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Power Supply, Average Manufacturing Capacity Utilization and Unemployment in Nigeria

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Authors' contributions

The research was jointly done by all the authors. Author AE developed the structure of the study, wrote the protocol and the initial draft of the manuscript including the typesetting, author OSI reviewed theoretical and empirical literature, developed the model of the study, did the econometric analysis and interpretation while author UCC supervised the research process and author ICO edited the final manuscript. All authors read and agreed on the final manuscript.

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ABSTRACT

This study examined power supply; average installed manufacturing capacity utilization and unemployment in Nigeria from 1980 to 2013. Unemployment and unsteady power supply are two common challenges confronting most developing economies. Its impact leads to compounded social vices especially in developing country where there is high rate of its prevalence, against developed economies that are able to support unemployed class with subsidies and social security allowances. Therefore, this research work using trend analysis and advanced econometrics test, ascertained the significant long-run relationship between average manufacturing capacity utilization and power supply in Nigeria and examined the significant causal relationship between average manufacturing capacity utilization and power supply in Nigeria. The result of our analysis shows that there is long run significant relationship that exists among unemployment rate, average manufacturing capacity utilization and power supply in Nigeria but there is no significant causal relationship between average manufacturing capacity utilization and power supply. Based on our findings, the study recommends that government should strengthen the power sector to provide

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constant electricity to the sector in Nigeria as this will help to lower the total variable cost of the manufacturing sector and increase the net returns as well as the capacity utilization of the sector.

Keywords: Power supply; average installed manufacturing capacity utilization; unemployment; co-integration test; granger causality test; Nigeria.

1. INTRODUCTION

1.1 Background to the Study

Through gainful employment, the working class attracts wealth to themselves, their dependants and to their nation. The issue of unemployment has become a world-wide phenomenon, demanding for increased attention; though the impact is more astounding in developing economies [1] in which Nigeria is a good example. The rate of unemployment in Nigeria stands at 19.7per cent [2] 9.1 per cent for USA [3] 7.9 per cent for Britain [4] and 25.7per cent for South Africa [5]. In fact, [6] identified unemployment as one of the major challenges confronting the Nigeria economy. The social impacts of unemployment are less prevalent in economies that are able to support unemployed class with subsidies and social security allowances. [7] once argue that- a man willing to work and unable to find suitable job at the prevailing wage rate, is perhaps the saddest sight that fortune's inequality, and could be an explanation for the high incidences of robberies, kidnappings, prostitutions and other vices among unemployable youths in the developing economies. In the words of [8] problems of unemployment ''have become pathetic in many developing economies'' especially the sub-Saharan Africa [9] and it is regarded as a pressing problem in Nigeria [10].

Several attempts have been made to curtail unemployment rate in Nigeria which include the introduction of Operation Feed the Nation programme by Obasanjo's regime in the mid 1970s, MAMSER and DFFRI programmes by the Babangida's administration in the 1980s. None of the interventions achieved significant results in curtailing the monster of unemployment in Nigeria. However, Nigerians are resilience and hardly give up in the face of challenges that affect their welfare and aspirations and this could explain the self-help provisions of infrastructures (electricity from privately or corporately owned generators and boreholes and wells to provide water supply) by many in spite of high costs that may not be good for competitive businesses. This is why [11] recognized that electricity as a source of energy is vital to the growth and development of any economy even though the study did not mention any specific impact on unemployment. Hence, erratic and inadequate power supply has been the major reason cited by many of the multinationals (Michelin, Dunlop Plc, Volkswagen Plc, PZ, Unilever) that either closed down or wounded up their operations in Nigeria which further worsened the level of unemployment [12] For instance, the exit of Michelin from Nigeria cost the economy 1,300 direct jobs. Similarly, in the study of youth unemployment in Nigeria, [13] identified increasing population, high degree of geographical mobility, lack of employable skills, non-involvement of youth in decision making processes as major causes of youth unemployment. In a more recent study of the Nigeria's power sector, [14] posit that the Nigerian economy is characterized by a large informal sector which relies heavily on electricity power to operate. This results from the failure of the national power source to provide stable and adequate power supply, hence alternative though expensive private arrangements had to be made to remain in production for those that could afford them. Entrepreneurs who could not cope with the expensive alternatives had no other choice than to seek alternative means of livelihood; and the results are rising unemployment rates.

With Power Reform Act already passed into law by the National Assembly and assented to by the erstwhile President Obasanjo in 2005, the former National Electric Power Authority was renamed *Power Holding Company of Nigeria* (PHCN). With this arrangement, it was expected that- by the end of 2007, PHCN would have been broken up into 18 companies in a takeover that was expectedly involving private sector in the generation, transmission and distribution of electricity and further improve on the performance of the sector. The offshoot companies of the PHCN would be made up of *one* transmission company, *six* power generation companies and *eleven* distribution companies [15]. Also, the Act attempts to encourage private investor in the sector. With this arrangement, different Independent Power Projects are expected to be embarked by some state governments and multi-national organizations that may be interested to generate their own

power and may extend to the members of the public who may be interested [16,17]. In line with this, government established National Electricity and Regulatory Commission (NERC) to facilitate government divestment from the power sector. The role of the commission, among other things, is to promote competition and private sector participation in the sector. Furthermore, it has the responsibility to establish or approve appropriate operating codes and safety, security, reliability and quality standards and to monitor the operation of the electricity market [18].

Many reasons have been adduced on why the various efforts made over the years by government in the last eight years have not yielded any significant improvement on power supply in Nigeria. Some of these are; First, is the constant vandalisation and attack on Escravos gas pipelines especially Chanomi Creek in Delta Sate by militant groups operating in the Niger Delta. The channel is feeding Egbin Thermal Station. Another pipeline, Escravos Lagos Pipeline owned by the Nigeria Gas Company (NGC), which feeds Afam Thermal Station with gas has been vandalized several times over. This has brought power generation to all time low [19].

Second, PHCN is indebted to NGC in the sum of N7billion for gas supplies. To recover their money, NGC several times had to halt supply of gas to the organization to recover the debts [20]. Third, besides the low gas supply to the thermal stations, the worst and major cause is the activities and conduct of the PHCN personnel. This age long problem in the sector persists in the organization. For instance, those personnel in the marketing Department hardly read the meter hence billing in such cases is largely by estimation resulting to spurious bills. In some cases where bills are estimated instead of the actual consumption, most of the consumers are often hostile to the officials or personnel of the organisation. Some even refuse outrightly to settle such bills, claiming that they cannot pay for services not rendered [17,21,22]. In a survey conducted by [16] in Lagos metropolis, one of the consumers complained: NEPA is an extortionist; their bills are not just certified bills. They bring crazy bills to people, not based on what they consumed but based on what they think, that is estimation. It is not good for any man to pay for what he has not used and when you go to their office to complain, they will not listen. We are helpless. If there is any other source we can get our supply from, we will go and get it. Power supply from NEPA is not regular. If it is regular people will better off in their businesses.

Fourth is the endemic corruption in the sector. It has been argued that besides the Nigeria Police Force, the next government parastatal that is ridden with the cankerworm is PHCN. Writing in one of most circulated national dailies, [23] wrote: Take for instance the case of Mr. Bassey Festus Bassey. He runs a computer firm at Edgerly Road in Calabar. He was indebted to the Power Holding Company of Nigeria (formerly NEPA) and had gone to negotiate with a top official of the institution on a possible instalmental payment to avoid being disconnected. He was shocked to hear that, rather than pay the money to PHCN, he could actually give half of the entire sum to an official for the bill to be written off. Just like that. But Bassey suspected that the game could backfire. So, he politely turned down the official's offer and chose to do the right thing. But the official was to fight back. He attempted to ensure that Bassey was disconnected. He only gave way when it dawned on him that his superior had approved an instalamental payment of the sum for the consumer.

Further, the problem of power supply is traceable to the usual gross inefficiency and bureaucracy that are evident in most parastatals. Sabotage is also a significant factor. High tension lines and transmission and generating equipment components are stolen regularly. Revenue collection is poor and the greatest debtors are government establishments and parastatals [24]. Another problem confronting PHCN is the low investment in power generation over the years. All the plants are very old. Thirty six percent of them are over twenty five years old, 48 percent are over twenty years old, and no new plant has been installed in the last fifteen years prior to the advent of civilian administration in 1999. With this, it is pertinent to note that the power supply situation in the country has not improved in the last eight years despite huge investments, government claimed to have made on it, [21].

Frustration and provocation by PHCN's crazy bills, ineptitude, dismal performance plaguing the organization and the spate of corruption going on, understandable explain public disenchantment against the performance of the sector has increased over the years [25,26].

1.1.1 Power suppy situation in Nigeria

Regular power supply is the prime mover of technological and social development. There is

hardly any enterprise or indeed any aspect of human development that does not require energy in one form or the other - electric power, fuels etc. Nigeria is richly endowed with various energy sources, crude oil, natural gas, coal, hydropower, solar energy, fissionable materials for nuclear energy. Yet the country consistently suffers from energy shortage - a major impediment to industrial and technological growth. The National Electric Power Authority (NEPA), a government parastatal, has the sole responsibility for managing the generating plants as well as distribution of power nationally. The total generating capacity is about 3000MW, approximately thrice the current level of national demand. However, the actual power available at any given time is less that 40 percent of the total capacity due to poor maintenance; hence there is a perennial shortage. This situation is exacerbated by a grossly inefficient, poorly maintained distribution system. Industry can only cope with power outages by resorting to internal generating plants [27,24].

Electricity goes on and off five times in an hour, this creates serious problems for manufacturing and industrial sectors. Equipments are damaged by power surges that usually accompany epileptic power supply and goods at various stages of manufacturing are damaged. Industry's response has been to run permanently on internal generating plants and use NEPA supply as standby. It is ironical that, in spite of the enormous power generation potential, about 60 percent of the country still has no access to electric power supply [28,27,24].

Libya with a population of only 5.5 million has generating capacity of 4,600 megawatts, approximately the same as Nigeria which has a population of about 140 million [29,30]. There are plans to build seven more plants in Nigeria [20]. All the stations are oil or gas fired and the country is selling power to other African countries. South Africa with a population of only 44.3 million has a generating capacity of 45,000 megawatts, almost eleven times the generation capacity in Nigeria which has three times the population of South Africa [21].

Studies and experiences have shown that power generation in the country has been dismal and unable to compare with what obtains in smaller African countries. The recent survey on power distribution to the industrial sector in Nigeria showed that average power outage in the industrial sector increased from 13.3hours in January 2006 to 14.5 hours in March 2006. In a worsening experience, the outage increased to 16.48 hours per day in June. In other words, power distribution in the month of June, 2006 to the industrial sector, on the average, was 7.52 hours per day [31].

In Sharada/Challawa industrial area in Kano, the outage increased from 15.4 hours in January, 2006 to 17.6 hours in March of the same year. In Bompai area in Kano State, power outage increased from 10.3 hours in January to 13.0 hours in March, while in Enugu/Anambra zone it increased from 17.2 hours to 18.5 hours within the same period. In Edo/Delta zone the average power supply to industrial area is put at 4.4 hours per day. The Ikeja industrial area of Lagos enjoyed power supply for 12.5 hours per day, the highest in the country. Industrial estates in Bauchi, Benue and Plateau zone receive power supply for 4.5 hours per day which amounted to near blackout in real sense [32,31].

Studies further revealed the power supply in virtually all the sates in Nigeria has been very dismal. For instance, in Benue State, only Makurdi the state capital receives electricity supply for about five hours a day. Also in Delta State some communities never had power supply for upwards of six months. In Lagos, the commercial nerve centre of the country, the situation is also bad as power supply in many residential parts of Lagos is about four hours per day with cuts at short intervals. It is a total black out in some areas for about three days or more [33,31,34].

In view of the trends in power supply, manufacturing capacity and unemployment rate in Nigeria, the statistical data revealed that between 1980 and 1981, power generated increased from 6.9% to 7.8% while manufacturing capacity rose from 70.1% to 73.3%. However, unemployment rate increased from 10% to 21.4% [35]. Within these periods, though power generation might have contributed to the growth in average manufacturing capacity, it was found to have not translated to decrease in the unemployment level. Considering 1990 and 1991, it was found that growth rate of power generated were 12.03% and 13.61% respectively. However, within the same periods, manufacturing capacity rates were 40.3% and 42% respectively while unemployment rate 3.5% and 3.1%. In this case, unemployment rate seemed to be on the decreases as more and more power are generated which resulted to

increase in the manufacturing capacity utilization. Observing the two years; 2000 and 2001, power generation slightly increased from 14.1% to 14.8% while there was a significant increase in the manufacturing capacity utilization from 36.1% to 42.7%. Unfortunately, there was no decrease in the unemployment rate as it rose 13.1% to 13.6%. In recognition that the problem of power supply is a challenging one scuttling socio-economic activities across the country, the civilian administration in Nigeria since its advent in 1999 started making huge investments in the energy sector. Available records showed that by the end of 2001 the generating capacity had increased from 1824 MW (from 19 generating units) in March 2000, to about 4000 MW (from 40 generating units) and a new peak generation of 2934 MW was recorded in the process. This was made possible through rehabilitation of existing generating units, installation of new generating plants and the procurement of power from independent operators [36,24,21].

In the general trend findings, data indicated that while power is generated, they contributed to rise in the manufacturing capacity utilization. Instead of this translating to the growth in employment opportunities, unemployment rate was on the increase. This was still confirmed by the data seen between 2012 and 2013. Power generation growth rate were 27.3% and 29.2% respectively while manufacturing capacity utilization were 59.8% and 60.3%. However, unemployment rates were 19.8% and 29.5% in 2012 and 2013 respectively. The likely adverse economic implications of such deviation are dwindling average installed manufacturing capacity utilization and rising unemployment. Having observed this, the need to research on the link between power supply, average installed manufacturing capacity utilization and unemployment in Nigeria is felt.

2. THEORETICAL FRAME WORK AND LITERTURE REVIEW

2.1 Theoretical Framework

The mainstream theory of manufacturing capacity utilization growth pays little attention to the role of power supply in the economy. However, in order to understand the importance of energy in the capacity utilization of the manufacturing sector and unemployment level in the economy, it is necessary to start with the role of energy in the production. Considering the theories of production, the neo-classical economic theory explains the economy as a closed system where output is produced by inputs of labour and capital. Therefore, the economic growth is the result of the increased inputs or their quality.

Power supply has indirect importance and they have been seen as intermediate inputs. Infact, the mainstream economists have accepted the concept of primary and intermediate factors of production. Primary factors of production are inputs that exist at the beginning of the period under consideration and are not directly used up in production (though they can be degraded and can be added to), while intermediate inputs are those created during the production period under consideration and are used up entirely in production. Capital, labour and land are the primary factors of production, while goods such fuels and materials are intermediate inputs. This approach has led to a focus in mainstream growth theory on the primary inputs, especially capital and labour, while intermediate inputs like energy have got an indirect role. According to them (mainstream economists), the quantity of energy available to the economy is endogenously given, though determined by biophysical and economic constraints.

2.1.1 Neutrality theory

During the last two decades there have been a number of papers dealing with the causality between economic growth and energy, especially energy consumption. Strong interdependence and causality between economic growth and energy consumption is a stylized economic fact, but the existence and direction of causality is still not clearly defined. Broadly speaking, the schools of thought on energy and growth could be divided in two groups. The first one consists of people that argue that energy is a crucial input of production and therefore the necessary requirement for economic and social development, but potentially it could also be a limiting factor to economic growth. On the other hand, the other group of people argued that energy has no significant impact, which is known as neutrality hypothesis.

2.1.2 The deadweight loss theory

This exists as the consumer/producer surplus is lost. This is more or less due to restriction imposed on output by external factors. Let us consider an industry with the standard shapes of the demand and supply curves. The supply of output by the firm is based on the production

function that combines capital, labour, infrastructural services (e.g. electricity) and other inputs. The impact of poor and unreliable supply of infrastructural services would be an increase in the production cost of the firm either through the higher cost incurred in the substitution of private for public supply of those services or through output losses from shutdown by those who cannot effectively find substitutes because they cannot afford to bear the additional cost burden. The effect of this situation is to shift the supply curve to the left implying that the producer is only willing to supply each previous level of output at higher price. The higher market price of the product reduces both the consumers and producers surplus. Generally, the inadequate and poor quality supply of infrastructure, such as electric power etc have a major impediment to industrial production and overall economic growth. Some dimension of the loss to the economy can be engulfed in terms of the deadweight loss (the reduction of consumers and producers surplus)

2.1.3 Marxist theory of unemployment

This theory was developed by Karl Marx in 1863. From his Theory of Surplus Value comes the citation: "*It is the very nature of the capitalist mode of production to overwork some workers while keeping the rest as a reserve army of unemployed paupers" [*37].

Karl Marx, in this theory, believes that unemployment is inherent within the unstable capitalist system and periodic crises of mass unemployment are to be expected. Capitalism, to the Marxists, unfairly manipulates the labour market by perpetuating unemployment which lowers labourers' demand for fair wages. Workers are pitted against one another with the motive of increasing profits for their employers. In the conception of Karl Marx, the only way to permanently eliminate unemployment would be to abolish capitalism and the system of forced competition for wages, and then shift to the socialist or communist economic system. For the contemporary Marxists, the existence of persistent unemployment is a proof of inability of capitalism to ensure full employment.

The socio-economic distress the Nigerian citizens faced under colonialism led the populace to clamour for socialism as advocated by the Marxists. The socialist movement was initially a reaction against extreme poverty caused by capitalism on the masses. It lays great emphasis on the state embarking on a broad programme of welfare for the people, "the programme that would provide social insurance to protect the masses against unemployment and economic distress"; for instance, the post-independent Africa preached socialism. The NCNC government under Dr. Nnamdi Azikiwe and Dr. Michael Opara, preached "Welfarism and Pragmatic Socialism". The Action Group, under Chief Obafemi Awolowo equally advocated "Democratic Socialism".

However, the present day Nigeria seems to be taking a leap at mixed economic system due to low impact of capitalism and socialism to bring about real economic growth and development. Developing countries of which Nigeria is one, are calling on both the government and private sectors to cooperate and develop the country's economy. Recently, the government is adopting the public- private partnership initiative in achieving and accelerating some developmental objectives. Pivoting the economy cannot be left in the hand of the private sector alone; therefore there is the need for the government to participate fully. [38] had strongly posited that full participation of government in running the economy through its fiscal policy will ameliorate Nigeria's numerous economic challenges especially poverty, unemployment and corruption.

More so, some intervention programmes introduced in Nigeria such as the Nigerian Directorate of Employment (NDE) with the goal of designing and implementing programmes to combat mass unemployment, Poverty Alleviation Programmes (PAPs), Subsidy Re-investment Programme (SURE-P), YOUWIN programme, etc, and subsequent injection of billions of naira into these programmes and other sectors to create more employment opportunities as claimed by the Federal Government can be seen as a leap into the Keynesian theory.

2.2 Empirical Literature

[39] ran a co-integration on energy and its relationship with economic growth in Pakistan, a developing nation like Nigeria and found that increase in electricity consumption leads to economic growth.

[40] using the multivariate approach (in Nigeria) in which real GDP was modeled as functions of real energy consumption, real energy price, real money supply, real government expenditure and

real exchange rate and also modeled real energy consumption as functions of real GDP, real energy price, real money supply, real government expenditure and real exchange rate. That is a GDP-energy consumption model and energy consumption-GDP model was formed and specified by vector autoregressive models in order to determine the direction of causality between energy consumption and real GDP. The findings of the study showed a unidirectional causality from growth to energy consumption and found no evidence of causality for the other way round. The implication of these findings is that energy consumption has no information on the fluctuation of growth in the Nigeria economy.

Although strong interdependence and causality between economic growth and energy consumption is a stylized economic fact, the direction of causality between economic growth and energy consumption is not clearly defined. In the last two decades, a number of academic papers explored the relationship between economic growth and energy, mostly energy consumption. On one hand, it is argued that energy is a vital and necessary input along with other factors of production (such as labour and capital). Consequently, energy is a necessary requirement for economic and social development so that energy is potentially a limiting factor to economic growth. On the other hand, it is argued that since the cost of energy is a very small proportion of GDP, it is unlikely to have a significant impact; hence there is a "neutral impact of energy on growth". The overall findings vary significantly with some studies concluding that causality runs from economic growth to energy consumption, other conclude the complete opposite, while a number of studies find bidirectional causality. One of the first relevant studies was the one from Classical economists did not recognize energy.

On the other hand, it is argued that since the cost of energy is a very small proportion of GDP, it is unlikely to have a significant impact; hence there is a "neutral impact of energy on growth". The overall findings vary significantly with some studies concluding that causality runs from economic growth to energy consumption, other conclude the complete opposite, while a number of studies find bidirectional causality.

[41] evaluated energy and sustainable development in Nigeria. He reviewed that access to clean modern energy services ,is an enormous challenge facing African continent as energy is fundamental for socioeconomic and poverty reduction and conclude that today, 60% to 70% of the Nigerian population, does not have access to electricity.

Most studies focus developing countries, which is understandable because these countries are economies with the highest energy intensity aiming to increase the energy efficiency. Still, the empirical evidence is mixed for industrialized countries as well.

3. DATA AND METHOD OF ANALYSIS

3.1 Data

The data used for this study are the time series covering 1980 – 2013 period and are obtained from the statistical Bulletin of Central Bank of Nigeria (CBN), annual reports and Statement of Account of various issues and online service from – data.worldbank.org/indicators.

3.2 Model Specification

Having considered so many theories on power supply, manufacturing capacity utilization and unemployment, this work is anchored on Marxist theory of unemployment. The theory believes that unemployment is inherent within the unstable capitalist system and periodic crises of mass unemployment are to be expected. [42] examined the relationship between electricity power and unemployment rates in Nigeria from 1970-2005. It was specified that

$$UNRATEt = \Sigma\alpha t\text{-}1\ UNRATE_{t-1} + \Sigma\ \beta t\text{-}1\ ELCONt_{-1} + \Sigma¥\ t\text{-}1\ ELWAS_{t-1} + \Sigma\Psi_{t-1}\ ELUNG_{t-1} + €i.. \quad (1)$$

Where $UNRATE_t$ represents the dependent variable (unemployment rate), ELCON represents electricity consumption, ELWAS represents the wasted output, ELUNG represents the ungenerated capacity and α, β, ¥ and Ψ are the constants

[42] modified the above model by replacing $\Sigma\Sigma\ \beta_{t-1}ELCON_{t-1}$ in equation (1) above with industrial electricity power consumption

$$UNRATEt = \Sigma\alpha 1\text{-}t\ UNRATEt\text{-}1 + \Sigma\ \beta et\text{-}1\ ELINDet\text{-}1 + \Sigma¥t\text{-}1\ ELWASt\text{-}1 + \Sigma\Psi t\text{-}1\ ELUNGt\text{-}1 + €i. \quad (2)$$

Where ELINDe, represents industrial electricity power consumption and βe, is the constant.

In the light of the restructured model by [42] the model is hereby adopted and modified. It is specified as below;

To ascertain the significant long run relationship between power supply, average manufacturing capacity utilization and unemployment in Nigeria, the study specifies the model below

$$UNEMP = f(PS, AMCU, INT) \quad (3)$$

Where; UNEMP = unemployment rate, PS = Power Supply captured by electricity generation and AMCU = growth rate of average manufacturing capacity utilization. The relationship will be structurally expressed as follows,

$$UNEMP_t = b_0 + b_1PS_t + b_2AMCU_t + b_3INT_t + U_t \quad (4)$$

Where b_0 = Constant term, $b_1 - b_2$ = Regression coefficients and U_t = Error Term.

To examine if there is granger causality between average manufacturing capacity and power supply, the study adopts a second model stated below as thus:

$$AMCU = f(PS, EXR, INT) \quad (5)$$
$$PS = f(AMCU, EXR, INT) \quad (6)$$

In the linear equation format it becomes:

$$AMCU_t = b_0 + b_1PS_t + b_2EXR_t + b_3INT_t + U_t \quad (7)$$

$$PS_t = b_0 + b_1AMCU_t + b_2EXR_t + b_3INT_t + U_t \quad (8)$$

4. EMPERICAL RESULTS AND DISCUSSION

4.1 Results

This section deals with extracting, compiling, and modeling raw data for purposes of obtaining constructive information that can be applied to formulating conclusions, predicting outcomes or supporting decisions in this research. When data has been collected with the assistance of relevant tools and methods, the next logical step, is to analyze and interpret the data with a view to arriving at empirical solution to the problem. Therefore, data from various sources are gathered, reviewed, and then analyzed to form some sort of finding or conclusion. For this study, we employ descriptive statistical techniques like mean, standard deviation and coefficient of variation. After the data evaluation with descriptive analysis, the econometrics test analyses followed.

4.2 Summary Statistics of Variables Employed for the Study

This is intended to provide the analytical test on the observed economic variables to enable us express opinion on the nature of trend in each of the employed data series. The data on unemployment rate (UNEMP), Power Supply (PS) captured by electricity generation, growth rate of manufacturing capacity utilization (MCU), interest rate (INT) and exchange rate (EXR) for the period of 1980-2013 in Nigeria are presented in tables below as their means, median and standard deviations (SD).

The concept of mean is the sum of a collection of numbers divided by the number of numbers in the collection (i.e. $\Sigma fx/N$). The collection is often a set of results of an experiment, or a set of results from a sample. Thus, this refers to a central value of a discrete set of numbers: specifically, the sum of the values divided by the numbers of values. Therefore, considering the variables (UNEMP, PS and MCU), their means (i.e. $\Sigma fx/N$) are = 419.77/34 = 12.679, 541/34 = 15.929 and 1601.210/34 = 47.094 respectively. These scores indicate the central value of the data of each variable specified in the model which is also regarded as the averages of the considered variables.

Table 1. Statistics of Variables employed for the Study

Variables	Details	Mean	Median	SD
UNEMP	Rate of Unemployment	12.246	10.950	8.561
PS	Power Supply	15.929	14.532	6.011
MCU	Manufacturing capacity utilization (Growth Rate)	47.094	43.400	11.802
INT	Interest Rate	12.734	12.875	4.353
EXR	Exchange Rate	63.310	21.886	62.715

Source: Author's calculation based on data from CBN Statistical Bulletin, 2013 and International Energy Statistics at www.eia.gov

The median is the numerical value separating the higher half of a data sample or a population from the lower half. It is therefore the middle value in the list of numbers. With the aid of the econometric software employed (E-views 7), the median during this period of study for the variables; Unemployment Rate (UNEMP) = 10.95, Power Supply (PS) = 14.53 and Average Manufacturing Capacity Utilization (MCU) = 43.4 respectively.

Thus the range of the median conformed to the order of percentages these variables bear by their mean. Average Manufacturing Capacity Utilization (MCU) has the highest value of 47.09% of the mean, showing a higher value of 43.4% of the median within the period of study. Power supply (PS) has the value of 15.93% of the mean, showing a value of 14.53% of the median while unemployment rate (UNEMP) has the value of 12.35% of the mean, indicating the value of 10.95% of the median.

The standard deviation (S^2) of a data set shows how much variation or dispersion exists from their mean. A low standard deviation indicates that the data points tend to be very close to the mean; a high standard deviation indicates that the data points are spread out over a large range of values. The values for the standard deviation for Unemployment Rate (UNEMP) = 8.6, Power Supply (PS) = 6.01 and Average Manufacturing Capacity Utilization (MCU) = 11.80.

4.3 Trend Analysis

The study seeks to evaluate the link among power sector; average installed manufacturing capacity utilization and unemployment within 1980-2013. Hence, the study employed trend analysis in order to examine properly the downwards and upward movement of the variables. Below is the graphical presentation of the trend analysis.

4.4 A Combined Trend of the Variables; UNEMP, PS and MCU

The above time series upward and downward movements give a picture of the general tendency in the development process over a long period. From the graph above, UNEMP, PS and MCU trend did not display a close straight line movement. Unemployment Rate (UNEMP) indicated a rise and fall magnitude of increasing movement over the period of the study. The pattern of trend displayed by Power supply (PS) could be described as linear graph. The pattern of trend displayed by Average Manufacturing Capacity Utilization (MCU) almost assumed a rise and fall movement but in a decreasing manner.

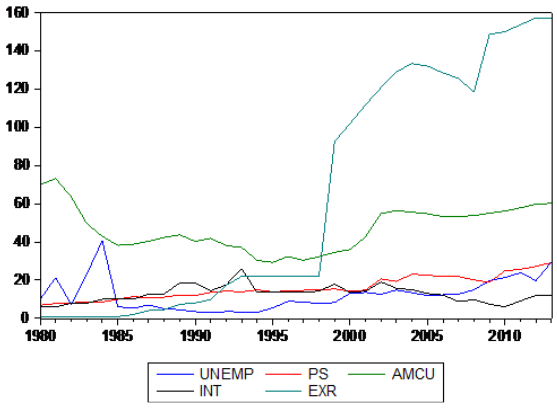

Fig. 1. A combined trend of the variables; UNEMP, PS and MCU

4.5 Unemployment Rate (UNEMP)

The unemployment rate (UNEMP) experienced a sharp rise and fall trend from 1980 to 1985. However, there was a slight downward trending between 1986 and 1995. This indicated small decrease in the unemployment rate. There came a slow and steady rise in the unemployment level from 1996 to 2013. The line graph showed that there was a gradual upward trend experienced within 1996 and 2013.

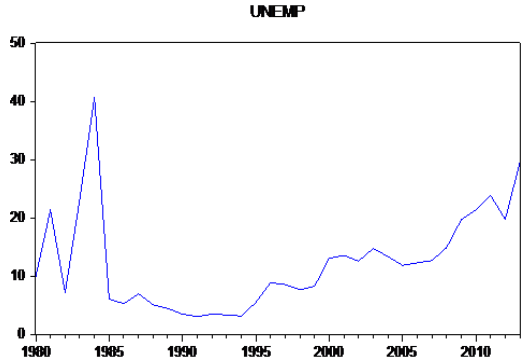

Fig. 2. Unemployment rate (UNEMP)

4.6 Power Supply (PS)

The data on power generation showed that there was significant rise in megawatt within 1980 and 2003. This was confirmed by the line graph of PS which was gradually trending upwards. However,

the economy witnessed an upward and downward movement with a steady rise from 2004 - 2013.

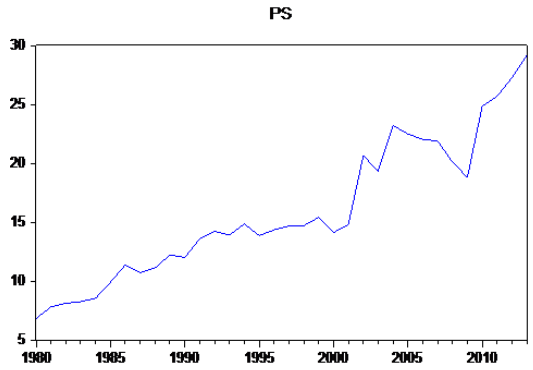

Fig. 3. Power Supply (PS)

4.7 Average Manufacturing Capacity Utilization (MCU)

The economy of Nigeria witnessed a gradual fall in the manufacturing capacity utilization from 1980 to 1985. There was a gradual rise 1986-1989. Though there was a drop in the increase in from 1990-1995. However, there was continuous increase from 1996-2013. This implies that the extent to which the productive capacity of the manufacturing sector is being used was increasing from 1996-2013.

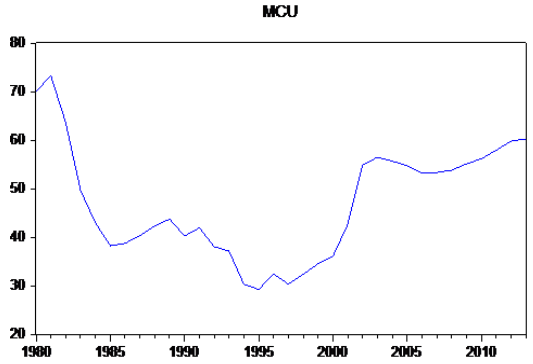

Fig. 4. Average Manufacturing Capacity Utilization (MCU)

4.8 Interest Rate (INT)

The interest rate was found to be steadily rising from 1980 to 1993 but fell drastically from 1993 to 1995. The fall was gradually sustained from 1995 down to 2010. It further witnessed a rise from 2010 to 2013.

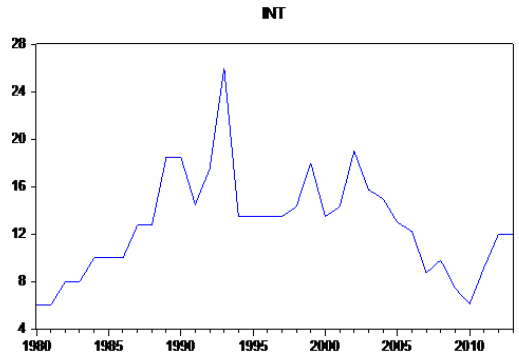

Fig. 5. Interest Rate (INT)

4.9 Exchange Rate (EXR)

The data on exchange rate was found to be on the increase from 1980-2013.

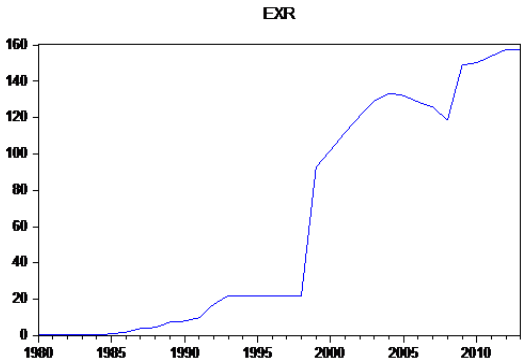

Fig. 6. Exchange Rate (EXR)

4.10 Unit Root Test

The Augmented Dickey-Fuller (ADF) test statistics were employed to test for the existence of unit roots in the data using trend and intercept. The test results are presented in Tables 2 and 3.

4.11 Co-integration Test

Johansen Cointegration is adopted to test for the presence long run relationship between the series of the same order of integration through forming a cointegration equation. The basic idea behind cointegration is that if, in the long-run, two or more series move closely together. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary.

The summary of the Johansen Co-integration Test is shown in the Table 4. The model with lag

1 was chosen with the linear deterministic test assumption.

Johansen co-integration test for the series; UNEMP and the explanatory variables; PS, AMCU and INT.

Under the Johansen Co-integration Test, there are two co-integrating equations. In Johansen's Method, the trace statistic determines whether co-integrated variables exist.

The presence of co integration among the variables as showed above indicates an evidence of long-run economic relationship among the variables. This implies that, vector error correction model is an option for further analysis. It integrates the short run dynamics and the long run equilibrium.

With the aid of VEC granger causality tests, the direction of causality among the variables specified in the model is ascertained. The

Table 2. Augmented dickey fuller unit root test

Trend and Intercept (Series at Levels)

Series	ADF test statistic	5%critical values	10% critical values	Remarks
UNEMP	-3.048171	-3.552973	-3.209642	Not stationary
PS	-2.598244	-3.552973	-3.209642	Not stationary
AMCU	-3.339383	-3.552973	-3.209642	Not stationary
INT	-2.747358	-3.552973	-3.209642	Not stationary
EXR	-2.124857	-3.552973	-3.209642	Not stationary

Sources: Researcher's compilation from E-views 7

Table 3. Augmented dickey fuller unit root test

Trend and Intercept (Series at 1st Difference)

Series	ADF test statistic	5%critical values	10% critical values	Remarks
UNEMP	-7.792109	-3.557759	-3.212361	Stationary
PS	-6.867474	-3.557759	-3.212361	Stationary
AMCU	-3.927201	-3.557759	-3.212361	Stationary
INT	-6.127032	-3.127032	-3.212361	Stationary
EXR	-5.342154	-3.127032	-3.212361	Stationary

Sources: Researcher's compilation from E-views 7

Table 4. Co integration result

Unrestricted cointegration rank test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.624613	68.66134	47.85613	0.0002
At most 1 *	0.532692	37.30780	29.79707	0.0057
At most 2	0.308236	12.96325	15.49471	0.1162
At most 3	0.035929	1.170905	3.841466	0.2792
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				

Table 5. VECM system equation

	Coefficient	Std. error	t-statistic	Prob.
C(1)	-0.852287	0.239622	-3.556794	0.0015
C(2)	0.069221	0.186686	0.370789	0.7138
C(3)	0.221553	0.750114	0.295359	0.7701
C(4)	-0.412124	0.289476	-1.423690	0.1664
C(5)	0.331053	0.371618	0.890841	0.3812
C(6)	-0.103580	1.347196	-0.076886	0.9393

R-Squared = 0.712686, F-Statistics = 3.65, Prob(F-Statistic) = 0.012, LM P-value = 0.17

Table 6. VEC granger causality test

Dependent variable: D(AMCU)			
Excluded	**Chi-sq**	**Df**	**Prob.**
D(PS)	0.176884	1	0.6741
D(EXR)	6.309609	1	0.0120
D(INT)	0.001424	1	0.9699
All	6.845603	3	0.0770
Dependent variable: D(PS)			
Excluded	**Chi-sq**	**Df**	**Prob.**
D(AMCU)	0.663547	1	0.4153
D(EXR)	0.067321	1	0.7953
D(INT)	0.006413	1	0.9362
All	0.787634	3	0.8524

direction of causality from the explanatory variables; PS, EXR and INT to the dependent variable; AMCU is tested using the P-values. Also, the causality from another dependent variable; PS to the explanatory variables; AMCU, PS, EXR and INT is evaluated using P-value.

5. DISCUSSIONS OF FINDINGS

5.1 Unit Root Test

Observing the variables; UNEMP, PS, AMCU and INT, it is found that all the variables are not stationary at levels in using Augmented-DickeyFuller at Trend & Intercept, because some of their calculated statistics are less than the critical values both at 5% level of significance. However, all the series are stationary at first difference 1(1). The results show that the time series are integrated of the same order; I(1), with the application of ADF. Thus, a linear combination of series integrated of the same order are said to be co-integrated.

5.2 Co-integration Test

The Johansen co-integration test indicated that there are two co-integrating equations. In Johansen's Method, the trace statistic determines whether co-integrated variables exist. As found from the first trace statistics, its value is greater than 5% critical values (i.e. [68.661 > 47.856] and [37.308 > 29.797] while the other trace statistic is less than the 5% critical [1.171 < 3.842]. The eigenvalues [0.625, 0.533] of the first and second trace statistics are significantly greater than zero. In other words; the null hypothesis of no co-integration among the variables is rejected since at least two equations at 5% are statistically significant. The test result shows the existence of a long-run equilibrium relationship among the variables.

5.3 Vector Error Correction Model

The coefficient of ECM(-1) is -0.852. The coefficient indicated that the speed of adjustment between the short run disequilibrium and the long run equilibrium is 85.2%. Thus, base on this estimate, the system disequilibrium will be corrected from the short run dynamics to its long-run equilibrium by 85.2% every year.

The computed coefficient of multiple determination (R^2) value is 0.7127. The value shows that 71.3% of variations in UNEMP are explained by changes in Power supply (PS), average manufacturing capacity utilization (AMCU) and interest rate (INT) while 28.7% of the variations in unemployment rate (UNEMP) are attributable to the influence of other factors not included in the regression function.

5.4 VEC Granger Causality Test

In the VEC Granger Causality, AMCU does not granger cause PS. This is confirmed by its P-value [0.6741]. However, AMCU granger causes EXR as confirmed by the P-value [0.0120]. The P-value for the causality from PS to AMCU is [0.664] while its P-value is [0.4153]. It shows that PS does not granger cause AMCU. The overall causality that runs the explanatory variables; PS, EXR and INT to AMCU indicated the chi-sq value to be 6.846 with P-value of 0.0770. Invariable, the causality from the explanatory variables to the dependent variable is not statistically significant.

5.5 Implication of the Results

The result showed that there is long run significant relationship that exists among unemployment rate, average manufacturing capacity utilization and power supply in Nigeria within 1980 and 2013. This is confirmed by the results of co integration. Thus, it is estimated from the upper chamber of the VECM result that 1% increase in average manufacturing capacity utilization (AMCU), on the average will bring about 0.3% decrease in UNEMP. This signifies a negative relationship between UNEMP and AMCU. If the average manufacturing capacity utilization rises, it will create more output and the rise in output will boost revenue. All things being equal, the proceeds will be plough back to the manufacturing sector, thereby widening the chances to employ more hands. This will cause a drop in the unemployment rate.

Theoretically, increase in the power generation should make negate the trend pattern of movement in unemployment rate. In order words, when power generation is enhanced, there will be a drop in the unemployment rate. Implying, that increase in the activities of the power sector, will drive investment and boost economic activities thereby reducing the level of unemployment. It is observed from the trends that power generation was increasing between 1980 and 1985 but unemployment rate was rising and falling drastically with the same period. The increased power generation is attributed to improved efficiency, reliability and quality of services and greater investment into the sector to stimulate economic growth. However, power generation was still on the increase from 1986 to 1994, unemployment rate was decreasing within the same period under consideration. Increase in the power generation and decrease in the unemployment level was felt at the same time within 2001 and 2003. The same experience was found between 2011 and 2012. The outcome within this period met apriori expectation. This implies that availability of power led to the increase in the economic activities, creating increase in investment and lowering the high unemployment rate. It is also estimated that 1% increase in power supply will cause unemployment rate to fall by 0.12%. This shows the importance of power supply in the country. For any manufacturing sector to increase its output there must be rise in the power supply. However, the result indicated that rise in the interest rate by 1% will cause rise in the unemployment rate by 0.8%. If the cost of borrowing rises, it will discourage the manufacturing sector to invest, thereby reducing output. This will eventually cause structural unemployment.

The result from the granger causality indicated that there is no significant causation between unemployment rate and average manufacturing capacity utilization. Generally, it was found that different fluctuations in the trends are depicted between power generation and average manufacturing capacity utilization. The reason for variables' fluctuation in the economy is adduced to poor performance of the sector which is as a result of the harsh economic environment. Some of the challenges that led to the harsh economic environment are: acute state of infrastructure deficiency, especially energy, general insecurity and perceived threat to political and economic stability, smuggling and dumping of cheap and substandard goods which usually suffocate local manufactured products, high cost of funds and inadequacy of long-term loan windows to support long-gestation investments; multiple taxation which is threatening the survival and growth of business in the country, weak demand as a result of low purchasing power, among others.

6. SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

The study was centered on power sector, average installed manufacturing capacity utilization and unemployment in Nigeria from 1980-2013. Specifically it determined the extent to which unemployment has been influenced by the power sector. It also evaluated the impact of average installed manufacturing on unemployment rate in Nigeria. Finally, it ascertained if there are different fluctuations in the trends, depicted among unemployment rate, power generation and average manufacturing capacity utilization. Descriptive analysis and econometric test on data obtained from CBN (1980-2013) were used. The empirical results indicated that there is long run significant relationship that exists among unemployment rate, average manufacturing capacity utilization and power supply in Nigeria within the period under study. Thus, when power generation is enhanced, there will be a drop in the unemployment rate. Implying, that increase in the activities of the power sector, will drive investment and boost economic activities thereby reducing the level of unemployment.

However, there is no significant causal relationship between average manufacturing capacity utilization and power supply. In the manufacturing sector, full capacity utilization has not been optimally used due to power instability. The reason for variables' fluctuation in the economy is adduced to poor performance of the sector which is as a result of the harsh economic environment.

Based on the findings, the policy implications are in these directions.

- To reduce the increasing rate of unemployment in Nigeria, there should be improved economic capacity utilization rate in the manufacturing sector. It is also recommended that an appropriate policy measure that aim at expansionary aggregate demand as a means of promoting capacity utilization in the

manufacturing sector should be introduced.

- Government should strengthen the power sector to provide constant electricity to the sector in Nigeria. This will help to lower the total variable cost of the manufacturing sector and increase the net returns as well as the capacity utilization of the sector. Furthermore, the industrial policy package during liberalization era will promote economic capacity in the industry.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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