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IMPACT OF RENEWABLE AND NON-RENEWABLE ENERGY ON FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH

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ABSTRACT

This study examines the impact of renewable and non-renewable energy on foreign direct investment (FDI) and economic growth in Nigeria from 1980 to 2017. The objectives are to assess how renewable energy influences economic growth, FDI, and the interplay between renewable and non-renewable energy. Using techniques such as the Augmented Dickey-Fuller test, Co-integration, and the Auto Regressive Distributed Lag (ARDL) model, secondary data from the World Bank were analyzed, focusing on GDP, renewable energy, non-renewable energy, and FDI. The findings indicate that GDP positively influences renewable energy in the long run, while non-renewable energy has a negative effect. In the short run, non-renewable energy and GDP significantly impact renewable energy, while FDI shows no effect. Recommendations include fostering a stable political environment to attract FDI and providing incentives like subsidies and tax holidays to promote trade and investment in renewable energy. Effective macroeconomic management is essential for translating economic growth into increased renewable energy consumption in Nigeria.

KEYWORDS: *Renewable Energy, Non-Renewable Energy, Foreign Direct Investment and Economic Growth.*

1. INTRODUCTION

Energy is an important resource for economic activities. Thus, the relationship between renewable, non-renewable energy, foreign direct investment and economic growth has attracted the attention of economic researchers, especially in recent years when industrial activities has proven its increasingly important role in growth of the economy (Lee and Chang, 2007; Narayan and Smyth 2008; Apergis and Payne, 2009). This global nature of energy challenges requires that energy resources be appropriately utilized, this can be achieved by adoption of renewable energy as a means of energy generation. Therefore, it is growing fast around the world and according to expectations it will edge out many conventional energy components and occupies a leading position in the overall share of energy consumption. Insufficient supply of energy affects all aspects of development, more specifically social, economic, environmental, and most especially quality of life. Improvements in standard of living are manifested in increased agricultural output, increased industrial output, the provision of efficient transportation, adequate shelter, healthcare and other human services and these will holistically require increased in energy consumption. Therefore, energy is considered as an important requirement for economic growth and is potentially an inhibiting factor to economic and social development (Apegis, 2014). However, the standard of living in most countries is directly related to their per capita energy consumption.

However, In the current era of globalization, multinational companies are able to trade with and expand across the entire globe (Ravenhill, 2014). Foreign Direct Investment from developed to less-developed countries is a catalyst for productivity improvements and enhanced output levels in the host economy, allowing the local industry to reinvest its profits into the industry. A more vibrant economy will have to use more energy to keep up with the higher level of production, as well as people's increasing demand for energy following the increased income level (Sadorsky, 2010). As per capita income increases, and population growth continues to increase in Nigeria, Sub- Saharan Africa and other parts of the developing countries, people will continue to demand for energy to secure their well-being and will depend on reliable energy sources to build a strong and productive economic foundation. To cope with the rise in energy demand together with the environmental issues of today, a change of energy usage is required. Finding ways to

increase the usage of more sustainable and clean energy, known as renewable energy, is therefore of importance. A positive effect of energy on FDI could signal that FDI allows for technology diffusion of sustainable production, thus easing the global pressure of the increase in energy demand (Allen 2008).

However, Nigeria is fortunate to have huge energy resources, which potentially give the country ample opportunity to transform her economy and the lives of her citizens. Nigeria sits astride of over 35 billion barrels of oil, 187 trillion cubic feet of gas, 4 billion metric tons of coal and lignite, as well as huge reserves of tar sands, hydropower and solar radiation, among others (Adenikinju, 2008). Despite the appealing potentials, Nigeria has not devoted equal attention to tap into her abundant energy resources to meet the requirements of her teeming population. Her efforts have been concentrated on the development, exploitation and utilization of crude oil and gas for fiscal objectives, which has consequently denied over 60% of her population access to electricity. Only 40% of Nigerians have access to electricity (Energy Information Administration, 2007). However, majority of the electricity is supplied to the urban areas, while the rural areas are left to accept their fate. This is a big issue on Nigeria which needs to be look into.

As a result of lack of sustainable form of electricity for large companies to run their operations, this has chase or closed down the operation of most foreign firms in Nigeria, which tends to reduce inflow of foreign direct investment into Nigeria economy. However, if Nigeria can invest heavily on alternative source of energy, this will increase the inflow of foreign direct investment into Nigeria economy. Countries in energy surplus in theory not in practical given the range of energy options in the country; it has been unable to translate its energy abundance into socio-economic development due largely to the policy environment and the nature of institutions put in place to drive activities in the energy sector (Gnansonuou, 2008). As a result of this issue, (Tang, 2009) opines that the influx of FDI is inducing energy consumption through the expansionary of industrialization, transportation and manufacturing sectors development while energy is required to support the manufacturing process.

The rest of the paper is organized as follows. In Section 2, we review the literature. In Section 3, we explain the empirical approach and describe the data. In Section 4, we present and discuss the results. Section 5 concludes the paper.

2. EMPIRICAL LITERATURE

A number of studies have examined the relationship between renewable and nonrenewable energy consumption measures foreign direct investment and economic performance within a country-specific context.

Tuggu (2013) investigates the long- and the short-run relationships between disaggregate energy consumption (i.e., alternative and nuclear, fossil and renewable) and total factor productivity growth in the Turkish economy. His results highlight that disaggregates energy consumption is cointegrated to total factor productivity growth and there exists bi-directional causal relationships among the variables in consideration, while Leitao (2014) also investigates the correlation between economic growth, carbon dioxide emissions, renewable energy and globalization. His results document that there is a strong and positive link between renewable energy and economic growth.

Sbia, (2014) consider the relationship between FDI and energy consumption in UAE for the period 1975-2011. This study uses multivariate time series (ARDL, VEC model, and Granger causality). The authors found a negative association between FDI and energy consumption. Concluding that the FDI contributes to the reduction of energy used. The openness trade also presents a negative association with energy consumption. The energy and FDI applied to the Chinese case was analyzed by Elliot, (2013). The authors consider a panel data (Random effects) for the period 2005-2008. They formulated an econometric model based on EKC literature (Elliot, 2013: 486-487). The results of this study demonstrate that income per capita and squared income per capita are according to EKC assumptions. Elliot et al. (2013) also found a negative sign between FDI and energy consumption. Using a dynamic panel data (GMM system estimator) for the period 1990-2011,

Omri and Kahouli (2014) found a positive impact of FDI, economic growth on energy consumption. The authors consider a sample for 69 countries (high- income countries, middle-income and low-income, Omri and Kahouli 2014: 917). Zaman (2012).

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Farhani and Rejeb (2012) applied for the MENA region for the period 1973-2008 demonstrates that economic growth is positively correlated with energy consumption for Egypt, Israel, Oman, Tunisia and Turkey (Farhani and Rejeb 2012:78). For the variable CO2, the econometric models using FMOLS show that 15 MENA countries present a positive impact on energy consumption with the exception Egypt, Oman and Sudan. Hanna et al. (2014:137) exhibit that resources are an important factor to explain the attraction of FDI. This qualitative study concluded that the intensity of natural resource and local environment are essential to explain FDI.

3. ESTIMATION TECHNIQUES

3.1 EMPERICAL MODEL SPECIFICATION

Most economic models, unlike the circular-flow diagram, use mathematical tools to represent basic economic features (Mankiw, 2011). An economic model serves as an abstraction of the real world, illustrating key aspects of economic phenomena (Fonta, Ichoku, & Anumundu, 2003). The model's specification is based on relevant information for the study, making it dependent on the data available. According to Koutsoyannis (1977), it is essential to include only the known elements of the subject in the model-building process to maintain theoretical soundness. Consequently, our model is specified as follows:

$$REN = f(GDP, NRE, FDI)$$

$$\Delta REN_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 NRENW_{t-1} + \beta_3 FDI_{t-1} + \sum_{i=1}^{n} \beta_{4i} \Delta FDI_{t-1} + \sum_{i=0}^{N} \beta_{5i} \Delta NRENW_{t-1} + \sum_{i=0}^{N} \beta_{6i} FDI + u_t$$

Where:

RE = Renewable Energy.
NRE = Non-Renewable Energy.
FDI = Foreign Direct Investment.
GDP = Gross Domestic Product.

Two endogenous variables are selected along with the energy consumption which is categorized as an exogenous variable based on the fact that it is largely influenced by external factors. The exogenous variables include: (RE) Renewable Energy. (NRE)Non-Renewable Energy and the endogenous variables include: (FDI) Foreign Direct Investment, (GDP) Gross Domestic Product.

3.2 SOURCES OF DATA

As regarding this research work. The use of secondary method was chosen for this study because it is considered to be the most appropriate method for the needed information. More so, the data were sourced from National Bureau of Statistics catalogue, Central Bank of Nigeria statistical bulletin together with some journals, Useful materials were also gotten from different texts books and materials via internet.

4. EMPERICAL ANALYSIS

4.1 ANALYSIS OF DATA AND INTERPRETATION OF RESULTS

This chapter presents the detailed results of the analyses conducted towards achieving the objectives of the study. The chapter presented the unit root test, Johansen co-integration test result, Stability test and long-run and short-run regression and descriptive statistics result with other post estimation test results.

4.2 TIME SERIES PROPERTIES OF THE VARIABLE

The study examined the time series characteristics of the variable adopted in order to avoid a situation of spurious regression.

4.2.1 UNIT ROOT TEST

The unit root test of the variables are conducted to determine whether they are stationary and to know the order to which they are integrated. The study adopted the Augmented Dickey Fuller test for unit root.

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TABLE 1: AUGMENTED DICKEY-FULLER UNIT ROOT TEST RESULT

VARAIBLES	LEVEL		FIRST DIFFERENCE		ORDER OF INTEGRATION
	T-STAT	PROB	T-STAT	PROB.	
REW	-2.636493	0.0993	-5.121841	0.0004	I(1)
NREW	-1.235389	0.6425	-4.569861	0.0015	I(1)
GDP	-0.227551	0.9205	-3.072318	0.0470	I(1)
FDI	-1.675142	0.4310	-5.264425	0.0000	I(1)

Author's compilation (2019)

The table above showed the unit root test result for the variables employed in the study. The result showed that all the variables are integration of the same order and are stationary at first difference i.e. they are first difference stationary at 5% level of significance, hence the study proceed to conduct co-integration test to determine if there is long-run relationship among the variables.

4.2.2 JOHANSEN CO-INTEGRATION TEST

TABLE 2 Unrestricted Cointegration Rank Test (Trace)

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.903708	67.66994	47.85613	0.0003
At most 1	0.526142	18.52225	29.79707	0.5277
At most 2	0.122414	2.838463	15.49471	0.9737
At most 3	0.004574	0.096281	3.841466	0.7563

Author's compilation (2019)

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

*** denotes rejection of the hypothesis at the 0.05 level**

****MacKinnon-Haug-Michelis (1999) p-values**

The Johansen co-integration test result above showed that there exist one cointegrating equation among the variables are 5% level of significance. This showed that the variables are co-integrated in the long-run. The major reason for this is because the trace statistics is significant at none i.e. it is greater than the critical value at 5% level and its respective probability value is significant which make it possible to reject the null hypothesis of none co-integrating equation at 5% level of significance.

4.2.3 LONG-RUN AND SHORT-RUN ESTIMATION CO-EFFICIENTS

The research work proceeds to estimate the long-run and over-parametized and parsimonious error correction model.

4.2.3.1 LONG-RUN CO-INTEGRATING COEFFICIENTS

TABLE 3 LONG-RUN COEFFICIENT LONG RUN COEFFICIENTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NREW	-0.748151	0.169302	-4.419029	0.0003
GDP	0.075764	0.017771	4.263468	0.0004
FDI	0.015259	0.009079	1.680715	0.1092
C	8.590170	0.961564	8.933537	0.0000

Author's compilation (2019)

R-squared	0.721982
Durbin-Watson stat	1.355635
F-statistic	12.33521
Prob(F-statistic)	0.000041

The results from Table 3 indicate that non-renewable energy has a negative and significant impact on renewable energy in the long run, with a 1% increase in non-renewable energy leading to a 0.748% decrease in renewable energy. Similarly, GDP has a positive and significant effect, where a 1% rise in GDP results in a 0.076% increase in renewable energy. In contrast, foreign direct investment (FDI) has a positive but insignificant impact on renewable energy. The constant term suggests that renewable energy will be 8.59% when all other variables are zero. The R-squared value indicates that 72% of the variation in renewable energy is explained by the model, and the F-statistic confirms overall model significance at the 5% level.

4.2.3.2 SHORT-RUN DYNAMIC AND ERROR CORRECTION MODEL

TABLE 4: SHORT RUN COEFFICIENT AND ERROR CORRECTION MODEL

ERROR CORRECTION MODEL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NREW)	-0.496300	0.114726	-4.325968	0.0004
D(GDP)	0.050260	0.010495	4.788900	0.0001
D(FDI)	0.010122	0.005220	1.939229	0.0675
ECM(-1)	-0.663369	0.135375	-4.900232	0.0001

Author's compilation (2019)

Table 4 showed the short run impact and the parsimonious error correction model result. From the result above, non-renewable has negative and significant relationship with renewable energy in the short-run. A percent change in non-renewable energy will result to -0.496300 percent change in REW in the short-run. Also, gross domestic product has a positive and significant relationship with renewable energy in the short run as one percent change in GDP will result to 0.050260 percent change in REW in the short-run. Foreign direct investment has a positive and insignificant relationship with renewable energy in the short-run. A percent change in FDI will result to 0.010122 percent change in REW in the short-run, and this value is insignificant at 5% level of significance. The error correction term, ECM(-1), showed the adjustment or feedback mechanism which shows the rate at which disequilibrium in REW is being corrected in the long run. The ECT here is negative and significant and therefore confirm that there is long-run relationship in the model. It showed that disequilibrium in real GDP is corrected by -0.663369 i.e. almost 66 percent annually.

4.4. DISCUSSION OF FINDINGS

The result of the study showed that all the explanatory variable (NREW and GDP) except FDI affect the explanatory variable (REW) in the long-run and short-run. This is against the a priori expectation of the study. This is examined at significant at 5% level of significance.

Also, in the short run all explanatory variables except gross domestic product impact renewable energy. This may be at a result of poor inflow of foreign investment into in the country both in the short-run and long-run, political instability, unfavorable business environment among others which affect both in the short-run and long-run. The result simply confirm that government should focus on the developing both governance, security, law, order, infrastructural development so as to increase the confidence of investors in the domestic economy of the country which will on the long-run produce rapid economic growth through increased capital accumulation

Non-renewable energy has a positive and significant effect on renewable energy in Nigeria which is in line with the result of several other research work. However, based on my findings, no research work to compare renewable and non-renewable energy.

Gross domestic products promote renewable energy in Nigeria both in the long-run and short-run which is in line with Okouye and Askan (2013) that diesel and motor petrol are the major contributors to economic growth in the long-run. Their results suggest that the challenge moving forward for Nigeria will be to replace diesel and motor petrol with

cleaner biodiesel alternatives, which will not adversely affect Nigeria's growth rate. Also, Pao and Fu (2013) insist on the role of renewable energy with its different components in promoting the Brazil's economic growth process. Based on a bivariate model.

The study found out that lack of confidence in the domestic market and poor mobilization of foreign direct investment in Nigeria as revealed in this study will cause FDI not to influence renewable energy in the long-run and short-run therefore can discourage investment which is line Sebuba (2014) found a negative association between FDI and energy consumption. Concluding that the FDI contributes to the reduction of energy used. The openness trade also presents a negative association with energy consumption.

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

This study analyzed the impact of renewable and non-renewable energy on foreign direct investment (FDI) and economic growth in Nigeria using secondary data from the World Bank and E-views 9.0 for econometric analysis. The research employed unit root tests, co-integration analysis, and error correction models (ECM). The findings indicate that non-renewable energy negatively affects renewable energy in both the long and short run, while GDP has a positive impact. FDI, however, showed no significant effect on renewable energy. The error correction term confirmed long-run equilibrium among the variables, with the model being stable and free from serial autocorrelation and heteroskedasticity. The results suggest that GDP is a key driver of renewable energy, while non-renewable energy poses a constraint.

5.2 CONCLUSION

The study examined the impact the impact of renewable and non-renewable energy on foreign direct investment and economic growth. The long-run result showed that renewable energy is influenced positively by real gross domestic product and while it is negatively influenced by non-renewable energy. This implies that real gross domestic product promotes renewable energy while non-renewable energy discourages renewable energy in Nigeria. Based on the short-run co-integration and error correction model, non-renewable energy and real gross domestic product influence renewable energy in Nigeria while real foreign direct investment fails to affect renewable energy in Nigeria.

5.3 RECOMMENDATION

The results of this study have some important policy implications which can be highlighted as follows:

1. Policy makers need to ensure that appropriate social, economic and political environment like maintaining governance, security, law and order is put in place to ensure increase in foreign direct investment inflow in the country.
2. There is need for the government to give incentives like subsidies, tax holiday etc. to exporters so as to benefit from increased trade openness and promote private investment.
3. Furthermore, the government and policy makers should use the various macroeconomic variables that promote GDP effectively for it to translate into increased renewable energy in Nigeria.
4. There should be measures like public sensitization to ensure balance between renewable energy and non-renewable energy in Nigeria so as to make non-renewable energy not to discourage renewable energy.
5. Finally, it is recommended that other scholars should look into the impact of macroeconomic variables such as inflation, tax, government expenditure and debt etc. on renewable energy in Nigeria and explore the other determinants of renewable energy.

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