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Capacity Utilization and Unemployment in Nigeria: A Two Stage Least Squares Technique

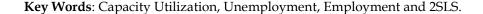**Malachy A. Ugbaka**
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Abstract

*T**his paper investigates the effect of capacity utilization on unemployment in Nigeria between 1981 and 2016 empirically leaning on the model employed by Asta & Zaneta (2010). The paper utilizes time series secondary data using two-stage least square regression techniques. The annual data utilized for the paper were regressed with E-views econometric package version 9. The results of the 2SLS analysis revealed that a positive relationship exists between capacity utilization and unemployment in Nigeria. The positive relationship is statistically significant at 5% level (P<0.05). This finding is contrary to the economic argument which underpins the intuition that the relationship between capacity utilization and unemployment is negative. The result shows that a 100% rise in capacity utilization leads to 3.4% increase in unemployment. The paper concludes that government should institute policies geared towards productive employment as this would reduce the pace of unemployment and underemployment in the country. Furthermore, government's focus should largely be concentrated on the micro, small and medium enterprises as these are the major drivers of employment growth in Nigeria as against the large scale businesses.*

Key Words: Capacity Utilization, Unemployment, Employment and 2SLS.

INTRODUCTION

The impressive performance of the economy as the biggest economy in Africa has been under scrutiny by several analysts, especially so, after the rebasing of its Gross Domestic Products data in 2014 by the National Bureau of Statistics (NBS, 2014). The general consensus is that, in spite of past economic reforms the absorptive capacity of the Nigerian labour market remains markedly

low. The economy is shrinking whilst output continues to grow, that is, the economy is incapacitated to absorb the growing labour inputs, resulting in rising unemployment figures. The outlooks of the economy seems impressive but with much ground to makeup as millions of Nigerians who lost their jobs during the recession are still in need of employment and it will take quite of bit of time to close the gap (World Bank, 2015; Solomon, 2015).

Capacity utilization is a variable of longstanding macroeconomic interest. Though, only directly measuring the relative level of activity in the industrial sector, capacity utilization also tends to reflect the state or broader economy. There is a high correlation between capacity utilization and joblessness. In principle, capacity utilization and employment should co-move closely. Many studies have found it to be a valuable indicator of inflationary pressure (Dotsey & Stark, 2005; Oyeranti & Oluseun, 2013).

Whereas many studies have examined the link between capacity utilization and inflation, comparatively fewer have explored the relationship between capacity utilization and unemployment especially for developing countries. Our objective is to examine the empirical analysis of the relationship between capacity utilization and unemployment in Nigeria and proffer helpful solutions that will ensure an employment-capacity utilization growth for Nigeria.

One of the measures of the intensity with which labour and capital are used in the production of output is the capacity utilization rate. In other words, capacity utilization rate is an indicator of how efficiently the factors of production are being used. It therefore implies that when utilization rate is low, it is assumed that firms can increase employment in response to demand and exhaust their capital without incurring large increases in the costs of production (Oyeranti & Oluseun, 2013).

Most researches on capacity utilization in Nigeria substantially focus on the factors affecting capacity utilization or determinants of capacity utilization (Dauda & Risikat, 2008) some authors focus on the stability of capacity utilization and inflation, in which the emphasis is purely on inflation and prices. Secondly, different authors have analysed the topic without considering the extent to which capacity utilization impact on employment/unemployment (Enimola, 2009).

This paper deviates from the existing tradition of identifying a number of factors that affects capacity utilization by allowing our evaluation to capture the relationship between capacity utilization and employment/unemployment in Nigeria. The rest of the paper is structured as follows. Section 2 is a brief review of empirical studies. Section 3 outlines the data and methodology. Section 4 reports and discusses the empirical findings. Section 5 concludes the paper.

LITERATURE REVIEW
Brief conceptual issues
Capacity utilization 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 to breaking down. Thus, firms normally aim to have more capacity than the average level of demand (Black, 2003). Manufacturing capacity utilization in Nigeria has been dynamic over time. Capacity utilization is a concept in economics, which refers to the extent to which an enterprises or a nation actually uses its installed productive capacity. Thus, it refers to the relationship between actual output produced and potential output that could be produced with installed equipment if capacity was fully used.

Capacity utilization in industry is described as the level of utilization of an industry's installed productive capacity (Loto, 2012). An industry would be said to be performing optimally when its installed production capacity is fully utilized. When utilization is low, it is assumed that firms should increase employment in response to demand. Unemployment, on the other hand, has been categorized as one of the serious impediments to social progress. Apart from representing a colossal waste of a country's manpower resources, it generates welfare loss in terms of lower output thereby leading to lower income and well-being.

Empirical Review
This section however, looks at some empirical studies and the respective methodological approaches adopted in previous related studies on the empirical analysis of the relationship between capacity utilization and unemployment within and outside Nigeria.

Hany Elshamy (2013) examined the relationship between unemployment and production in Egypt. The paper uses co-integration analysis to estimate Okun (1970) coefficient in the long run and in the short run by using the Error Correction Mechanism (ECM). The analysis relied heavily on annual data from the International Financial Statistics (IFS) published by the IMF for the period 1970-2010. The study finds out that in the long run and short run the coefficient was statically significant with the expected sign.

Mitchell & Pearce (2010) also have found that unemployment rate and production(capacity utilization) growth move in opposite directions but the change in unemployment rate causes less influence in capacity utilization growth as compared to Okun's coefficient benchmark.

Geidenhuys & Marinkov (2007) tried to give answer to the question of unemployment response to changes in capacity utilization in South Africa. For this reason, they estimated the relationship between economic activity and unemployment rate. The results indicated a negative relationship between unemployment and capacity utilization in South Africa over the period 1970 -2005 with more evidence in favour of asymmetries during recessions.

Daly & Hobijn (2010) undertook a study whose result showed that in 2009, strong growth in capacity utilization in the United States of America allowed firms to lay off large numbers of workers while holding output relatively steady. The Authors asserted that this behavior threw a wrench into the long-standing relationship between changes in production and changes in the unemployment rate, known as Okun's law. If Okun's law had held in 2009, the unemployment rate would have risen by about half as much as it did over the course of the year.

Arshad (2010) examined the relationship between unemployment and productivity in the Swedish economy. Using quarterly time series data for the period 1993Q1 – 2009Q2, the study showed that in the Swedish economy in the study period and that there is a long run and short run relationship between unemployment and productivity.

García-Cabo (2013) examined the low correlation between cyclical productivity and unemployment. From significantly negative before 1980's, it has switched sign in several OECD countries and became positive. By using a New Keynesian model with sticky prices, search frictions and variable effort, he found that in the U.S. technology shocks can generate positive correlation between productivity and unemployment, while in Europe non-technology shocks generate the same effect. The results suggested that the increase in size of technology shocks and the reduction of the pro-cyclicality of productivity after a non-technology shock in the U.S. can account for changes in correlation. On the other hand, aggregate demand shocks have gained

weight in Europe in the last 20 years and explain the positive sign in the unemployment-productivity correlation in those economies.

Amassoma & Nwosa (2013) examined the relationship between unemployment rate and productivity growth in Nigeria for the period 1986 to 2010. The study utilized co-integration and error correction model approach. The Johansen co-integration result showed that the variables were co-integrated. The regression estimates based on the short run and long run models showed that unemployment rate has an insignificant influence on productivity growth in Nigeria.

Marco, G., Mauro, G., Ramsey, J. B. & Willi, S. (2015) examined the effect of capacity utilization on unemployment USA. They employed wavelet analysis to decompose economic time series into their time scale components, each associated to a specific frequency range. They decomposed the relevant USA time series data in different time scale components and considered co-movements of productivity and unemployment over different time horizons. They found that US post-war data indicated that productivity creates unemployment in the short and medium terms, but employment in the long run.

Adenikinju & Chete (2002) also purport, using the two stage least squares method, that capacity utilization has to improve before significant high rate of productivity could be witnessed in the manufacturing sub-sectors.

Also, Ogunleye & Ayeni (2008) confirm using Granger causality test, that for total factor productivity to improve and for export revenues to shoot up, the capacity utilization of the manufacturing sub-sectors must rise astronomically.

Rupkin (2008), using stochastic general equilibrium framework, concludes that the impulse experiments show that inventories and the rate of capacity utilization are mostly complements, while inventories and the rate of labour utilization are mostly substitutes. Trupkin's analysis is centered on the effects of two possible shocks. Preference (demand shocks) and technology shocks. Moreover, the author affirm that low persistent shocks emphasize the role of inventories as being shock absorber whereas high persistent shocks emphasize the role of inventories as being complement to consumption.

Siyan & Ekhator (2001) conducted a study on restructuring the Nigerian economy through the privatization of public enterprises gave an insight into the gross inefficiency that characterized most public enterprises like the National Electric Power Authority (NEPA) now Power Holding Company of Nigeria (PHCN). The study revealed 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. Poor services have forced most industrial customers to install their own power generators at high costs to themselves and the Nigerian economy. The chronic shortage of available generating capacity has negatively affected the industrial and manufacturing sectors.

THEORETICAL FRAMEWORK

The framework for the study follows the conjecture of Keynes, in an attempt to explain the theory of unemployment. Keynes and his followers emphasized deficiency in aggregate demand as the source of unemployment. Keynes thought that unemployment was basically cyclical, generated by the deficiency of aggregate demand in his opinion, capitalists hire workers and invest such labour to produce – output when the expectations about the economy and profits are favourable or optimistic. To him, if expectations about the future are supported by the economic

reality, investments will be increasing such that employment will continue to rise until the equilibrium condition is reached. This equilibrium is however obtained by the intersection of aggregate demand and supply – the point of effective demand will and may be less than the full employment equilibrium; such that if expectation about the future of the economy is not favourable, the capitalists will reduce investment thereby making unemployment to rise. Hence, equilibrium is achieved where unemployment exists. This unemployment is due to the deficiency of aggregate demand particularly investment expenditure.

DATA AND METHODOLOGY

The paper examined the relative importance of the relationship between capacity utilization and unemployment in Nigeria. The paper relies on time series secondary data from the World Development Indicators published by the World Bank (WDI, 2016) and the Central Bank of Nigeria Statistical Bulletin (CBN, 2016) , and employs Two Stage Least Squares (2SLS) to determine the relationship between capacity utilization and unemployment. It is in response to the current challenges posed by the country's unimaginable rate of unemployment (joblessness) and falling capacity utilization rate that this study attempts a crucial diagnosis of the relationship between capacity utilization and unemployment in Nigeria.

Model Specification

There are two main channels through which capacity utilization is thought to affect unemployment/employment. First, firms do not want to make a commitment to hiring new workers especially during recession until they are sure the recovery is solid and uncertainty about the strength of recovery near turning points leads to delay in hiring new workers. Second, during downturn it's natural for firms to reorganize production. As firms lay workers off, they reassign tasks to the workers who remain and again, mounting capacity constraints induce firms to reduce or downside.

The model employed is adapted from the works of Asta & Zaneta (2010) where they expressed unemployment as a function of capacity utilization and some other control variables. The model is stated as:

$$ump_t = \emptyset_0 + \emptyset_1 ACU + \emptyset_2 X + U \quad (1)$$

Where;

ump_t is unemployment (joblessness); ACU is average capacity utilization; X is the vector of other control variables, U is the disturbance term, t is the time period and $\emptyset$ are the parameters to be estimated. We included other important variables that can affect unemployment in Nigeria. The model is written as follows:

$$ump_t = \beta_0 + \beta_1 GDP + \beta_2 GCF + \beta_3 ACU + \beta_4 ELC + \beta_5 INF + \beta_6 DF + \epsilon \quad (2)$$

Where:

ump is the unemployment, GDP represents gross domestic products, GCF is the level of investment in the economy, ACU is average capacity utilization, ELC equals the electricity generation in the country, INF is the inflation representing consumer price index(cpi) and DF is deficient financing. The application of the OLS to an equation belonging to a system of simultaneous equations yields biased and inconsistent estimates, the obvious solution is to apply other methods of estimation which give better estimates of the parameters and are appropriate in handling complex relationships (Adam, 2001). Among these methods is the Two-stage least

squares (2SLS). This prompted the authors to employed Two Stage Least Square (2SLS) to drive home the objectives of the paper.

The empirical methodology involves three steps. We begin by performing an integration analysis using unit root tests. Thus, to avoid the problem of the spurious regression and the failure to account for the appropriate dynamic specification, we follow most existing empirical studies by using the standard Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests. The second step is to test if the instruments chosen are independent of the error term. The third step involving testing the variables in the model to ensure that they do not contained high levels of the same information which would lead to a biased and inaccurate result.

Data
We used time series secondary data from the World Development Indicators published by the World Bank (WDI, 2016) and the Central Bank of Nigeria Statistical Bulletin (CBN, 2016). Thus, to avoid the problem of the spurious regression and the failure to account for the appropriate dynamic specification, we follow most existing empirical studies by using the standard Augmented Dickey-Fuller and Phillip-Perron unit root tests.

Unit Root Tests
The result of the unit root test shows that all the variables were integrated of order 1. That is all the variables were said to be stationary at first difference. Only CU is stationary at level, (with constant, constant and trend and under none). Hence, we concluded that our model was correctly specified.

Simultaneity Tests
In order to establish that the instruments chosen are independent of the error term, we carried out simultaneity test. Simultaneity problem arises because some of the regressors are likely to be correlated with the disturbance, or error term. A test of simultaneity is a test of whether (an endogenous) regressor is correlated with the error term. If it is, the simultaneity problem exist, the way to test for this problem is to perform a Durbin-Wu-Hausman test (Evans, 2013). Wu-Hausman test shows that the 2SLS estimate is consistent and efficient in explaining the model.

Multicollinearity Test
Again we performed multicollinearity test to ensure that none of the explanatory variables in the model contained high levels of the same information which would lead to a biased and inaccurate result. The VIF values are well below 5.0; which shows that there is no significant presence of multicollinearity among the exogenous variables in the system of equations.

RESULTS AND DISCUSSION
This next sub-section report the results of the 2SLS technique employed to obtain the estimates of equation 2. The result of equation 2 relating unemployment to some of it major determinants like electricity generation, gross fixed capital formation among others is presented in Table below.

Results of the 2SLS

Regressor	Coefficient	t- value
Constant	-350.1250	-3.249017
GDP	14.53387	7.007906
GCF	-4.228020	-4.228143
ACU	3.351072	3.086790
ELC	0.871069	0.157309
INF	-0.084153	-0.700979
DF	0.127842	0.880145
Summary Statistics		
R^2	0.941903	
Adj R^2	0.928993	
Dw statistics	1.986797	
F-Statistics	72.95664	
Included observations: 31 after adjusting endpoints: Sample(adjusted): 1981 to 2016		

Source: Author's Computation, (2018)

Most of the variables that serves as unemployment determinants in the results came out as expected and statistically significant. The 2SLS method employed proved efficient and exhibits the BLUE properties of least square methods as all statistics meant for reliability tests came out robust. The results show that Gross Domestic Products (GDP), Average Capacity Utilization (ACU), Electricity Generation (ELC) and Deficit Finance (DF) have a positive relationship with unemployment, while Gross Fixed Capital Formation (GCF) and inflation (INF) exhibit negative relationship with unemployment. The estimate for Average Capacity Utilization (ACU) is given as 3.4. This shows that an increase of one hundred percent in the value of the variable will contribute to a rise in unemployment, by almost 34 percent. Specifically, the result reveals that a positive relationship exists between capacity utilization and unemployment in Nigeria. The positive relationship is statistically significant at 5% level (P<0.05). This result is actually puzzling as it contradicts the theoretical expectation. The result shows that a 100% rise in capacity utilization leads to 3.4% increase in unemployment. Although, this is surprising, it is in conformity with that of Solomon, 2015 and Aliyu, 2012 on jobless growth in Nigeria and that of Marco el al (2015) on USA economy.

Similarly, estimate for gross capital formation (GCF), is given as -4.22. This shows that a decrease of one hundred percent in the value of the variable will contribute to a fall in unemployment, by almost 42 percent. However, gross domestic products (GDP) and electricity generation (ELC) indicate a positive relationship with current unemployment; the coefficients are given as 14.53 and 0.87. It implies that gross domestic products and electricity generation impact positively on unemployment. More specifically, a rise in gross domestic products and electricity generation by hundred percent will cause the unemployment rate to increase by 15 and 9 percent respectively.

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 ($\bar{R}^2$) which are 94 and 93%, respectively. It can be concluded that the six regressors in the equation explained about 94% of the systematic variation in the dependent variable (unemployment) during the period covered by the study. The DW Statistics 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 1.99 which is approximately 2. This means that the model is reliable in explaining the relationship between capacity utilization and unemployment in Nigeria. The J-statistic probability (27.0000) confirmed the appropriateness of the instruments used on the model.

CONCLUSION AND POLICY RECOMMENDATIONS

The paper used time series data for the period 1986-2016 in examining the relationship between capacity utilization and unemployment in Nigeria using 2SLS. In achieving the empirical expectation, the study engaged the use of data from the world development indicators and central bank of Nigeria among other sources. The analytical results showed that the model performed reasonable well in explaining the coefficients of the equation.

The results obtained confirmed and supported the existence of positive relationship between capacity utilization and unemployment in Nigeria which is contrary to the theoretical argument that relationship between capacity utilization and unemployment is negative. Based on the findings, a number of policy issues naturally arise from the paper.

1. Productive employment should be encouraged as this would reduce the pace of unemployment and underemployment in the country.
2. The government's focus should largely be concentrated on the micro, small and medium enterprises as these are the major drivers of employment growth in Nigeria as against the large scale businesses.
3. A follow up to this, should be the drive to reduce capacity constraints facing manufacturing sector of in the economy.

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