Effect of Electricity Power Consumption on Economic Growth of Nigeria

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ABSTRACT

The aim of this study is to examine the effect of electricity consumption on Nigeria's economic growth efforts from 1981 – 2012 with a view to proffering suggestions and recommendations where necessary. This study employs secondary data using the expanded Cobb Douglas production function; using 1990 as the base year. The Ordinary Least Square (OLS) is applied in the analysis of the model. Empirically, we find that there is a positive linear relationship between GDP and GFCF, ELEC, EXCH and LABF, while an inverse linear relationship exists between INDO, INF, INT and GDP. The Adjusted R^2 is 98.7% variation in the dependent variable (GDP). Individual test shows that GFCF and EXCH are statistically significant, while electricity consumption; industrial output, labour force, interest rate and inflation are not significant. This means that both electricity consumption and industrial output do not have positive impact on economic growth in Nigeria, hence, is responsible for the low level of industrialization in Nigeria. The ADF result shows a unit root among the variables at first difference, except for inflation, that is at level. The variables in the model are co-integrated showing a long–run unidirectional casualty. Again, the variables have joint significant effect on GDP in Nigeria. This study recommends among others the diversification of energy resources.

Keywords: *Electricity consumption, economic growth,* power supply, generation

INTRODUCTION

Electricity power generation began in Nigeria in 1896 with the development of 20 Mega walts power station established in Ijora Lagos (Chigbo, 2008). It was because of the increasing demand for electric power, that the Electricity Corporation of Nigeria (ECN) was established in 1950 to oversee the electricity sector in Nigeria (Chigbo, 2008). In the northern part of Nigeria, the Niger Dam Authority (NDA) was set up to manage the dams which generated slightly above 50 Mega walts. With the management of Kainji Hydro power, Afam Power Plant, Delta Power Plant by NDA the electric power witnessed a major expansion in generation, transmission and distribution between 1960 and 1974 in Nigeria. There was increase in economic activities which translated to increased economic growth and development. However, with the increase in population and urbanization; efficient and affordable electricity supply bacame difficult, hence both the Niger Dam Authority

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and Electricity Corporation of Nigeria were merged in 1972 to form National Electric Power Authority (NEPA). Nigeria is fortunate to have huge energy resources which potentially gives the country ample opportunity to transform her economy and the lives of her citizens. It is because of the perennial problem of power supply in Nigeria that made the Federal Government to unbundle NEPA and allow the private sector to participate in the sector through the Electric Power Sector Reform Act 2005, which gave birth to Power Holding Company of Nigeria (PHCN) to take over the functions of NEPA and all its assets, liabilities and staff (Ekpo, 2010). PHCN created 18 successor limited liability companies of 6 Generation (Gencos), II Distribution (Discos) and I Transmission (Transco) owned by the private sector to enhance efficient electricity production and consumption (Abubakar, 2008). The Nigeria Electricity Regulatory Commission (NERC) is to provide for the licensing and regulation of generation, transmission, distribution and supply of electricity to enforce such matters as performance standards, consumer's rights and obligations to provide for the determination of tariffs, and for other related matters (Adegunwa, 2008).

No country can boost of sustainable economic growth and industrial development without adequate electricity or energy supply. According to Iwayemi (1998), the importance of electricity in economic growth process in Nigeria cannot be undermined in policy formulation. Because the power sector in Nigeria could not supply affordable, quality, efficient, adequate electricity to Nigerians, the response has been increased "captive power supply" as the solution to NEPA's incompetence. Nigeria has all it takes to produce energy in the form of gas, coal, oil, thermal, etc, as the number six energy producing country in the world, but up till now producing efficient and stable electricity for its citizens has been a mirage. According to Babatope, Taiwo and Patrick (2013), energy is an indispensable force driving all economic activities, hence the greater the energy consumption, the more the economic activities in the country. The gap between electricity production (supply) and consumption (demand) has been identified as the reason for low economic growth in Nigeria.

Since Nigeria's independence in 1960, insufficiency in power generation and supply for industrial and domestic use, has always been identified as a key factor working against upward and continuous leap of Nigeria's economy. Electricity has very erratic supply in Nigeria, giving pressure to high demand for petroleum fuel substitute (Akpan G. and Akpan U, 2013). The epileptic power supply in Nigeria has been attributed to corruption; bureaucratic bottlenecks, vandalism, incompetence amongst others. The Federal Government invested much in the power sector between 1971 and 2007 without achieving stable supply. However, the projected production has been falling short of the projected consumption; thereby affected the country's economy adversely. Nigeria remains the highest importer of generators in the world, in spite of her abundant energy resources. Averagely, the country spends more than ₦800 million yearly on the importation of generators (Backon and Besael, 2001). This is why the country depends on electric captive supply more than any other country globally. Supply from the national grid has been oscillating between 4000mw to 2180mw (Kumuyi, Akinbinu and Adeyinka, 2008). The military administration

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did not see any wisdom in building new power plants. The government had been providing funds for the power sector, but they have not been judiciously utilized. The civilian administration under Obasanjo budgeted enough to ensure regular and efficient electricity supply. As the population was growing, the unreplaced obsolete equipment were increasing, hence a serious gap between electricity supply and demand. This study has been designed to examine the effect of electricity and the direction of the effect using the data within the period under review. The broad objective of this study is to investigate the effect of electricity power consumption on economic growth of Nigeria. Specifically, the objective is to ascertain the impact of gross fixed capital formation (GFCF), electricity consumption (ELEC), Industrial output (INDO), Inflation (INF), Interest rate (INTR), Exchange rate (EXCH), and Labour force (LABF) on Gross Domestic Product (GDP) in Nigeria. A comprehensive hypothesis was formulated in the null form for the study. Thus, there are no significant relationship between GFCF, ELEC, INDO, INF, INT, EXCH, LABF and GDP in Nigeria.

Electricity is the energy of charged elementary particles supplied as electric current for lighting, heating and driving machines, etc (Crowther, 1998). While economic growth is an increase in a country's national output. Electric power is an integral part of energy required for domestic; industrial and commercial purposes. Electricity is indispensable for a countries economic growth and development. Nigeria ranks 57 among the largest economies in the world, striving to be among the 20 largest economies by the year 20:2020; however the poor electricity supply has been the bane. Adegbulugbe and Adenikinju (2011) reveal that the growth in the energy sector is coming from oil and gas sub-sector not electricity. Economic history has shown that electricity is a catalyst for economic growth and development; however the per capita consumption of electricity is below 200kwh in Nigeria, which is antithetical to growth. There has been a marginal improvement in electricity infrastructure over the years. For instance, electricity generation capacity in Nigeria between 1985 and 2000 grew by a mere 10 percent when compared with other countries as shown in the table below:

S/N	Country	(%) Generation Capacity Growth
1.	Vietnam	332
2.	Iran	142
3.	Indonesia	237
4.	Malaysia	243
5.	South Korea	205
6.	Nigeria	10

Source: Maigida, 2008 as cited in Onakoya and Odedairo (2013).

According to Apergis and Payne (2009), energy consumption is important for economic growth, both directly and indirectly in the production process as a complement to labour and capital stock. Sambo (2011) reports that electricity supply in Nigeria has not been supporting growth because the industrial sector which is the power house of economic growth in any country is not adequately supplied with electricity. For example, the irony is that in Nigeria, the residential sector is the largest consumer of electricity followed by the commercial sector before the industrial sector (Ekpo, 2010). The reason being persistent

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irregular and inadequate power supply to the industrial sector in this country. Electricity is under supplied in Nigeria, because only 40% of Nigerians have access to electricity, while around 90 million people live in dark (Adeyeye, 2008).

Nwachukwu (2014) reveals that electricity in the country has been erratic and epileptic, thus resulting in frequent power outages that have impaired economic growth and development. This resulted in the increased cost of production and high cost of goods and services in the country (Adenikinju, 2003). For Nigeria to meet up with the vision 20:2020, she requires power generating capacity of 140,000 mw as against the present 4800mw to be slightly below South Africa and Brazil per capita power consumption capacity. The frustration Nigerians go through every second of the day as a result of insufficient power is unbearable. The power situation in the southeast geographical zone is the worst in the country, despite the fact that this part of the Nigerian nation arguably holds the key to Nigeria's technological and industrial revolution (Nnaji, 2009). Solow-Swan and Harrod Domar, laid much emphasis on capital and labour as essential factors of production for economic growth. Growth comes through savings and accumulation of stock for investment and electricity is seen as endogenous factor of production, because it is a component of capital. The Solow-Swan growth model assumes that increasing capital relative to labour creates economic growth.

Several empirical studies have been carried out on the relationship between energy consumption and economic growth using different countries, periods and different methodologies. But this study is limited to empirical studies in Nigeria based on different periods and methods. Orhewere and Machame (2011) examine energy consumption in Nigeria between 1970-2005 using Vector Error Correction (VECM) and granger casualty found unidirectional causality running from electricity consumption to GDP in the short-run and long-run. They also found bidirectional casualty running from oil consumption to GDP in the long run. Akpan G. and Akpan U. (2012) in examining the long run and casual relationship between electricity consumption and economic growth in Nigeria between 1970 and 2008, using Multivanate Vector Error Correction (MVEC) found a negative relationship between electricity consumption and economic growth in Nigeria. No causality was found between electricity and growth, in either way which further lends credence to the crisis in the Nigerian electricity sector.

Dantama, Umar, Abdullahi and Nasiru (2012) examine the impact of energy consumption on economic growth in Nigeria over the period 1980-2010 using the autogressive distributed lag (ARDL). The results indicate a long-run relationship between economic growth and energy consumption. Umesiobi (2012) investigates the impact of the electricity sub-sector on Nigerian economy empirically, using time series data collected from 1980-2010 and adopted autoregressive distributed lag (ADRL) approach to co-integration. The following findings were made: A unidirectional causality runs from GDP to energy supply and the explanatory variables influenced GDP to the tune of 88%. There was no significant relationship existing between inflation, interest rate and GDP, from the Johassen cointegration result, it shows that the variables are cointegrated because they have a long-run relationship. The researchers, from the analysis of variance (ANOVA)

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results found that the electricity sub sector has not impacted significantly on the Nigeria economy. Harrison (2013) researches on energy consumption and economic growth nexus in Nigeria between 1970 – 2010 using time series data and capital, labour and total energy consumption as some of the variables. The study employed Error Correction Model (ECM) techniques and carried out some diagnostic tests such as: Unit root, granger causality, joint significance and co-efficient of determination etc. the following findings were made: the unit root test using Augmented Dickey Fuller (ADF) shows that the variables are integrated, (have unit root) in the process. The variables are co-integrated, indicating that some stable long-run equilibrium relationship exists among the variables. The coefficient of determination (R^2) result shows that what happens to RGDP is accounted 61% by the explanatory variables, while the joint significance is 92%. The result shows that variables in the model significantly affected the dependent variable as shown by the R^2 and F-statistic. Onakoya and Odedairo (2013) applying the co-integration and ordinary least square techniques to determine the causal nexus between energy consumption and economic growth in Nigeria from 1975-2010, found a long run relationship among the variables.

The stationarity result using ADF indicates that all the variables were stationary at first difference at 5% level of significance. The R-square value shows that about 72% of the change in Real Gross Domestic Product (RGDP) can be explained by the explanatory variables (i.e. Total energy consumption, capital and labour). The F-statistic (5.13) value illustrates that total energy consumption; capital and labour are jointly significant at 5% level. The Durbin Watson (1.75) indicates that there is autocorrelation because it is close to 2.

Kehinde and Jonathan (2014) investigates whether electricity consumption has positive, negative or neutral impact on economic growth in Nigeria between 1990–2011 as well as the direction of causation in Nigeria. The study introduced capital formation and labour stock in multivariate system for the period covered. Augmented Dickey Fuller (ADF) test for unit roots test, Johansen test for co-integration, vector error correction model (VECM) and Granger causality were employed. The result of the findings shows unidirectional causality from electricity consumption to real gross domestic product (RGDP). The long run estimate supports the Granger causality test by revealing that electricity consumption is positively related with RGDP in the long-run. The result shows that there is unidirectional causality from capital formation to RGDP.

MODEL SPECIFICATION

Based on the secondary data and time series data collected from the Statistical Bulletin of the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) of various years, this study adopted the modified models of Umesiobi (2012) and Harrison (2013). It includes condition variables like exchange rate, interest rate, industrial output and inflation for economic growth, as output is a function of inputs like capital, labour and energy or electricity, which is a component of capital. The mathematical form of the model can be stated as follows:

$$GDP = f(GFCF, ELEC, INDO, INF, INT, EXCH, LABF + U) \ldots\ldots (1)$$

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Where:

GDP	=	Gross Domestic Product (Economic Growth)
GFCF	=	Gross Fixed Capital Formation: (Proxy for capital)
ELEC	=	Electricity Consumption
INDO	=	Industrial Output
INF	=	Inflation
INT	=	Interest rate
EXCH	=	Exchange rate
LABF	=	Labour Force (Proxied by the total annual number of workers in the country)
U	=	Error term or stochastic variable
$a_1 - a_7$	=	Estimators

Our apriori expectations are:

$a_1>O$, $a_2>O$, $a_3>O$, $a_4<O$, $a_4<O$, $a_5<O$, $a_6<O$ and $a_7>O$.

Hence, GFCF, ELEC, INDO and LABF positively affect GDP, while INF, INT and EXCH negatively affect GDP. Presenting the above equation (1) in a linear model as:

$GDP = a_0 + a, GFCF + a_2ELEC + a_3INDO + a_4INF + a_5INT + a_6EXCH + a_7LABF + U$.

This is an expanded form of Cobb Douglas Production function.

RESULTS AND DISCUSSION

The data used in the analysis are placed under appendix. The diagnostic test results unveils that the unit root test, using ADF show that GDP, GFCF, ELEC, INDO, INT and LABF are stationary at first difference while INF is stationary at level at 5% level of significance (see Appendix). For granger causality result, there are some elements of co-integration, among the variables used in the model. The result shows unidirectional relationship. This can be afar from the variables where the probability values are less than 5% (0.005) (see Appendix). Since the trace statistic value (170.5133) is greater than the 5% critical value (125.6154), null hypothesis is rejected because there is co-integration among the variables in the model. The multiple regression result shows that there is a positive linear relationship between Natural log of GFCF, Natural log of ELEC, Natural log of EXCH, Natural log of (LABF and Natural log of RGDP). This means that as these explanatory variables increase, real gross domestic product will increase, A unit increase in LNGFCF, LNELEC, LNEXCH and LNLABF will cause GDP to increase by 0.8673, 0.107554, 0.349504, and 1.747071 respectively. The signs of the above explanatory variables are in line with the prior expectation except for exchange rate, because an increase in GFCF, ELEC, LABF and appreciation of the naira will help to boost the gross domestic product. There is an inverse relationship between LNINDO, LNINF, LNINT and LNGDP.

The result of the test for the goodness of fit using Adjusted R-square shows that the explanatory variables included in this model accounted for 98.7% variation in the gross domestic product of Nigeria, the remaining unexplained is taken care of by the error term, *U*. Test for individual significance using student t-test, have the following results, capital

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formation (GFCF) has significant impact on GDP because since the t-calculated (7.9002) is greater than the t-tabulated (2.064), null hypothesis is rejected, while alternative is accepted. Electricity consumption has no significant impact on GDP in Nigeria, since the t-calculated value (0.415) is less that the t-tabulated (2.064), we accepted the null hypothesis that ELEC has no impact on GDP in Nigeria.

Industrial output has no significant impact on gross domestic product, since the t-calculated (-1.148224) is less than the t-tabulated (2.064), we accept the null hypothesis, that INDO has no significant impact on GDP in Nigeria. Inflation has no significant impact on gross domestic product (GDP) since the t-calculated (-0.86846) is less than the t-tabulated (2.064) we accept the null hypothesis that INF has no significant impact on GDP in Nigeria. Interest rate has no significant impact on gross domestic product, since the t-calculated (-0.743207) is less than the t-tabulated (2.064), we accept the null hypothesis and reject the alternative hypothesis that interest rate has no significant effect or impact on GDP in Nigeria. Exchange rate has a significant impact on gross domestic product, since the t-calculated (4.516902) is greater than the t-tabulated (2.064), we reject the null hypothesis and accept the alternative hypothesis that EXCH has significant impact on GDP in Nigeria. Labour force has no significant impact on gross domestic product (GDP) since the t-calculated (1.573078) is less than the t-tabulated (2.064). The explanatory variables jointly affect GDP, since F-calculated (332.5320) is greater than t-tabulated (2.42) (see Appendix).

Empirically, seven explanatory variables namely; GFCF, ELEC, INDO, INF, INT, EXCH and LABF were employed using 1990 as the base year in determining the impact. The following findings were made from the study. The regression model estimates reveal that the coefficient of GFCF, ELEC, EXCH and LABF have positive linear relationship with RGDP and significant, while the coefficients of INDO, INF and INT have inverse functional relationship with RGDP. This is in line except for EXCH and INDO respectively. The explanatory variables (GFCF, ELEC, INDO, INF, INT, EXCH, LABF) jointly affect GDP in Nigeria, from the regression result, since (332.532) is greater than the tabulated value (2.42). The co efficient of determination of 0.9868 also supports this, which means that 98.7% of the variation in GDP is accounted for by the explanatory variables, which confirms the appropriateness of the model. The result of individual test, using the t-test revealed that GFCF and EXCH have significant impact on GDP. They are important determinants of RGDP in Nigeria. The reason is that capital formation increases via savings accumulation and investments, which accelerate economic growth. This agrees with the findings of Harrison (2013) that positive investment climate and adequate infrastructure enhance productivity and efficiency of industries in Nigeria. As the country's export rises, mainly in the oil exchange, economic growth is positively affected, because exchange rate appreciates, thereby increasing the nation's foreign reserve vis-a-vis the GDP.

When the local currency appreciates, economic growth increases as exchange rate acts as a control variable in economic growth. The individual tests of significance showed that INDO. INF, INT, ELEC and LABF do not significantly impact on RGDP in Nigeria is not in doubt. This is exemplified in the regression result which shows a negative

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impact of INDO on GDP in Nigeria. The individual sector's contributions in Nigeria to GDP is not significant because electric power supply is never stable, constant and reliable to assist the industrialists, hence, the rampant use of private generators and the exit from business by those who could not afford private generators power supply. Electricity supply poverty has made industries to produce below full capacity, increased production costs etc. The result of the individual test of significance shows that inflation and interest rate have no significant impact on GDP in Nigeria. This is also in line with the findings of Umesiobi (2012). From the result, there is no causality between ELEC and GDP in Nigeria which means ELEC has no true relationship with industrial output (INDO) and RGDP by extension because the industries depend on private generators for survival. This is also in line with Olotu's (2007) findings that in most cases, captive electric power supply has been a response to irregular public power generation and transmission. There is no relationship between ELEC and RGDP in Nigeria as shown in the granger causality result.

Olaniyan's (2010) findings show that electricity consumption and supply has negatively affected not only industrial output but also economic growth in Nigeria. The reasons are; corruption; vandalism of electrical installations' obsolete equipment, lack of qualified technicians etc. From the Johanesen cointegration result, a long run equilibrium relationship was established among the variables at 5% level of significance. Hence, a long run relationship exists among the variables in the study. Also, unidirectional causal relationship based on the probability values which are less than 5 (0.005) was established. From the result, there is no causality between ELEC and RGDP in Nigeria. The variables are stationary at first difference, which means they are integrated.

CONCLUSION AND RECOMMENDATIONS

This study aims at examining the effect of electricity consumption on Nigeria's economic growth efforts between 1981 and 2012. The findings of this work indicate that the electric power consumption has not positively affected the economic growth of Nigeria. Therefore, for this sector which is the engine of industrialization, economic growth and development to contribute meaningfully towards unemployment and poverty reduction, there should be a holistic transformation. The transformation includes; ownership and management, financial and technological changes as well as legal framework. There should be an established road-map and targets towards improving power generation and distribution in Nigeria. If these are considered and implemented, the erratic inefficient, low quality electric power supply in Nigeria will be reduced drastically. Consequently, energy sources should be diversified through abundant renewable sources in Nigeria, such as biogas, solar, water lettuce, water hyacinth, dung, cassava leaves, solid waste urban refuses, sewage and agricultural residues. Policies should be made to boost investment in the energy sector by encouraging private investor's to play active role in this regard. In addition, the mandatory use of pre-paid meters will make the electricity consumers or users to be conscious of electricity management, thereby reducing wastage of energy experienced with conventional meter users. To increase the efficiency of the power sector's staff, training and retraining programmes should be organized periodically to keep them abreast with modern technology.

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This will enable Nigerian indigenous engineers and technicians take charge of the electricity sector effectively. Protection of electricity installations by the government, communities and security agents will reduce the rate of power outages. Adequate Funding and Management of National Power Training Institute of Nigeria (NAPTIN) will address the dearth of skilled technical manpower in the power sector and enhance skill acquisition in four core technical categories namely: distribution substation, operators (DSO), cable Jointers, Linesmen/pole climbers and electrical fillers.

Appendix 1

Dependent Variable: LNRGDP
Method: Least Squares
Date: 09/17/15 Time: 03:31
Sample: 1981 2012
Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.81836	8.248623	1.432767	0.1648
LNGFCF	0.867639	0.109824	7.900251	0.0000
LNELEC	0.107554	0.258831	0.415535	0.6814
LNINDO	-0.888604	0.773894	-1.148224	0.2622
LNINF	-0.034880	0.040162	-0.868461	0.3937
LNINT	-0.162270	0.218338	-0.743207	0.4646
LNEXCH	0.349504	0.077377	4.516902	0.0001
LNLABF	1.747071	1.110607	1.573078	0.1288

Source: E-view version 7

Appendix 2

Variable	**At Level**	**At 1st Difference**	**5% Critical Value**	**Level of Integration**
GDP	-0.630339	-4.470596	-2.971853	1(1)
GFCF	0.401026	-3.317607	-2.971853	1(1)
ELEC	1.234675	-7.696972	-2.971853	1(1)
INDO	-0.371877	-5.055339	-2.971853	1(1)
INF	-4.708491	-6.161776	-2.971853	1(0)
INT	-2.752132	-7.102180	2.971853	1(1)
EXCH	-2.207254	-4.738595	-2.967767	1(1)
LABF	0.664394	-4.757287	-2.971853	1(1)

Source: E-view version 7

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Appendix 3

S/N	Hypothesis	Observation	F-Statistic	Probability	Causality
1	RGDP granger causes GFCF while GFCF does not granger cause RGDP	30	5.03229	0.0146	Unidirectional
2	ELEC does not granger cause RGDP, and vice verse	30	0.78413	0.4674	No causality
3	INDO does not granger cause RGDP whereas RGDP granger causes INDO	30	4.93907	0.0156	Unidirectional
4	INF does not granger cause RGDP, and vice versa	30	2.50976	0.1016	No causality
5	INT does not granger cause RGDP, and vice versa	30	0.01765	0.9825	No causality
6	EXCH rate granger causes RGDP, whereas RGDP does not granger cause EXCH rate	30	4.67069	0.0189	Unidirectional
7	LABF does not granger cause RGDP, whereas RGDP granger causes LABF	30	5.52216	0.0103	Unidirectional
8	ELEC does not granger cause GFCF, GFCF does not granger cause ELEC	30	0.841151.26747	0.4410.290	No causality
9	INDO does not granger cause GFCF, and vice versa	30	1.649672.36422	0.2130.117	No causality
10	INF does not granger cause GFCF, and vice versa	30	0.032571.14001	0.9600.339	No causality
11	INT does not granger cause GFCF, and vice versa	30	0.768340.38128	0.4740.689	No causality
12	EXCH granger causes GFCF, whereas GFCF does not granger cause EXCH	30	6.67460	0.0048	Unidirectional
13	LABF does not granger cause GFCF, whereas GFCF granger causes LABF	30	3.58466	0.0428	Unidirectional
14	INDO granger causes ELEC, whereas ELEC does not granger cause INDO	30	4.71109	0.0184	Unidirectional
15	INF does not granger cause ELEC, and vice versa	30	0.330631.99011	0.7260.158	No causality
16	INT does not granger cause ELEC, and vice versa	30	0.010550.21731	0.9850.802	No causality
17	EXCH does not granger cause ELEC, and vice versa	30	0.630870.48696	0.5440.622	No causality
18	LABF granger causes ELEC, whereas ELEC does not granger cause LABF	30	7.03199	0.0038	Unidirectional
19	INF does not granger cause INDO, and vice versa	30	0.127360.88418	0.8800.426	No causality
20	INT does not granger cause INDO, and vice versa	30	2.051390.00549	0.1460.995	No causality
21	EXCH granger causes INDO, whereas INDO does not granger cause EXCH	30	9.01410	0.0011	Unidirectional
22	LABF does not granger cause INDO, and vice versa	30	2.308582.71439	0.1220.087	No causality
23	INT does not granger cause INF, and vice versa	30	0.398393.03398	0.6760.061	No causality
24	EXCH granger causes INF, whereas INF does not granger cause EXCH	30	4.02586	0.0305	Unidirectional
25	LABF does not granger cause INF, and vice versa	30	0.41964	0.13309	No causality
26	EXCH granger causes INT, whereas INT does not granger cause EXCH	30	4.28075	0.0252	Unidirectional
27	LABF does not granger cause INT, and vice versa	30	0.17958	0.54386	No causality
28	LABF does not granger cause EXCH, whereas EXCH granger causes LABF	30	8.25637	0.0018	Unidirectional

Source: Time Series Analysis

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Appendix 4

Date: 09/17/15 Time: 03:36
Sample (adjusted): 1983 2012
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: LNRGDP LNGFCF LNELEC LNINDO LNINF LNINT LNEXCH LNLABF Lags interval (in first differences): 1 to 1

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.950800	260.8694	159.5297	0.0000
At most 1 *	0.838191	170.5133	125.6154	0.0000
At most 2 *	0.751664	115.8731	95.75366	0.0010
At most 3 *	0.652156	74.08398	69.81889	0.0219
At most 4	0.479253	42.40392	47.85613	0.1477
At most 5	0.407877	22.82920	29.79707	0.2546
At most 6	0.200063	7.107978	15.49471	0.5651
At most 7	0.013617	0.411314	3.841466	0.5213

Trace test indicates 4 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.950800	90.35601	52.36261	0.0000
At most 1 *	0.838191	54.64021	46.23142	0.0051
At most 2 *	0.751664	41.78915	40.07757	0.0318
At most 3	0.652156	31.68006	33.87687	0.0894
At most 4	0.479253	19.57472	27.58434	0.3713
At most 5	0.407877	15.72122	21.13162	0.2416
At most 6	0.200063	6.696664	14.26460	0.5256
At most 7	0.013617	0.411314	3.841466	0.5213

Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**Mackinnon-Haug-Michelis (1999) P-Values

Source: E-view version 7

Appendix 5

Adjusted R-squared	=	0.9868
Durbin-Watson	=	1.25
F-statistic	=	332.5320

Source: E-view result version 7.

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Appendix 6

Table 4.1 Data of Industrial Output, Electricity Consumption, Interest Rate, Exchange Rate, Inflation, etc (1981-2012)

YEAR	GDP (1990=100)	GFCF (₦ billion)	ELEC (kWh)	INDO (₦m)	INF	INT	EXCH (%)	LABF (%)
1981	205222.10	18.20	3.84	89072.80	17.40	10.00	0.63	95.80
1982	199685.30	17.10	6.34	83206.50	6.94	11.75	0.72	95.30
1983	185598.10	13.30	6.49	72261.76	38.77	11.50	0.77	93.80
1984	183563.00	9.10	5.06	78146.99	22.63	13.00	0.89	93.40
1985	201036.30	8.80	6.72	85355.00	1.03	11.75	1.75	93.90
1986	205971.40	11.40	7.80	83085.05	13.67	12.00	4.02	94.70
1987	204806.50	15.20	7.86	81833.31	9.69	19.20	4.54	93.00
1988	219875.60	17.60	7.88	85413.02	61.12	17.60	7.36	94.70
1989	236729.60	26.80	9.01	94244.46	44.67	24.60	8.04	95.50
1990	267549.90	40.10	8.29	106759.58	3.61	27.70	9.91	96.50
1991	265379.10	45.20	8.75	108398.57	22.96	20.80	17.30	96.90
1992	271365.50	70.80	9.02	109988.49	48.80	31.20	22.07	96.60
1993	274833.30	96.90	10.36	109641.37	61.26	36.09	22.00	97.30
1994	275450.60	105.60	10.06	107043.89	76.76	21.00	21.90	98.00
1995	281407.40	141.90	9.88	108446.54	51.59	20.79	21.88	98.20
1996	293745.40	204.00	9.51	115279.05	14.32	20.86	21.89	96.60
1997	302022.50	242.90	9.30	116867.51	10.21	23.32	21.89	96.80
1998	310890.10	242.30	8.95	118154.79	11.91	21.34	92.34	97.00
1999	312183.50	231.70	9.04	110853.13	0.22	27.19	101.70	86.90
2000	329178.70	331.10	9.11	122061.80	14.52	21.55	111.23	86.40
2001	356994.30	372.10	9.48	128740.06	16.50	21.34	120.58	87.40
2002	433203.50	499.70	13.46	123906.00	12.19	30.19	129.22	85.20
2003	477532.90	865.90	13.44	150250.74	23.79	22.88	132.89	86.60
2004	527576.00	863.10	16.73	156486.83	10.01	20.82	131.27	88.10
2005	561931.40	804.40	17.96	159161.43	11.60	19.49	128.65	87.70
2006	595821.60	1546.50	15.93	155165.53	8.50	18.70	125.81	87.30
2007	634251.10	1937.00	20.33	151699.09	6.60	18.36	118.55	85.10
2008	672202.60	2053.00	19.12	146519.59	15.10	18.70	148.90	80.30
2009	718977.30	3050.60	18.62	149486.50	112.00	22.62	150.30	78.60
2010	775525.70	4012.90	21.62	158190.46	4.02	22.51	154.74	76.10
2011	64900.00	3908.30	24.45	161118.01	10.54	22.42	157.50	74.30
2012	750000.00	3357.40	26.62	162985.26	13.95	23.79	157.50	74.30

GFCF = GROSS FIXED CAPITAL FORMATION (PROXY FRO CAPITAL FORMATION)
ELEC = ELECTRICITY CONSUMPTION
INDO = INDUSTRIAL OUTPUT (PROXY FOR INDUSTRIAL PRODUCTION)
EXCH = EXCHANGE RATE
INF = INFLATION
LABF = LABOUR FORCE (PROXY FRO LABOUR FORMATION)
GDP = GROSS DOMESTIC PRODUCT (PROXY FOR ECONOMIC GROWTH)

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