Developing Country Studies
ISSN 2224-607X (Paper) ISSN 2225-0565 (Online)
Vol 2, No.4, 2012

Electricity Crisis and Manufacturing Productivity in Nigeria (1980-2008)

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Abstract
Many researchers and policy makers have often emphasized the importance of adequate and regular electricity supply towards increasing manufacturing productivity in Nigeria. In line with this, this study was carried out to evaluate the impact of electricity crisis on the manufacturing productivity growth in Nigeria.The variables in the model include, manufacturing productivity index (as dependent variable) while electricity generation, capacity utilization rate, government capital expenditure on infrastructures and exchange rate (represent the independent variables). The study employed the ordinary least square multiple regression to analyze the time series data between 1980 and 2008. The result of the study shows that electricity generation and supply in Nigeria under the reviewed period impacted negatively on the manufacturing productivity growth, due to unnecessary government's spending on non-economic and unproductive sectors. In view of the findings, the study suggests among others, a reverse of the ugly trend of poor electricity supply through the initiative of independent power project, as proposed by some states in Nigeria.

Keywords: Electricity Crisis, Manufacturing, Productivity, Nigeria, 1980-2008.

Introduction

One of the pre-requisites of manufacturing productivity is adequate supply of electricity which is mainly utilized for driving machines for the production of various items. Manufacturing sector which is deliberate and sustained application and combination of an appropriate technology, infrastructure, managerial expertise, and other important resources has attracted considerable interest in development economics in recent times. This is because of the critical role manufacturing sector plays in economic development. This sectors acts as a catalyst that accelerates the pace of structural transformation and diversification of the economy, enables a country to fully utilize its factor endowment and to depend less on foreign supply of finished goods or raw materials for its economic growth, development and sustenance.

The electricity crisis is represented by such indicators as electricity blackouts and persistence reliance on self generating electricity. Indeed, as noted by Ekpo (2009), Nigeria is running a generator economy whit its adverse effect on cost of production. The country's electricity market is dominated on the supply side by a state owned monopoly Power Holding Company of Nigeria (PHCN) formerly called the National Electric Power Authority (NEPA) has been incapable of providing minimum acceptable international standards of electricity service that is reliable, accessible and available international standards of electricity for the past decades. In view of the compounding problem of electricity generation in Nigeria, especially in the last decade, the study attempt to examine the relationship between electricity crisis and manufacturing productivity in Nigeria between 1980 and 2008.

Literature Review

Electricity concept and industrialization in Nigeria

For any meaningful industrialization process to take place in any economy, electricity supply and demand must remain uncompromising elements of the process. This submission was corroborated by Iwayemi (1998) and Odell (1995). While the former argued that for Columbia as a nation to industrialize electricity supply and demand are crucial factors in the process, the later also realize the importance of energy sector in the socio-economic development of Nigeria. He further submitted that strong demand and increased supply of electricity would stimulate increased income and higher living standards in Nigeria.

Also in agreement with the duo of Iwayemi(1998) and Odell(1995), Ndebbio (2006), submitted that electricity supply drives industrialization process. He argued that one important indicator to show whether a country is industrialized or not is the megawatt of electricity consumed. According to him, a country's electricity

consumption per capita in kilowatts per hour (KwH) is proportional to the state of industrialization of the country.

Adenikinju (2005), also supported the various arguments from Iwayemi (1998), Odell (1995), as well as Ndebbio (2006), by providing a strong argument to further support the overwhelming importance of energy supply to the Nigerian economy. The poor nature of electricity supply in Nigeria, according to him, has imposed significantly cost in the industrial sector of the economy. This argument also corroborates the survey of the manufacturers Association of Nigeria (MAN) in 2005, where it was indicated that the cost of generating power constitute about 36 percent of the production.

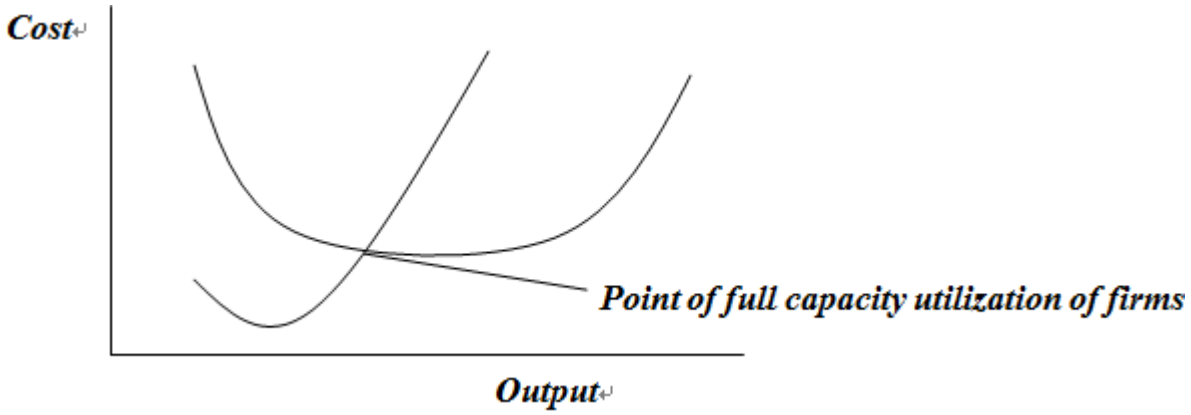
Ekpo (2009), in his own submission, elaborated on the cost of running a generator economy and its adverse effects on investment. He strongly opined that for Nigeria as a nation to jump start and accelerate the pace of industrialization, the country should consider fixing power supply problem.

Review of theoretical and empirical studies

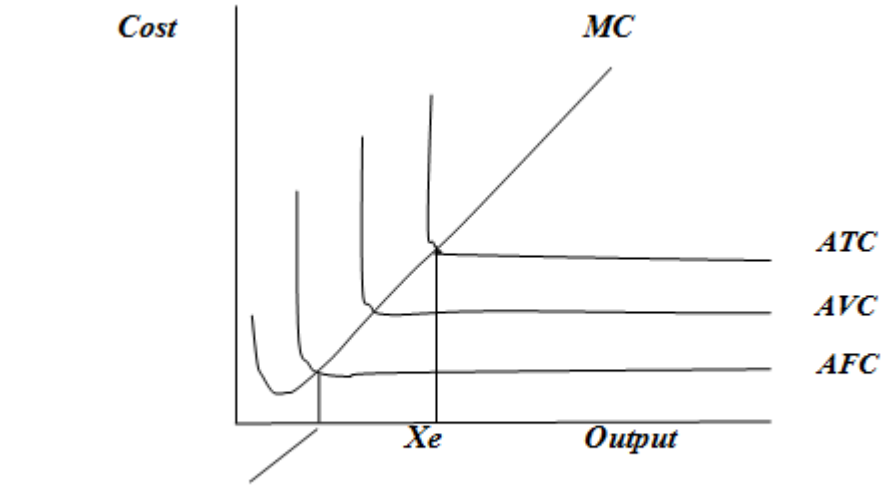
Theoretical Issues

This study has attracted some basic theoretical and empirical discussions, reflecting issues border on electricity and manufacturing productivity growth. Some of the theories include, the liberalized electricity markets theory, traditional theory of cost and modern theory of cost among others. Meanwhile, the liberalized electricity market theory explains the right of firms to choose to invest in different types of power plants which allow production of electricity at different levels of marginal cost. Since electricity is not storable at reasonable cost, it is optimal for firms to invest in a differentiated portfolio of technologies in order to serve strongly the fluctuating demand. Prior to the liberalization of electricity markets, regulated monopolists decided on optimal investment and pricing strategies, but in the course of liberalizing those markets in Europe and US, which started in the 1990s, regulated monopolistic generators have been transformed into competing, but potentially and strategically acting firms.

Another relevant theory of the study is the traditional theory of cost, which admits that the optimal level of output is attainable at a single level of output above which costs began to rise. Therefore, the output capacity is fully utilized at a point where the marginal cost curve cuts the average cost curve at the minimum while the former start rising.



Under the traditional theory of cost, firms do not build plants with varying productive capacity, thus excess capacity is often a phenomenon experienced by firms. Excess capacity according to Bannock, et al (1998) is the difference between the amount produced by a firm or group of firms and the higher amount that could most efficiently produce. For instance, if a firm produces 1,000 cars at a cost of N5, 000 each, but the lowest cost output would be 1,300 cars at N4, 000 each. Therefore, there is excess capacity of 300 cars. Bannock et al (1998) asserts that sustained excess capacity is also a feature of firms in monopolistic competition, while it will only exist in the short run under perfect competition.



Point of excess capacity

Excess capacity could also mean the difference between the actual output and maximum possible output of a firm, industry, or economy at large, when there are unemployed resources.

However, the modern theory of cost, in its own description, assumed that firms build their plants with some flexibility in their productive capacity and making it possible for such firms to have reserve capacity. In furtherance to that, the theory also asserts that firms who utilize two-third and three quarters of their adequate supply of power are considered to be efficient. The reserve capacity under the modern theory of cost implies that some outputs can be produced at a single cost.

Whichever positions or arguments put forward by each of the theories considered in this study, they are not permanently meant to bridge the gap between the electricity crisis and manufacturing productivity growth especially in the developing countries of Africa. The permanent solutions should be sought in the total revolution and overhauling of the power sector, to allow the optimal use of the equipment in the manufacturing sectors across developing countries especially, Nigeria. For instance, inadequate supply of power makes the manufacturing sectors in Nigeria go for power generator and the cost of running such leads to increase in cost of production such as money spent on petrol, diesel etc. this increase in cost has sent many manufacturing firms out of business and eventually reduces the industrialization efforts of Nigeria.

Empirical Studies

Most of the empirical works reviewed in this study has indicated the poor state of electricity supply in developing African countries. The poor state of this infrastructure also has a negative impact on the economic performance of developing economies. For instance Lee and Anas (1992) reported that manufacturing sub-sector in Nigeria spend on average 90% of their variable cost on infrastructure, with electric power accounting for half of time share. The duo, having study 179 manufacturing firms in Nigeria also reported that the impact of electricity deficiency of all types was consistently higher in small firms.

Ukpong (1973), also carried out a study on the cost of power outages to the industrial and commercial sector in Nigeria. He used the production function approach to evaluate the power outage cost between 1965 and 1966, with selected firms. From his estimate, he discovered the unsupplied electrical energy to be 130Kwh and 172Kwh between the periods. The corresponding costs of the power outage to the industrial sector in the two years were estimated at N1.68million and N2.75million respectively. The unsupplied electrical energy according to Ukpong, has a negative implication on the manufacturing productivity growth in Nigeria.

A similar framework of analysis was also carried out by Uchendu (1993) on the industrial firms, in the commercial areas of Lagos State, Nigeria. The study estimated several types of outage costs such as material and equipment losses and value of unproduced output, which was estimated at N1.3million, N2.01million and 2.32million in 1991, 1992 and mid 1993 respectively. The development reduced the value added of major manufacturing firms in Nigeria during these periods.

World Bank (1993b) conducted a study and estimated the adaptive cost of electricity failure in Nigeria, was amounted to USD380million. Also the estimate of National Electric Power Authority (NEPA) now Power Holding Company of Nigeria (PHCN) revenue lost to unsupplied consumer energy was stated by World Bank as USD140million. However, the short term losses incurred by consumers such as raw material and equipment

losses in other words the supply of electricity is unreliable from the public power supplier in Nigeria, and the reliability is known to be less than 50% by time nationwide (World Bank, 1993b). Also from the available study from World Bank (1993b), only 34% of Nigerian's population has access to the public power supply, which is always in short supply for the household sector and not to consider supply to the manufacturing subsector in Nigeria.

The Model

The reviewed work of Ndebbio (2006), that adequate and regular supply of power stimulates industrialization process form the basis of the model of this study. The work further expresses manufacturing productivity index as a function of megawatt of electricity generated or supplied, i.e. MPI = f (EGI). Therefore, from the existing model of Ndebbio (2006), the study specifies the following model;

$$MPI = \alpha 0 + \beta 1EGI + \beta 2CPU + \beta 3GCE + \beta 4EXR + Ui$$

Where; MPI = Manufacturing productivity index
EGI = Electricity Generation
CPU = Capacity Utilisation
GCE = Government Capital Expenditure
Ui = Stochastic error term

In estimating the parameters of the model, ordinary least squares (OLS) multiple regression technique was employed. The data for all the variables stated in the model were extracted from 2007 edition of Central Bank of Nigeria Statistical Bulletin over the period of 29 years and the expected results of the relationship from the specified model are as follows;

$$\frac{\delta MPI}{\delta EGI} > 0 \quad \frac{\delta MPI}{\delta CPU} > 0 \quad \frac{\delta MPI}{\delta GCE} > 0 \quad \frac{\delta MPI}{\delta EXR} < 0$$

All the variables except the exchange rate (EXR) are expected to have positive relationship with the manufacturing productivity index.

Results and Discussion

Table 1: Ordinary Least Square Regression Result

Variable	Coefficient	Standard error	t-statistics	Probability value
Constant	5.10	0.78	6.53	0.0000
EGI	-0.08	0.13	-0.075	0.4628
CPU	0.25	0.12	2.20	0.0374
GCE	-0.12	0.023	-4.26	0.0003
EXR	0.17	0.03	6.20	0.0000

Source: from Data Computation

LMPI = 5.104710 – 0.084025LEGI + 0.253359LCPU – 0.11905LGCE + 0.168802LEXR
$R^2 = 0.67$
F-statistics = 11.92
D.W = 1.53
No of observation = 29

By interpretation, the result of the study in table 1 shows a positive relationship between capacity utilization, exchange rate and the index of manufacturing productivity, while on the contrary, electricity generation and government capital expenditure produced negative relationship with manufacturing productivity index. It was also revealed from the table, a high variation of 67% for the coefficient of multiple determination (R^2), meaning that 67% variation in manufacturing productivity is explained by the explanatory variables i.e. electricity generation, capital utilization, government capital expenditure and exchange rate. It was also observed through the probability values in table 1 that apart from electricity generation (EGI), all the variables were statistically significant at 5% level.

Discussion of results

The revealed negative relationship between electricity generation and the index of manufacturing productivity from the result, simply confirmed the study of Lee and Anas (1992) which identifies inadequate electricity supply as reason for low manufacturing productivity in Nigeria. The inadequate and irregular supply of electricity translates to high cost of production through the use of alternative power supply.

On the contrary, the result shows a negative relationship between capacity utilization and manufacturing productivity index. Apart from the fact that the result conformed to the a priori expectation, it was also supported by Ukpong (1993), World Bank (1993b), which also consider short of electricity supply to the manufacturing sector as a severe bane to increase capacity utilization in the sector. The result of the relationship between manufacturing productivity index and government capital expenditure was not inconformity with the earlier expectation. The expectation should be that government capital expenditure should respond well to the manufacturing sector in Nigeria, but the reverse is the case. This may partly due to the fact that most times, the budgetary allocation to the energy sector has not been properly channeled to meet the desired result. For instance, during President Olusegun Obasanjo regime, an allocated fund meant for revitalizing energy sector could not be accounted for. This most publicized fund was said to have gone down the drain without achieving its intending purpose in Nigeria. This situation among others affect the energy sector, by way of inadequate and irregular supply, especially to the manufacturing sector which further translate to negative productivity in the sector.

Also, from the result of relationship between the manufacturing productivity index and exchange rate, a positive relationship was established instead of negative expectation. This result shows a relationship not conforming to the a priori expectation. One would expect exchange rate to react negatively with the index of manufacturing productivity, but it was positive due to the fact that many manufacturers have resulted to rely heavily on power generating plants as the alternative to erratic power supply in Nigeria. Although, the use of these generating plants would definitely add to the cost of production and price of the product, but it is a worthwhile venture in Nigeria, for manufacturers, in order to remain in business and still meet the demand of his customers. The ugly power situation in Nigeria has continued to encourage the influx of power generating plants by manufacturers into the country as alternative power supply, in order to increase their productivity. Therefore, as demand for power generating plants continue to increase; not minding the exchange rate for its import, productivity in the manufacturing sector also increases. This development might have responsible for the positive relationship between the manufacturing productivity index and exchange rate, because all these generating plants being used as alternative to epileptic power supply in Nigeria are imported.

The findings from this study have serious implications on the economy of Nigeria. First, due to inadequate and irregular power supply, coupled with inadequate government spending on capital goods, manufacturers have shifted their attention towards alternative source of power supply in the country. This development has continually increased the cost of production as well as prices of goods and services from these industries. This increase in cost of production and prices of goods and services causes greater reduction in both production and consumption of manufacturing products in the country.

Second, the reduction in manufacturing productivity due to inadequate and irregular power supply will automatically discourage export of domestic goods. Since manufacturers are running a generator economy, prices of domestic goods relatively become higher than foreign goods. As a result of this, Nigerians prefer consuming more of foreign goods than domestic goods; this may eventually lead to country's unfavourable balance of payment; showing excess of import over export as well as reduction in the country's foreign reserves.

Conclusion and Recommendations

From the analysis done so far, Nigerian manufacturing sector could not have been said to have found its rightful place as a sector which could ginger up the economic growth rate which currently stands at 6.9% but instead has been bedeviled by structural problems and policy distortions. One of these problems is the irregular and inadequate power supply in the country. The Power Holding Company of Nigeria (PHCN) has not been efficient enough at sustaining electricity generation to industrial sector. The much proclaimed target of 6,000Megawatts of electricity that could have been achieved in 2011 has remained a misery, thereby impacting negatively on manufacturing growth.

Government capital expenditure on energy sector that could have assisted the country to fix electricity problem in Nigeria could not because government officials have made it their usual habit to embezzle public funds that could have been used to finance power project. Moreover, it is evident that most of the manufacturing industries in Nigeria heavily rely on foreign capital inputs and expertise for efficient production which could have been made readily available through a strong domestic currency.

Nevertheless, the prospects of improved performance in the manufacturing sector are not far from reality, only if government can show serious commitment and spend sufficiently on electricity sub-sector for its regular

and efficient distribution in Nigeria. In addition, the federal government should also support the initiative of independent power project, as proposed by some states in Nigeria.

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