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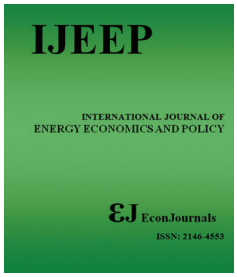

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Energy Consumption and Foreign Direct Investment Inflows in Nigeria: An Empirical Perspective

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ABSTRACT

The aim of this study is to examine the relationship between energy consumption and foreign direct investment in Nigeria over the period of 1990-2017. Consequently, Data were collected from UNCTAD World Bank database, World Data Atlas and CBN Statistical Bulletin respectively. Cointegration, DOLS and Granger Causality approach were employed to address the objective of the study. The major findings in this study are summarized as follow. Energy consumption and FDI inflow have a significant negative relationship with each other. There is a significant positive relationship between energy consumption and oil exports. However, openness of the economy and energy consumption have a non-significant negative relationship. In the same vein, there is an existence of a unidirectional causality which runs from FDI to oil exports in Nigeria. There is one way causal relationship running from energy consumption to oil exports. FDI inflows Granger Causes energy consumption. Meanwhile, energy consumption Granger Causes openness of the economy. Due to the findings that emerged in this study, it is important that this study recommends the following to the policy makers in Nigeria since energy consumption does not drive FDI inflows the policy makers in the country should provide a conducive climate that will facilitate the accessibility of foreign investors to primary energy consumption in the country. Also, the country should improve the value addition to the production of primary energy so that its consumption could be competitive in the global market.

Keywords: Energy, Consumption, Foreign Direct Investment, Oil Exports and Nigeria
JEL Classifications: F21, F23

1. INTRODUCTION

In the past few decades, consumption of energy has been on the increase globally due to its overwhelming impact on the economic growth in the world (Matthew et al., 2018). In developing countries, critical factors such as growth in the population rate, urbanization and continuous rise in the level of economic activities have orchestrated the increase in the global energy consumption (Suganthi and Samuel, 2012; Al-mulali and Ozturk, 2015; Babajide et al., 2015; Farhani and Ozturk, 2015; Raza et al., 2016; Alam et al., 2016; Nain et al., 2017; Ayinde et al., 2019).

Meanwhile, the availability of an uninterrupted supply of electricity in Nigeria is very germane to the creation of job opportunities, reduction of poverty and development of industries. Despite the fact that there are various sources of energy in Nigeria this has not guaranteed a stable power supply in the country.

However, the inflows of FDI in Nigeria is traceable to the era of natural resources exploitation by the colonial masters. Also, the aftermath effect of oil discovery in 1958 and oil boom of 1970s led to the rise of FDI inflows in Nigeria. In the last few decades, Nigeria has attracted a substantial amount of foreign direct investment (FDI). A cursory look into the UNCTAD document

indicates that 70% of FDI inflows in ECOWAS countries went to Nigeria in 2006, in which 90% of its FDI inflow went to oil sector alone. In the same vein, FDI inflows remain unequally distributed across the continent of Africa in 2016, in which only five countries (Angola, Egypt, Nigeria, Ghana and Ethiopia) accounted for 57% of the continent's total FDI inflows. In the same year, FDI inflows to West Africa grew by 12% to $11.4 billion. This was propelled by FDI inflows into Nigeria which increased by over 30% (UNCTAD, 2017).

The issue surrounding the linkage between FDI and energy consumption is one of the areas that has generated a lot of controversies in international economics. It has been established in the literature that foreign based firms are prone to investing in the country where the costs of production are minimized. This leads to gradual deterioration of the resources and environment of the host economy over time (Asghari, 2013). This has sparked off ongoing debate regarding the concerns for environment in increasing FDI inflows in developing economy. But the role of a stable energy supply in building the economic prosperity of any nation cannot be overemphasized. The higher the economic growth, the higher the consumption of energy and verse versa (Achour and Belloumi, 2016: Saidi and Hammami 2015; Komal and Abbas, 2015).

Due to the lower domestic savings and investments rates in Nigeria, FDI inflows could be an escape route for the country to get foreign capital and technology which can efficiently ensure the stability and growth process of the power sector in the country. Despite the fact that studies on FDI inflows in Nigeria are numerous, yet there has been a little or no effort to examine the spillovers of FDI on energy consumption in the country in the recent times. In view of the above, this study examines the relationship between energy consumption and FDI inflows in Nigeria. Also, the uniqueness of this study lies in the adoption of latest econometric technique in which majority of the past studies have not fully explored.

However, this study is organized as follows besides introduction, section two looks at critical review of relevant literature and section three presents model specification, estimation, discussion of results and policy recommendation.

2. LITERATURE REVIEW

An attempt has been made in this section to present the review past empirical studies regarding the subject matter of this study. Aminu and Aminu (2015) employed Granger causality test, impulse response and variance decomposition to investigate the relationship between energy consumption and economic growth in Nigeria from between 1980 to 2011. It was discovered from the study that there was an absence of causal relationship among the variables of interest. Also, the result of variance decomposition showed that capital and labour affected output growth more than energy consumption in the country. In another related study, Mathew et al. (2018) examined the relationship between human capital development, energy consumption and economic growth in Nigeria between 1981 and 2016 with the application of the fully modified ordinary least squares. The authors submitted that human capital development was related to economic growth insignificantly in Nigeria. However, electricity consumption and economic growth are significantly related in the country. Kivyiro and Arminen (2014) used autoregressive distributed lag model and Granger causality to assess the nexus between carbon dioxide emissions, energy consumption, economic development and FDI in six Sub Saharan African countries. The result from the study showed that Granger causality varied in each of the countries.

Adeola and Aziakpono (2017) analyzed the relationship between the usage of electricity power and economic growth in South Africa with the application of the trivariate causality. The authors discovered that a two-way causality runs between the usage of electricity power and economic growth in the country. Ogbanje et al. (2010) examined the spillovers of FDI on agricultural sector in Nigeria with the aid of Duncan Multiple Range Test and Ordinary least square. The authors submitted that the net FDI inflow in Nigeria did not bring about development to agricultural sector. In another perspective, Mojekwu and Samson (2012) utilized co-integration alongside error correction technique to assess how FDI and the challenges of sustainable development are related in Nigeria. It was discovered from the study that a long-run relationship exists between FDI, gross capital formation and economic growth in Nigeria. Akinlo (2009) critically evaluated the linkage between electricity power usage and the productivity of economic activities in Nigeria. It was discovered from the paper that a long-run relationship exists between the variables under study. This implies that electricity consumption leads to economic growth in the country.

Aliero and Ibrahim (2012) utilized Granger causality approach to examine the linkage between energy consumption and economic growth in Nigeria from 1970 to 2009. It was discovered from the study that no causal relationship existed between total energy consumption and economic growth when aggregate energy consumption data was adopted. But reverse was the case when the disaggregate energy consumption data were utilized for the same period.

However, Doytch and Narayan (2016) adopted Blundell–Bond dynamic panel estimator to estimate how FDI affects renewable and non-renewable energy consumption in 74 economies between 1985 and 2012. The authors opined that total FDI catalyzed green-energy advancing practices and discouraged the application of non-renewable energy in high-income countries, low and lower middle-income countries. Also, the transfer energy-saving practices was encouraged while the usage of nonrenewable energy sources was discouraged in low and lower middle-income countries. While using autoregressive distributed lag model and Granger causality, Xu et al. (2016) investigated the impact of energy consumption on FDI in Shanghai between 1991 and 2013. It was discovered from the study that energy consumption has a positive and significant impact on FDI in the short run. Meanwhile, the impact is not significant in the long run. There is one way causal relationship between energy consumption and FDI in the country. In the same vein, Islam et al. (2013) applied Vector Error Correction Model (VECM) to examine the relationship between energy consumption, economic growth and financial development in Malaysia. The result from

the paper argued that in both the short run and long run energy consumption has a link with economic growth and financial development in Malaysia. Opaluwa et al. (2012) investigated the relationship between FDI and manufacturing sector performance in Nigeria with the aid of Vector Auto Regression (VAR), co-integration and error correction model. The authors submitted that FDI and the growth of manufacturing sector has a significant negative relationship.

In addition, Lin and Linh (2015) examined the nexus between environmental degradation, economic growth, FDI and energy consumption in 12 highly populated countries in Asia with the aid of a dynamic causal analysis. The authors concluded that in the both short and long-run there was an existence of causal relationships among economic growth, FDI, energy consumption and CO_2 emissions in the countries. Omri and Kahouli (2014) discovered a mixed result while examining the causal relationship between income, FDI inflows and energy consumption in 65 countries. Dantama et al. (2012) evaluated a relationship between energy consumption and economic growth in Nigeria between 1980 and 2010 with the use of ARDL bound approach, cointegration and unrestricted error correction model. The authors posited that there was a long run cointegrating relationship among petrol, coal and electricity consumption and economic growth. Also, petroleum and electricity consumption showed a positive and significant impact on economic growth while coal consumption has an insignificant negative impact on economic growth in the country.

In summary, from the reviewed literature, it could be concluded that studies on FDI and energy consumption is scanty in Nigeria. Therefore, there is a need for further study to examine the nexus between these variables in the recent times.

3. METHODOLOGY

This paper makes use of secondary data such that FDI data were extracted from UNCTAD document, energy consumption data were sourced from World Data Atlas, oil exports, and inflation rate data were sourced from the Central bank of Nigeria Statistical Bulletin.

3.1. Model Specification

$$ENC = F(FDI, OILEX, OE) \quad (1)$$

Equation (1) is linearized as follows to derive Equation (2)

$$LnENC_t = \propto_1 + \beta_1 LnFDI_t + \beta_2 LnOILEX_t + \beta_3 OE_t + \varepsilon_t \quad (2)$$

3.2. The Direction of Causality between FDI Inflows and Energy Consumption in Nigeria

In analyzing the Granger causality between FDI inflows and energy consumption, study adopted pairwise granger causality analysis in estimating the VAR model in equation (3-6) below

$$FDI_t = \alpha_0 + \sum_{i=0}^{p} \alpha_1 FDI_{t-1} + \sum_{i=0}^{p} \alpha_2 ENC_{t-1} + \sum_{i=0}^{p} \alpha_3 OILEX_{t-1} + \sum_{i=0}^{p} \alpha_4 OE_{t-1} + \varepsilon_{1t} \quad (3)$$

$$ENC_t = + \beta_0 + \sum_{i=0}^{p} \beta_1 ENC_{t-1} + \sum_{i=0}^{p} \beta_2 FDI_{t-1} + \sum_{i=0}^{p} \beta_3 OILEX_{t-1} + \sum_{i=0}^{p} \beta_4 OE_{t-1} + \varepsilon_{2t} \quad (4)$$

$$OILEX_t = \gamma_0 + \sum_{i=0}^{p} \gamma_1 OILEX_{t-1} + \sum_{i=0}^{p} \gamma_2 FDI_{t-1} + \sum_{i=0}^{p} \gamma_1 OE_{t-1} + \sum_{i=0}^{p} \gamma_3 ENC_{t-1} + \varepsilon_{3t} \quad (5)$$

$$OE_t = \gamma_0 + \sum_{i=0}^{p} \gamma_1 OE_{t-1} + \sum_{i=0}^{p} \gamma_2 ENC_{t-1} + \sum_{i=0}^{p} \gamma_3 FDI_{t-1} + \sum_{i=0}^{p} \gamma_4 OILEX_{t-1} + \varepsilon_{4t} \quad (6)$$

where,

FDI represents FDI which is measured by the annual FDI inflow into the country in million dollars.

ENC is used to proxy primary energy consumption in the country. It is measured in quadrillion.

OE is openness of economy.

OILEX is oil exports and is measured in billion Naira.

ε captures error term which is assumed to be stochastic and t represent years.

$\propto_1$ is an intercept and β_1, β_2, and β_3, are slope parameters to be estimated. It is expected that coefficient of the variables to have the following signs: β_1, β_2 and $\beta_3 > 0$.

3.3. Pre-estimation Test

(a) Unit root test.
(b) Cointegration test.

3.4. Model Estimation

An attempt was made in this section to verify different diagnostic tests like unit roots and cointegration test before the estimation error correction model. The study adopted the standard augmented Dickey Fuller test, Philips Perron test and Johansen cointegration technique to determine the order of integration and the existence or otherwise of long run equilibrium among the variables respectively.

4. RESULTS AND DISCUSSION

The normal distribution of data is very important when a study involves an econometric analysis. In view of the above, Table 1 shows a descriptive analysis of the variables of interest. The mean

and median values of FDI, energy consumption and openness of the economy are very close. It is only oil export that shows a wide difference in between the mean and median values. This shows that the data utilized for this study are fairly distributed following the assertion of Karmel and Polasek, 1980 that if a distribution of data series is perfectly symmetrical, the values of mean, mode and median of such data series must converge. In addition, another important parameters to establish the normal distribution of data is the value of Kurtosis and Jaque-Bera statistics. The value of Kurtosis of the variables are not far from 3 apart from oil export. This suggests that the distribution of the data is near symmetrical.

An attempt was made in Table 2 to examine the stationarity property of the data because any analysis based on the non-stationary data would lead to a spurious or nonsense result which could be misleading for policy implications. Therefore, the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used to conduct the stationarity test. The results of the estimated data show that all the variables are stationary after their first differencing. In other words, all the variables are I(1). This implies that these variables possess unit roots.

Table 1: Descriptive statistics of annual data series (1990-2017)

Descriptive statistics	LnFDI	LnENC	OE	LnOILEX
Mean	3.58E+09	9.65E+14	37.96148	5253.371
Median	2.19E+09	8.70E+14	39.28000	2993.110
Maximum	8.92E+09	1.59E+15	53.28000	14323.15
Minimum	1.00E+09	6.70E+14	20.72000	106.6265
Std. Deviation	2.58E+09	2.39E+14	8.675872	4981.415
Skewness	0.769560	1.130200	-0.202288	0.554950
Kurtosis	2.250799	3.369640	2.563189	1.887697
Jargue-Bera	3.296469	5.901796	0.398797	2.777734
Probability	0.192389	0.052293	0.819224	0.249358
Sum	9.67E+10	2.61E+16	1024.960	141841.0
Sum. Sq. Deviation	1.74E+20	1.49E+30	1957.040	6.45E+08
Observation	27	27	27	27

Source: Author's computation 2018

From the Table 3 above, the estimated results indicated that the studied variables are stationary after first differencing. This implies that these variables could diverge in the short run but it might have a long run relationship. As a result of this, Johansen and Juselius (1990) multivariate cointegration test was adopted to examine the existence or otherwise of long run relationship among the variables. Consequently, the trace statistics and the maximal eigen value statistics indicate that there is at most 3 co-integrating vectors in the systems. This shows that that these variables have a long run equilibrium relationship with one another. Therefore, Dynamic ordinary least square was utilized in this study to estimate a long run relationship among these variables.

Dependent Variable: LnENC
Method: Dynamic Least Squares (DOLS)

Table 4 shows the estimated results of the regression analysis. All the coefficients apart from oil export did not follow the a priori expectation. In the same vein, the independent variables of the model which comprises of FDI, openness of the economy and oil exports jointly explained about 93% of the systematic variations in the dependent variable, energy consumption leaving 7% unexplained as a result of random chance. This implies that the model adopted for this work is relatively good. Meanwhile, when the loss in the degree of freedom was adjusted, the explanatory power reduces to about 85%.

Moreover, there is a positive relationship between energy consumption and oil exports, which is significant at 1% level of significance. A unit change in oil exports leads to about 9.2% increment in energy consumption in Nigeria. This implies that energy consumption in Nigeria is very sensitive to oil exports. However, openness of the economy and energy consumption have a negative relationship with each another, which is not significant. In the same vein, energy consumption and FDI inflow have a negative relationship with each other, which is significant at 5% level of significant. This finding contradicts the submission of Xu et al. (2016) in a related study in Shanghai.

This section examined the direction of causality among energy consumption, FDI inflows, oil exports and openness of the economy in Nigeria within the context of Pairwise Granger

Table 2: Unit root test

Variables	ADF test			PP test		
	Level	1st difference	Remarks	Level	1st difference	Remarks
FDI	−2.9810***	−2.9862***	I (1)	−2.9810***	−2.9862***	I (1)
OE	−2.9810***	−2.9918***	I (1)	−2.9810***	−2.9862***	I (1)
OILEX	−2.9810***	−2.9862***	I (1)	−2.9810***	−2.9862***	I (1)
ENC	−2.9810***	−2.9862***	I (1)	−2.9810***	−2.9862***	I (1)
	−2.9810***	−2.9862***	I(1)	−2.9810***	−2.9862***	I(1)

Source: Authors' computation (2019) *** %5 level. ADF: Augmented Dickey-Fuller, PP: Phillips-Perron

Table 3: Johansen cointegration test (Trace statistics) and (maximum Eigen value)

Null hypothesis	Eigen value	Trace statistics	P-value**	Maximum eigenvalue	P-value**
r=0*	0.692426	51.07630	0.0241	29.47602	0.0283
r≤1	0.483880	21.60028	0.3213	16.53538	0.1951
r≤2	0.173404	5.064907	0.8019	14.26460	0.7716
r≤3	0.012083	0.303916	0.5814	3.841466	0.5814

Source: Authors' computation (2019)

Table 4: Regression estimates for FDI inflows and oil exports in Nigeria

Variable	Coefficient	t-statistics	P-value
LnOILEX	9.21E+10*	5.163377	0.0003
OE	−7.60E+12	1.599109	0.1381
LnFDI	−1.25150.3**	3.888744	0.0025
C	1.23E+15*	6.198645	0.0001
R-squared	0.931960		
Adjusted R-squared	0.857734		

Authors' Computation (2019) ***Significant at 10%, **Significant at 5%, *Significant at 1%. FDI: Foreign direct investment

Table 5: Pairwise granger causality test

Sample: 1990 2017			
Lags: 2			
Null Hypothesis	**Obs**	**F-Statistic**	**Prob.**
FDI does not Granger Cause OILEX	25	4.83906	0.0193
OILEX does not Granger Cause FDI		2.39377	0.1169
OE does not Granger Cause OILEX	25	0.59967	0.5586
OILEX does not Granger Cause OE		2.98347	0.0735
EC does not Granger Cause OILEX	25	7.07389	0.0047
OILEX does not Granger Cause EC		1.41867	0.2654
OE does not Granger Cause FDI	25	0.01987	0.9803
FDI does not Granger Cause OE		0.44519	0.6469
EC does not Granger Cause FDI	25	0.63289	0.5414
FDI does not Granger Cause EC		5.46300	0.0128
EC does not Granger Cause OE	25	3.95066	0.0358
OE does not Granger Cause EC		0.08026	0.9232

Authors' computation (2019)

Causality Test. The results presented in Table 5 show that the existence of a unidirectional causality which runs from FDI to oil exports in Nigeria. Similarly, there is one way causal relationship running from energy consumption to oil exports. FDI inflows Granger Causes energy consumption. Meanwhile, energy consumption Granger Causes openness of the economy. However, there is no feedback relationship between openness of the economy and FDI inflows and oil exports.

5. CONCLUSION AND RECOMMENDATIONS

This study examined the relationship between energy consumption and FDI inflows in Nigeria over the period of 1990-2017. Consequently, the major findings in this study are summarized as follow. There is a significant positive relationship between energy consumption and oil exports. However, openness of the economy and energy consumption have a non-significant negative relationship with each another. In the same vein, energy consumption and FDI inflow have a significant negative relationship with each other. This means that energy consumption does not propel FDI inflows in Nigeria.

There is an existence of a unidirectional causality which runs from FDI to oil exports in Nigeria. There is one way causal relationship running from energy consumption to oil exports. FDI inflows Granger Causes energy consumption. Meanwhile, energy consumption Granger Causes openness of the economy. Meanwhile, there is no feedback relationship between openness of the economy and FDI inflows and oil exports.

However, due to the findings that emerged in this study, it is important that this study recommends the following to the policy makers in Nigeria since energy consumption does not drive FDI inflows the policy makers in the country should provide a conductive climate that will facilitate the accessibility of foreign investors to primary energy consumption in the country. Also, the country should improve the value addition to the production of primary energy so that its consumption could be competitive in the global market.

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