU	26	3.36034	0.0542
LMCU does not Granger Cause LINFL		0.83350	0.4484
LOPEN does not Granger Cause LMCU	26	1.20562	0.3194
LMCU does not Granger Cause LOPEN		1.50895	0.2442

Source: Author's computation, 2015

The result of the Granger causality test shows no evidence of causation between manufacturing capacity utilization and exchange rate in Nigeria. The calculated values of the F-statistic for EXRV-MCU (1.56965) and MCU-EXRV (0.91840) are less than the corresponding critical value (F*= 2.76). Also, the results for interest rate and manufacturing capacity utilization as well as trade openness and manufacturing capacity utilization did not show evidence of causation between them. However, there is evidence of uni-directional causal impact of inflation rate on manufacturing capacity utilization in Nigeria (F = 3.3603 > F* = 2.76) at 10 per cent level of significance. This result implies that changes in the rate of inflation in the economy cause changes manufacturing capacity utilization. The significant impact of inflation on manufacturing performance reported in this study confirms the finding in Hussain and Malik (2011) but contradicts Umaru and Zubairu (2012).

5. Summary of Findings, Conclusion and Recommendation

The Granger causality test showsuni-directional causation from inflation to manufacturing capacity utilization but did not produce evidence of causation between capacity utilization in the Nigerian manufacturing sub-sector and the independent variables (exchange rate, interest rate, and trade openness). Based on the above results, the study concludes that only inflation significantly explains the behaviour of manufacturing capacity utilization in Nigeria.The study recommends that government should monitor movement in inflation rate to ensure it does not go beyond the threshold that supports output growth. Government should pay particular attention to the management of monetary aggregates so as to reduce demand pressure on available goods and services while stabilizing the supply side through increased productivity.

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