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INFLATION AND CAPACITY UTILISATION IN NIGERIA'S MANUFACTURING SECTOR

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ABSTRACT

This study analysed the relationship between inflation and capacity utilisation empirically leaning on the model employed by Baylor (2001). It utilised time series secondary data using least square multiple regression technique. The quarterly data utilised were tested for stationarity using ADF test. The multiple regression results showed a significant negative relationship between inflation and capacity utilisation. This finding was contrary to the economic argument which underpinned the intuition that the relationship between inflation and capacity utilisation should be positive. We also found that although the relationship between the two varied significantly over time, the model revealed that if current capacity utilisation rate doubled, inflation will decline by 3.6 per cent in Nigeria.

Keywords: Capacity utilisation, Inflation, Manufacturing

INTRODUCTION

Different measures of capacity utilisation rates have often been considered as plausible determinant of upcoming inflationary pressures and hence, a useful source of information for monetary policymaking authorities. Despondently, the relationship between the rate of capacity utilisation and inflation has not been found to be consistently and necessarily linear[1]. For example, MacKlem (1997)

[1] The importance of a convex nonlinear relationship between activity and inflation has been noted by Evans (1986), DeLong and Summers (1988), Laxton, Meredith, and Rose (1995) and Laxton, Rose, and Tambakis (1999).

argues that if capacity constraints limit the ability of firms to meet cyclical increases in the overall level of demand, then the short run relationship between output and inflation will tend to have a curved shape and inflation tends to become more sensitive to changes in output given that the cycle of economic activity is high than when it is low.

The danger of imposing linearity on the capacity utilisation-inflation nexus is apparent; empirical coefficients that will emerge from such imposition are bound to be over or underestimated by the prospect of inflation arising from low state of the business cycle as typified by low level of capacity utilisation. Inability to account for non-linearity might thus induce adverse monetary policy reaction functions to hurt inflationary pressures.

The traditional indicators of inflationary pressure have been known to be excess demand occasioned by unchecked and rapid economic growth, leading to cyclical price changes. Another major impulse is a cost strain in the prices, due to increase in the prices of volatile items such as energy. Notably, a commonly held view in economics is that when there is a slack in the economy – that is, labour and capital are not fully employed – the economy can expand without an increase in inflation (Dotsey and Stark, 2005). This idea has a long history in economic theory, with its earliest clear exposition dating back to John Maynard Keynes.

One of the measures of the intensity with which labour and capital are used in the production of output is the capacity utilisation rate.[2] In other words, the capacity utilisation rate is an indicator of how efficiently the factors of production are being used. It therefore implies that when utilisation rate is low, it is assumed that firms can increase employment in response to demand and exhaust their capital capacity without incurring large increases in the costs of production. Also, it follows that firms will not be forced

[2]The capacity utilisation rate is not the only measure that conveys whether resources are underutilised. Other common measures are the output gap and the NAIRU (non- accelerating inflation rate of unemployment).

to raise prices in order to make profits on additional output since output can be increased with little or no inflation.

But recently, the views of analysts have been diverse. While some economists opine that inflationary trends are linked to the existing capacity utilisation in an economy and that when capacity utilisation rises, price inflation will increase. However, others are of the view that the relationship between inflation and capacity utilisation appears to vary over time. An important question for empirical investigation is: do capacity constraints put additional pressure on prices? And, if so, is the impact of such constraints on prices (inflation) sizeable? To date, several studies have investigated the non-linearity in the relationship between real activity and inflation using macroeconomic variables. Interestingly, against received wisdom in the theoretical literature, empirical research has produced mixed findings.

Most studies on inflation in Nigeria focus largely on its determinants, some authors concentrate on the monetary factors, where the emphasis is purely on money growth, while others investigate the impact of monetary and structural forces[3]. Further, some others have examined the subject without considering the level of unemployment of productive resources, believed by Keynes to impact on inflation.[4] This study deviates from the existing approach of identifying a number of factors that relates to inflation by allowing our analysis to capture how the indirect impact of money supply, government expenditure and policies[5] determine the investment of firms. The rationale for this is to allow us examine the problem of inflation from the structuralists' point of view using capacity utilisation as a measure of the level unemployment[6]. The

[3] An example is Egwaikhide and Gabriel (1994)

[4] The Short-run Philip Curve also emphasises the above relationship.

[5] Mojekwu and Iwuji (2011) have demonstrated in their analysis that the rate of capacity utilisation in Nigeria is a reflection of government policies.

[6] Bauer (1990) has shown that capacity utilisation can be viewed as an output-gap model, playing the role usually reserved for the unemployment rate.

essence of this approach is to take into account the interactions in the structural behaviour of firms in the economy, with a view to predicting how firms' decisions affect the level of inflation. Similarly, we also argue that since oil exportation determines about 82 per cent of government expenditure in Nigeria, it captures the effect of government expenditure in our model.

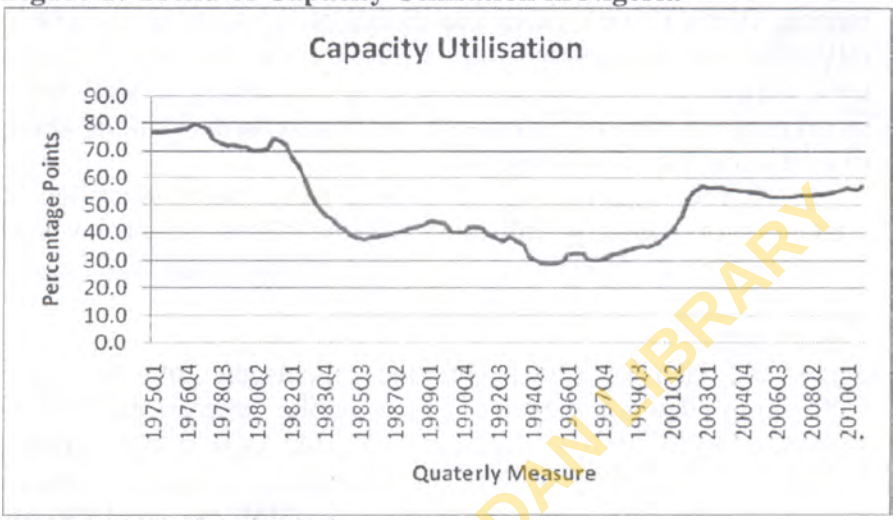
To fill the gap in the literature on inflation-capacity utilisation nexus as identified above, we set out to achieve two objectives. First, to determine the stability of the relationship between capacity utilisation and inflation in Nigeria. Second, establish the impact of capacity utilisation on inflation using quarterly data from 1975 to 2010.

The study is structured as follows. Brief examination of the data for capacity utilisation and inflation forms the background of the study. Next is the review of the literature to properly conceptualise and glean relevant views on the issues of interest. The theoretical framework is then presented constituting the platform for the model employed to carry out the empirical analysis. The last section contains the recommendations and conclusion.

DATA TREND

Capacity utilisation is actual output as a percentage of capacity. Capacity is the maximum output firms could produce with their existing equipment. Capacity is not static because of the fluctuations in demand and the likelihood of equipment breaking down. Thus, firms normally aim to have more capacity than the average level of demand (Black, 2003). Manufacturing capacity utilisation in Nigeria has been dynamic over time. Figure 1 shows how the manufacturing capacity utilisation in Nigeria has fared.

Figure 1: Trend of Capacity Utilisation in Nigeria



Source: CBN Statistical Bulletin

Figure 1 reveals that the manufacturing capacity utilisation rate varies widely and is higher in earlier years. It drops in 1980s and rises from the mid-90s. From 1975 to 2010, capacity utilisation fails to rise beyond 80 per cent.

The problem of the Nigerian manufacturing sector started in the late 1970s when the economy experienced sharp increase in the international oil price. The government responded with the import substitution strategy, tough budgetary and fiscal measures, deregulation of foreign exchange market, abolition of import licenses, and devaluation of the naira.

The effect of these policy measures had little success, as the economy took further steps backward. To stimulate domestic production, the structural adjustment programme (SAP) was initiated in 1986. SAP brought with it escalation in exchange rate, resulting in high cost of raw materials and spare parts. The SAP programme ended up a failure. The harsh economic situation triggered a chain reaction, such as high cost of production, scarcity of raw materials and spare parts as well as huge inventory of unsold goods due to low purchasing power. These factors impacted

negatively on capacity utilisation (Mojekwu and Iwuji, 2011). Indeed, Oluba (2008) traced the causes of the decline in capacity utilisation rate to government's badly chosen economic policies, trade barriers and incessant epileptic power supply as well as the broad range of total infrastructural failure and banks' limited ability to lend to the manufacturing sector.

A few macroeconomic factors have been identified as predictors of capacity utilisation. Eniola (2009) identifies such factors to include: power supply, interest and inflation rates.

Power Supply

Siyan and Ekhator (2001) provide an insight into the gross inefficiency that characterised most public enterprises like the National Electric Power Authority (NEPA) now Power Holding Company of Nigeria (PHCN). The study reveals that the installed capacity of NEPA in the 1980s was 6000MW but by 1990, the available installed capacity dropped to less than 2000MW and has continued to drop since then. Some of the plants available in 1980s were no longer available by 1990. Reasons for the continued drop included inefficiency and corruption. In 1980, there were a total of 76 installed units with total capacity of 6000MW, but by 2001 only 22 units were available with total capacity of 2716.6MW and actual capacity generated was 2278MW. There was 338.6MW of generation loss from available capacity.

By 2011, the installed capacity rose to 8644MW, but the actual capacity was put at 3200MW (Latham and Watkins, 2011). The energy sector in the country has witnessed substantial government under-funding for complementary capital projects and routine maintenance operations which resulted in huge transmission losses. Poor services have forced most industrial customers to install power generators at high costs to their businesses and the Nigerian economy. The chronic shortage of available generating capacity has negatively affected the industrial and manufacturing sectors. With self-generation of power prevalent in the industrial, commercial and domestic subsectors, the electrical energy demand in Nigeria currently estimated at 10,000 MW is not realistically confirmed or validated (FMPS, 2006).

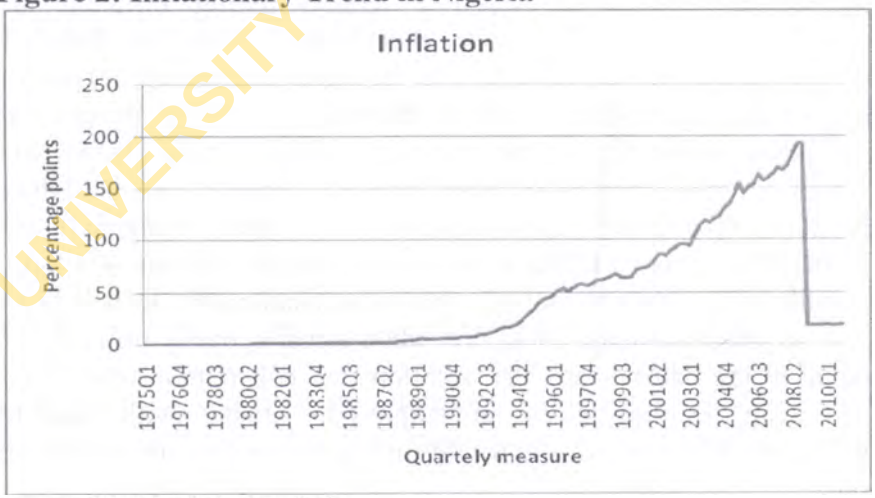
Interest Rate

When banks lend money to a manufacturer, they use depositors' money. The interest charged, currently about 25 per cent of the principal is made up of two components, five per cent to depositors and 20 per cent to cover bank overhead and profit. If this interest is too high as is the case in Nigeria, production cost will also rise and impact negatively on capacity utilisation.

Inflationary Trend

There is a persistent tendency for prices and money wages to increase over time. According to Umo (2007), inflation is a general increase in the level of prices, sustained over a long period of time. Thus, inflation is a macroeconomic phenomenon and does not refer to specific products whose prices may fall or rise during the period under consideration. In other words, it covers the aggregate or basket of goods. It is therefore measured as a ratio of the increase in aggregate price against aggregate price at the base period. Conventionally, inflation rate is expressed in percentage. Figure 2 shows the inflationary trend in Nigeria.

Figure 2: Inflationary Trend in Nigeria



Source: CBN Statistical Bulletin

It can be observed that the inflation rate was insignificant from 1975 to 1987. However, it rose steadily and sharply from 1989 till 2008, which was close to 200 per cent and dropped symmetrically and has been less than 50 per cent till the first quarter of 2010.

LITERATURE REVIEW

While a large body of theoretical and empirical studies has been devoted to the understanding of the determinants and effects of inflation in Nigeria, some (most relating to developed economies) have made efforts to study the relationship between capacity utilisation and inflation. Thus, some studies have leaned on the theoretical models to study empirically the relationship between inflation and capacity utilisation (Bauer, 1990; Garner, 1994; Finn, 1996; Dekock and Nadal-Vicens, 1996; and Baylor, 2001). Observably, the empirical evidence provided by most of these studies is mixed, and a consensus is yet to emerge.

Theoretical Review

McElhattan (1978) developed a theory linking inflation and capacity utilisation. The model that evolved from the theory is composed of two basic structural equations. The first expresses excess aggregate demand as an increasing function of capacity utilisation, while the second relates the rate of change in nominal wages to the expected inflation rate, the growth rate of labour productivity and the excess demand in the labour market. In this formulation, it is clear that when actual capacity utilisation is larger (smaller) than natural rate of capacity utilisation, the inflation rate will increase (decrease), and that when actual capacity utilisation is equal to the natural rate, the inflation rate will remain unchanged. This can be viewed as an output-gap model, with capacity utilisation playing the role usually reserved for the unemployment rate.

An entirely different approach is taken by Tatom (1979), who sets up a partial adjustment model in which changes in

capacity utilisation are the result of monetary surprises. In Tatom's model, money causes inflation, and only monetary surprises cause changes in capacity utilisation. There is no structural link between capacity utilisation and inflation, and the natural rate of capacity utilisation is achieved as a result of an absence of shocks. According to the theory, capacity utilisation adjusts to its equilibrium level at the point of the natural rate of capacity utilisation with a lag, and departures from this point occur as a result of monetary surprises.

Gittings (1989) basically follows McElhattan's (1978) approach, but argues that high capacity utilisation gives rise to inflation. He gives two reasons for the existence of inflationary pressures when capacity utilisation is high. First, as capacity constraints are reached, firms are better able to increase their prices in response to strong demand; however, the customers of these same may find themselves in a similar position. The second argument is that aggregate-demand growth raises the demand and prices for new capital goods, along with the costs of financing those goods, relatively more when there is less idle capital to employ. Thus, over the business cycle, the rental price of capital rises relative to that of labour.

Bauer (1990) argues that the belief that high capacity utilisation levels lead to an accelerated rate of inflation is based on the assumption that high capacity utilisation levels are related to increasing marginal cost of production in the short run. In the long run, high capacity utilisation may prompt new investment, thereby expanding capacity and relieving price pressures. The development of proper framework for examining the endogenous relationship is the most important contribution of this study.

Finn (1996) offers a contrary view to the reasoning that the relationship that exists between capacity utilisation and inflation is theoretically sound. She also shows that utilisation and inflation frequently move together. She tries to provide a theoretical basis for the uncertain behaviour of capacity utilisation and inflation. The theory is based on the standard neoclassical theory advanced by

Kydland and Prescott (1982) and Prescott (1986), which emphasises the importance of technological shocks for the behaviour of real variables such as output, consumption, investment and employment. The author builds on the above to develop a new theory by blending ingredients from various other theories.

The key idea emerging from Finn's (1996) theory is that energy price increases that are sizeable and not accompanied by contractions of money growth will lead to a sharp decline in utilisation hike in inflation. Another variable responsible for negative co-movement between inflation and utilisation is an exogenous change in money. An expansion of money growth directly raises current inflation by reducing the effective return to labour effort. This implies that the marginal productivity of capital utilisation is now low and thus, causes a fall in utilisation. But since the inflation tax on real economic activity is small, the effect of money growth on real variables including inflation is small. Therefore, money growth induces a small amount of negative co variation between inflation and utilisation.

On the other hand, if money growth is allowed to respond significantly and directly, technological shocks utilisation and inflation will move together. The theory's explanation has not only worked in principle, but also met with quantitative success. The major limitation of most of these theoretical expositions is that they did not recognise the possible effects of exogenous shocks[7].

Empirical Review

Asogu (1991) undertook an empirical investigation using ten different specifications that included monetary, structural and open economy aspects of inflation in Nigeria. Variables considered in the regressions include money supply and its lagged value. Others are industrial production index, import price index and the official exchange rate. All variables were expressed in terms of their rate of change. Real output had the right signs in all the models, but was

[7] This does not include Finn (1996)

significant in only one case. Money, prices and exchange rates were significant in all the equations where they featured. In summary, the result of the estimation reveals that real output, especially, industrial output, net exports, current money supply, domestic food prices and exchange rate changes, were the major determinants of inflation in Nigeria. The study therefore affirms the importance of the structural character of the economy, open economy and monetary aspects of inflationary trend in Nigeria

Egwaikhide and Gabriel (1994) submit that Nigerian inflation seems to find explanation in monetary and structural factors and that both the official and parallel markets' exchange rates exert upward pressure on the general price level.

Garner (1994) tries to examine whether capacity utilisation for the US manufacturing sector is still a reliable indicator of inflationary pressures. He concludes that the historical relationship between capacity utilisation and inflation still holds, indicating that capacity utilisation and inflation are reliable indicators of inflationary pressures.

Dekock and Nadal-Vicens (1996) analysed the inflation implications of high levels of capacity utilisation using data from 15 OECD economies. They carried out empirical investigation to ascertain whether capacity utilisation in manufacturing is a reliable inflation indicator over and above economy-wide indictors of inflationary pressures. Three transmission mechanisms through which shocks to manufacturing can impact on inflation are identified as follows:

(i) Direct pressure on producer prices in manufacturing arising from bottlenecks and a downtime in productivity growth at high operating rates.

(ii) Spillovers of manufacturing sector wage increases into inflationary wage growth in the service sector, and

(iii) Investment in manufacturing capacity that stimulates expansion capacity pressures and inflation on an economy- wide basis.

The study reveals that capacity utilisation has marginal predictive power for inflation in seven out of 15 major OECD economies, and that the inflationary impact of an increase in manufacturing operating rates tends to be sizeable. Further, in about one- half of the countries sampled, shocks to capacity utilisation account for more than one-tenth of the variation in inflation size.

Finn (1996) using US data draws out two features that characterise the relationship between capacity utilisation and inflation. First, it was discovered that inflation and utilisation often move in opposite directions. Indeed, it was established that the most dramatic period of sharp energy price rise translated to the greatest episode of negative co-movement. During this period (1973-1979), utilisation plummeted while inflation soared.

Baylor (2001) explores the issue of whether Canada's capacity utilisation series is an indicator of changes in future inflation. Two alternative Philips curve specifications are examined. The findings from both models suggest that although there existed a positive and stable relationship prior to the mid-1980s, this relationship is no longer significant. After 1986, econometric tests reject the hypothesis that capacity utilisation rates predict changes in consumer price inflation. The study explains why the link between inflation and capacity use has broken down. An increasing global economy, rapid technology progress, a more preemptive monetary policy and measurement were presented as possible explanations for no relationship between inflation and capacity utilisation arrived at.

Baylor (2001) identifies two main channels through which capacity utilisation is thought to affect inflation. First, high rates of capacity utilisation are associated with rising cost (through decreasing returns to scale) and increasing pricing power. When supply is low relative to demand, producers can increase prices without serious loss in sales, these forces directly affect prices of goods and services.

Second, mounting capacity constraints induce firms to invest in new plant and equipment, stimulating economic expansion

and further capacity pressures giving birth to additional inflationary pressures. It is generally thought that capacity pressures will take longer to impact inflation through the latter channel because of delays associated with planning and executing capital investment projects.

Empirically, Akinbobola (2012) affirms that in the long run, money supply and exchange rate have significant inverse effects on inflationary pressure, while real output growth and foreign price changes have direct effects on inflationary pressure. The possible justification for the inverse effect of money supply on price level is that inflation may not be due to aggregate demand pressure but caused by problems in the supply chain of goods both from the domestic and foreign supply outlets

On the aggregate, the empirical literature has shown that both monetary and structural factors can cause inflation. Economic fundamentals that can induce inflation include real output, industrial output, net exports, money supply, domestic food prices and exchange rate. While some agreed that capacity utilisation impacts inflation positively or negatively or the association varies, others are of the opinion that the relationship still holds. Indeed, a few others would still agree based on their findings that the relationship has broken down. This indicates lack of consensus yet on the exact relationship between inflation and capacity utilisation.

Methodological Review

The model employed by Bauer (1990) reveals that the Mc Elhantan type is wrongly specified though it yields logical results. He utilises a more fully specified structural model that relates the two time series explicitly like in Haynes and Stone (1985). The study examines the theoretical and empirical relationship between capacity utilisation and inflation. It finds that there is a connection between the duo. The observed relationship is bidirectional. The study shows that the relationship is not static but varies over time.

Moser (1995) identifies the main determinants of inflation in Nigeria. He presents both a long run model and a dynamic error correction model, as well as discusses the policy implications of the results. All the coefficient estimates had their expected signs. The monetary effect is quite large and significant at one per cent level, while real income and the exchange rate are also significant at that level. Interest rate, on the other hand, had no significance in the long run. In addition to the above estimates of the structural parameters in a long run relationship, he also estimates a dynamic version, specified as an error correction model.

Feridun and Adebiyi (2005) sought to establish whether monetary aggregates have useful information for forecasting inflation, other than that provided by inflation itself. They conducted forecasting experiments, using Mean Absolute Percentage Errors (MAPEs). Then they evaluated whether each monetary variable improved the forecasts of a simple AR (1) model of inflation. They find that the MAPEs for all the variables are less than that of the benchmark AR(1) model. The forecasting experiments show that, over the whole sample period, most of the variables examined serve as important information variables for price movements. Treasury bill rate, domestic debt and M_2 provide the most important information about price movements. Treasury bill rate provides the best information, since it has the lowest MAPE. Conversely, the least important variables are the deposit rate, dollar exchange rate and M_1. M_2 provides more information about inflation than M_1 over the sample period.

Olubusoye and Oyaromade (2008) used the error correction mechanism model where inflation is assumed to originate from both the demand-side and the supply-side. Specifically, the latter is the tradeable sector whereas the former is represented by the non-tradeable sectors. The model shows that efforts by the monetary authorities to stabilise domestic prices are likely to be continuously disrupted by volatility in the international price of crude oil.

Akinbobola (2012) tries to explore the dynamics of money supply, exchange rate and inflation in Nigeria. He utilises secondary data obtained from the International Financial Statistics (IFS) on all variables investigated in the model. The sample covers quarterly

data from 1986:01to 2008:04. The model is estimated using Vector Error Correction Mechanism (VECM).

Various methodologies have been adopted in the study of the determinants of inflation, such as ordinary least squares, structural models, error correction mechanism, long run models, dynamic error correction models and experiments using MAPEs. Nonetheless, none of these methodologies is suitable for our analysis given that our objectives are out to determine the direct impact of monetary aggregates and government expenditure on the economy. This implies a need for a methodology that has the in-built structure to address the objectives of our study.

THEORETICAL FRAMEWORK

The framework for the study follows the conjecture of Keynes in an attempt to explain the theory of inflation. Keynes and his followers emphasised the increase in aggregate demand as the source of demand-pull inflation. Broadly, the *aggregate* demand comprises, consumption, investment and government expenditures. When the value of aggregate demand exceeds the value of aggregate supply at the full employment level, inflationary gap arises. The more the gap between aggregate demand and supply, the more rapid the inflation. Given a constant average propensity to save, rising money incomes at the fully employment level would lead to an excess of aggregate demand over supply and which in turn results in inflationary gap. Notably, Keynes used the notion of the inflationary gap to show an inflationary rise in prices.

The Keynesian theory is based on a short run analysis in which prices are assumed to be fixed. In fact, prices are determined by non-monetary forces. On the other hand, output is assumed to be more variable, determined largely by changes in investment spending. The Keynesian chain of causation between changes in investment, money income and in prices is an indirect one through the rate of interest rate. Thus, when the quantity of money increases, its effect is on the rate of interest which tends to fall. A fall in the interest rate would, in turn, increase investment which

would raise aggregate demand. A rise in aggregate demand would first affect only output and not prices provided there are unemployed resources (Gordon, 1976).

But a sudden large increase in the aggregate demand would encounter bottlenecks when resources are still unemployed. The supply of some factors might become inelastic or others might be insufficient and non-substitutable. This would lead to increase in marginal costs and hence in prices. Accordingly, prices would rise above average unit cost and profits would increase rapidly which, in turn, would push up wages owing to trade pressures.

Trade unions will press employers to grant wage increases considerably in excess of increases in the productivity of labour, thereby raising the cost of production of commodities. Employers, in turn, will raise prices of their products. In many cases, their products are used as inputs for the production of commodities in other sectors. As a result, production costs of other sectors will rise and thereby push up the prices of their products. Thus, wage-push inflation in a few sectors of the economy may soon lead to inflationary rise in prices in the entire economy. This is the type of inflation that leads to substantial increases in the cost of goods and services.

Further, an increase in the price of domestically produced or imported raw materials may lead to cost-push inflation. Since raw materials are used as inputs by the manufacturers of finished goods, they enter into the cost of production of the latter. Thus, a continuous rise in the prices of raw materials tends to set off a cost-price-wage spiral. Unfortunately, the theory fails to appreciate the true nature of money and assume that money could be exchanged for bonds only.

In response to the weaknesses of Keynesian theory, the new-Keynesian theoretical exposition maintained that inflation depends on the level of potential output or the natural rate of unemployment or non-accelerating inflation rate of unemployment (NAIRU). However, the exact level of potential output or natural rate of unemployment is generally unknown and tends to change over time.

In a related development, the trade- off between inflation and unemployment is described as the Phillips (1958) curve. Specifically, the relevance of the Phillips curve is that it captured an economically important empirical relationship between inflation and unemployment. However, its major weakness is that it does not take into account the interactions in the structural behaviour of consumers and firms in the economy. Rather, it captures empirical regularities between unemployment and inflation rates based purely on correlations in historical data.

A new Keynesian-Philip curve was later developed that accommodates a phenomenon of sticky prices where there is a positive relation between the rate of inflation and the level of demand, and therefore, a negative relation between the rate of inflation and the rate of unemployment. This is consistent with the expectations of augmented Phillips curve, which also appears in new Keynesian dynamic stochastic general equilibrium model. As argued earlier, a measure of the intensity with which labour and capital are used in the production of output is the capacity utilisation rate. We therefore adopt the use of capacity utilisation to capture the relationships that Keynesian economists identified as the indirect chain of causation between changes in investment, money income, employment and in prices through the interest rate.

The model is therefore predicated on the assumption that the inflation is largely affected by exchange rate and oil price shocks. This is premised on the fact that the lion share of government expenditure depends on oil revenue and that the budget estimates are based on a certain international oil price benchmark. It is also assumed that current year inflation is based on past year inflation. Finally, it is assumed that the impact of monetary growth, government expenditure and policies[8] has a profound impact on capacity utilisation. Hence, we capture these effects through the rate of capacity utilisation. This clearly reveals the relevance of manufacturing capacity utilisation while searching for the drivers of inflation in Nigeria.

[8] Again this is consistent with Mojekwu and Iwuji (2011)

DATA AND METHODOLOGY

The study relies on quarterly data from 1975 to 2010, sourced from *CBN Statistical Bulletin*, and employs the Ordinary Least Squares (OLS) to measure the impact of capacity utilisation on inflation. The CPI is the most widely available measure of general price movements. We adopt the headline CPI, as published by *CBN Statistical Bulletin* (2011) since this is the most publicly visible measure in spite of its shortcomings[9]. We equally examine the properties and behaviour of the macroeconomic data employed using stationarity tests and report the results of the estimated OLS model.

Given that the study is not to identify the determinants of inflation in Nigeria, we focus on the impact of the decisions of firms, with respect to how their investment in capacity impacts inflation. This constitutes the anticipated main contribution of this study. To achieve the intended objectives, we streamline our model to exclude government expenditure, since a large portion is derived from the exportation of crude oil, and also because the annual budget figures are based on a certain oil price benchmark.

Model

Baylor *(op. cit)* identify that there are two main channels through which capacity utilisation is thought to affect inflation. First, high rates of capacity utilisation are associated with rising costs (through decreasing returns to scale), and increasing pricing power (when supply is low relative to demand, producers can increase prices without serious loss in sales). Second, mounting capacity constraints induce firms to invest in new plant and equipment, stimulating economic expansion and further capacity pressures, giving birth to additional inflationary pressures. It is generally thought that capacity pressures will take longer to impact inflation

[9] Its components are subject to strong transitory fluctuations, the impact of weather changes in terms of poor rainfall or flood automatically affects food prices.

through the latter channel because of delays associated with planning and executing capital investment projects.

The model employed is similar to that of Baylor (2001), a modified version of the standard price mark-up model used in estimating the short run Phillips curve. The starting point is the canonical empirical Phillips curve:

$$\pi_t = A + B_{cu_t} + C_{\pi^* t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where: π is inflation, π* is expected inflation, and *cu* is a measure of capacity utilisation. It is assumed that there is a stable relationship between changes in the inflation rate and capacity utilisation. Rewriting equation (1) we obtain:

$$\pi_t = A + B_{cu_t} + \sum_{i=1}^{n} \gamma \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

With $\sum \gamma = 1$, we rewrite equation (2) as

$$\pi_t - \pi_{t-1} = A + B_{cu_t} + \sum_{i=1}^{n} \left(\left(\sum_{j=1}^{i} \gamma_j \right) - 1 \right) (\pi_{t-i} - \pi_{t-i-1}) \dots\dots\dots\dots (3)$$

Therefore, the change in inflation is related to the capacity utilisation rate and past changes in inflation. Observably, measures of past inflation are not the only determinants of inflation. Various exogenous events, such as supply shocks, also significantly affect prices. Changes in oil prices and changes in the real exchange rate can affect prices directly and indirectly. The consideration of oil volatility becomes necessary as crude oil is the major export commodity in Nigeria.[10] Similarly, the real exchange rate

[10] This is consistent with Olubosoye and Oyaromade (2008). They also incorporated crude oil prices and exchange rate into their model. Oil exportation accounts for about 97 per cent of foreign earnings and 82 per cent of total annual government expenditure in Nigeria.

determines the purchasing power of the naira vis-a-vis the Dollar for the purchase of machineries, and technology. To avoid misspecification, crude oil prices and exchange rate are incorporated as control variables. Adding a vector of variables to control for supply-side shocks yields the final specification of the model:

$$\Delta\pi_t = A + B_{cu_t} + \sum_{i=1}^{n} c_i \Delta\pi_{t-1} + \sum_{j=1}^{m} d_j Z_{jt} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where: the Z_{jt} are control variables and $\square_t$ is the error term.

Test and Results

The general from of the model is expressed in equation four. The explicit form of the equation where all the relevant variables are introduced generates equation 5 as follows:

$$INF_t = a_1 + b_1 INF_{t-1} + b_2 INF_{t-2} + b_3 CU + b_4 CCP + b_5 EXR + \square_t \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where: INF is inflation, using consumer price index (CPI), CU represents capacity utilisation rate, CCP is the change in crude oil price and EXR is the real exchange rate.

Time Series Properties of the Variables

Since this study deals with time series macroeconomic variables, there is need to test for unit root in each of the variables employed. The importance of this derives from the fact that estimation in the presence of non–stationarity in variables usually leads to biased and inconsistent estimates of the standard errors of the coefficients and this could lead to misleading inference if appropriate technique is not applied to overcome the problem. The unit root tests are carried out using Augmented Dickey–Fuller (ADF).

Table 1: Augmented Dickey-Fuller Unit Root Test.

Variables	AUGUMENTED DICKEY-FULLER UNIT ROOT TEST					
	Constant		Constant & trend		None	
	Level	FD	Level	FD	Level	FD
INF	-1.115364	-10.26560*	-1.976246	-10.23039*	-0.415604	-10.27118*
CCU	-1.922968	-4.771701*	-0.433326	-5.111446*	1.717218***	-4.768839*
CP	-1.270637	-10.23348*	-2.132806	-10.23455*	-0.043656	-10.22130*
EXR	-3.641426**	-20.06580*	-7.111823*	-20.00636*	-2.557193**	-20.10503*

Source: Authors' computation.

FD signifies First Difference.*, ** and *** denote significance at 1%, 5 per cent and 10 per cent respectively

From Table 1, it is obvious that all the variables are integrated of order 1 or 1(I). In other words, all the variables are said to be stationary at first difference. Only real exchange rate is stationary at level (with constant, constant and trend and under none). Therefore, we can safely conclude that first differencing is sufficient for modelling the time series adopted in this study.

Stability Check

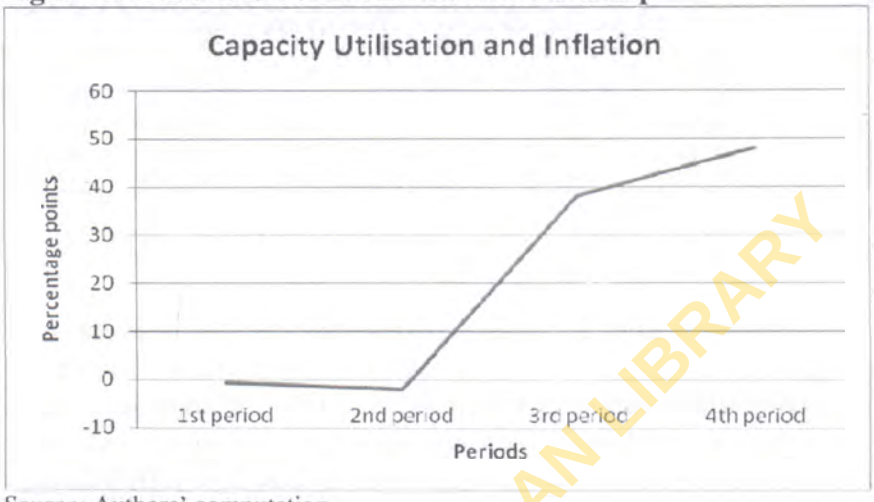
We divide our data into four periods, with each having a minimum of 32 data points. This is to enable us critically observe the relationship between capacity utilisation and inflation in line with our first objective. The regression results obtained are presented in Table 2.

Table 2: Estimates of Inflation and Capacity Utilisation Rates

Years	Sample Periods			
	1975:1to 1982:2	1982:3 to 1989:4	1992:2 to 1999:1	1999:2 to 2010
Inflation capacity utilisation (%)	-0.5	-1.9	38	48

Note: These estimates are based on regressions with the CPI as the dependent variable.

Figure 3: Estimates of an Unstable Relationship



Source: Authors' computation.

Figure 3 shows the relationship between capacity utilisation and inflation over four periods. It can be clearly seen that the relationship between inflation and capacity utilisation has been highly unstable. Between 1975 and 1982, it was -0.5 per cent, -1.9 per cent, between 1982 to 1989, and then it skyrocketed to 38 per cent between 1992 and 1999 and it rose by ten per cent to 48 per cent between 1999 and 2010. This shows that the relationship between capacity utilisation and inflation have varied widely especially between the second and third periods.

Equation 5 was estimated for the general model, from 1975Q1 to 2010Q4, using eviews with OLS. The results are presented in Table 3.

Table 3: Estimates for the Impact of Capacity Utilisation on Inflation

Regressor	Coefficient	t- value
Constant	3.033838	1.011310
INF (-1)	1.113162	13.13016
INF (-2)	-0.156277	-1.820447
CU	-0.036839	-0.659712
CCP	-0.036394	-0.961049
EXR	0.027940	1.191743
Summary Statistics		
R^2	0.970339	
Adj R^2	0.969248	
Dw statistics	1.985119	
F-Statistics	889.8204	
Included observations: 142 after adjusting endpoints: Sample(adjusted): 1975:1 2010:4		

Source: Authors' computation.

The results show that past period inflation (INF_{t-1}) and real exchange rate (EXR) have a positive relationship with inflation in the current period, while capacity utilisation (CU), change in crude prices (CCPs) and inflation (INF_{t-2}) exhibit negative relationship with inflation.

The elasticity of previous inflation rate for (INF_{t-1}) and (INF_{t-2}) with respect to current inflation (INF_t) is given as 1.11 and -0.15 respectively. This indicates that a hundred per cent increase in past inflation with one lag will fuel current inflation by 111.3 per cent. Similarly, inflation with a lagged difference of two periods will lead to a reduction in current inflation rate by 15.6 per cent.

The estimate for EXR is given as 0.03. This shows that an increase of 100 per cent in the value of the variable will contribute to a rise in INF_t, by almost three per cent. However, CU and CCPs indicate a negative relationship with current inflation; the coefficients are given as -0.037 and -0.0364 correspondingly. It implies that CU and CCPs will impact negatively on inflation. More specifically, a rise in CU and CCPs by 100 per cent will cause the inflation rate to decline by 3.6 per cent each.

The measure of the success of the regression in predicting the values of the dependent variable within the sample is reflected

by the coefficient of determination, that is, R square (R^2) and R square Adjusted ($\overline{R}^2$) which are 97 and 96 per cent, respectively. It can be concluded that the five regressors in the equation explained about 96 per cent of the systematic variation in the dependent variable (inflation) during the period covered by the study.

The DW Statistic measures for the presence of autocorrelation in the model. However, it is noticed that the model is free from autocorrelation since the DW Statistic observed in the model is 1.98, approximately 2. This means that the model is reliable in explaining the relationship between inflation and CU in Nigeria.

CONCLUSION AND RECOMMENDATIONS

The study shows that the relationship between CU and inflation in Nigeria is an inverse one. It reveals that if CU doubles at any time period, the result will be a decline in the current rate of inflation by about 3.6 percentage points. Possible explanation for this result may be that since increasing CU means the acquisition of more capital stock, money supply in circulation is reduced. It becomes a mop up mechanism that diverts idle fund, which have the tendency to fuel inflation to be channelled in to productive activities. The lags in the manufacturing and distribution chain also help to tie down these funds, till they are purchased by the final consumer, thereby impacting negatively on inflation.

This is an interesting relationship for policy. Thus government should evolve policies that will help manufacturing industries in the country increase capacity as this will help to curb the rate of inflation. One way to achieve the above is to address notable constraints to CU such as infrastructure with particular reference to electricity/energy supply. It is truism that low level of CU is an euphemism for unemployment. Hence, increasing CU is expected to lower the weight of unemployment of resources in the whole economy, particularly labour resources. In addition, it can also be inferred that efforts on the part of the monetary authorities towards lubricating access to financial resources will induce

economic agents in the manufacturing sector, particularly the manufacturers to improve on the level of installed capacity being utilised.

REFERENCES

Akinbobola, T.O. 2012. The dynamics of money supply, exchange rate and inflation in Nigeria. *Journal of Applied Finance and Banking*, Vol.2, No.4, 2012, 117-141 ISSN: 1792-6580 (print version), 1792-6599 (online) Scienpress Ltd, 2012.

Akinlo, A. 2003. The determinants of inflation in Nigeria. *Indian Journal of Economics*, LXXXVI(341).

Asogu, J.O. 1991. An econometric analysis of the nature and causes of inflation in Nigeria. Central Bank of Nigeria (CBN), *Economic and Financial Review*,29(3).

Bakare, A. S. 2012. Local content policy in oil sector and capacity utilisation in the Nigerian manufacturing. *Business and Management Review*, Vol. 1 (6) pp 82- 92 www.business journalz.org/bmr.

Banjoko, S. A. 2002. *Production and operations management.* Nigeria: Pumark Nigeria Limited.

Bauer, P.W. 1990. *A reexamination of the relationship between capacity utilisation and inflation,* http://clevelandfed.org/research/review/ 1990 q3.

Black, J. 2003. *Oxford dictionary of economics*. Second edition, Oxford University Press, New York.

Baylor. M. 2001. Capacity utilisation and inflation: is statistics Canada's measure and appropriate indicator*? Department of Finance Working Paper.*

Central Bank of Nigeria. 2008. *Statistical bulletin*, Golden Jubilee edition. Vol.17.

Dotsey, M. and Stark, T. 2005. The relationship between capacity utilisation and inflation. *Q2 Business Review*, www.philadelphiafed.org.

Dekock, G.S. and Nadal-Vicens, T. 1996. Capacity utilisation-inflation linkages: a cross country analysis. *Federal Reserve Bank of New York Research Paper No 9607.*

DeLong, J. B. and Summers, L.H. 1988. How does macroeconomic policy affect output? *Brookings Papers on Economic Activity* 2 433-80.

Devereux, M. 1989. A positive theory of inflation and inflation variance. *Economic inquiry.* Jan 1989; 21,1 ABI\iform global.

Egwaikhide, F.O. and Gabriel, O.F. 1994. Exchange rate, money supply and inflation in Nigeria: an empirical investigation. *African Journal of Economic Policy (AJEP)*, **1**(1), (1994).

Eniola, S.S. 2009. The determinants of capacity utilisation in Nigeria manufacturing industry. *Journal of Economic Thought*, 3(1), 57- 63.

Evans, P. 1986. Does the potency of monetary policy vary with capacity utilisation? *Carnegie-Rochester Conference Series on Public Policy 24* (Spring), 303-32.

Federal Ministry of Power and Steel 2006. *Renewable electricity policy guidelines.* International Centre for Energy, Environment and Development, Abuja.

Feridun, M. and Adebiyi, M.A. 2005. Forecasting inflation in developing economies: the case of Nigeria. *International Journal of Applied Econometrics and Quantitative Studies.* Vol. 2-4(2005).

Finn, M.G. 1996. A theory of the capacity utilisation/inflation relationship. *Federal Reserve Bank of Richmond Economic Quarterly,* Vol. 82/3 Summer.

Garner, A.C. 1994. Capacity utilisation and US inflation. *Economic Review,* fourth quarterly.

Gittings, T. A. 1989. *Capacity utilisation and inflation, economic perspective.* Federal Reserve, Bank of Chigago.

Gordon, R.J. 1976. Recent developments in the theory of inflation and unemployment. *Journal of Monetary Economics*, Vol. 2, Pp.185-219.

Greene, W.H. 2003. *Econometric analysis*, Fifth edition, Pearson Education, Inc, Upper Saddle River, New Jersey, USA.

Gujarati, D. N. 2004. *Basic econometrics,* Fourth edition, McGraw-Hill companies.

Haynes, S.E. and Stone, J. A. 1985. A neglected method of separating demand and supply in times series regression. *Journal of Business and Economic Statistics*: *American Statistical Association*, Vol. 3(3) Pages 238- 43 June.

Hill, C., Griffiths, W.E. and Lim, G.C. 2008. *Principles of econometrics.* John Wiley and Sons International. LOR Feature 2.

Kydland, F. E. and Prescott, E. C. 1982. Hours and employment variation in business cycle theory. *Economic Theory*, Vol. 1 (No. 1, 1991), pp. 63–81.

Latham and Watkins 2011. *Nigeria power sector reforms: Opportunities and challenges for investment.* Client Alert Finance Department Number 1144.

Laxton, D., Meredith, G. and Rose, D. 1995. Asymmetric effects of economic activity on inflation: Evidence and policy implications. *IMF Staff Papers,* 42 (June), 344-74.

Laxton, Douglas, David Rose, and Demosthenes Tambakis. 1999. The US. Phillips curve: the case for asymmetry. *Journal of Economic Dynamics and Control,* 23, 1459-85.

MacKlem, T. 1997. *Capacity constraints, price adjustment and monetary policy.* Spring, Bank of Canada Review.

McElhattan, R. 1978. Estimating a stable–inflation capacity utilisation rate. *Economic Review.* Federal Reserve Bank of Sanfrancisco Fall 20-30.

Mojekwu, J. N. and Iwuju, I.I. 2011. Factors affecting capacity utilisation decision in Nigeria: a time series analysis. *International Business Research,* Vol 5.

Moser, G.G. 1995. The main determinants of inflation in Nigeria. *IMF staff Papers,* 42, 270-289.

Oluba, M.N. 2008. The manufacturing capacity utilisation question, *Short Essay Series, Business Day.*

Olubusoye, O.E. and Oyaromade, R. 2008. Modelling the inflation process in Nigeria. *AERC Research Paper,* 182.

Phillips, A. W. 1958. The relation between unemployment and the rate of change in money wage rates in the United Kingdom, *Economic,* 25 November.

Prescott, E. C. 1986. Theory ahead of business cycle measurement, *Carnegie-Rochester Conference Series on Public Policy,* Vol. 25 (Autumn1986), pp. 11–44.

Siyan, P. and Ekhator, V. 2001. Restructuring the Nigerian economy through the privatisation of public enterprises: An impact analysis of the National Electric Power Authority (NEPA). Daily Broadcast, National Control Centre, Oshogbo, Nigeria. Lagos Organisation Review 32,

Tatom, J.A. 1979. The meaning and measurement of potential output: a comment on Perloff and Wachter Result three aspect of policy and policymaking, knowledge, data and institution, *Carnegie-Rochester Conference Series on Public Policy.* New York North Holland Publishing Co. 10 165-78.

Umo, J. U. 2007. *Practical microeconomic analysis in African context.* Nigeria: Netlink Research Consult Ltd. Ebute Metta, Lagos.