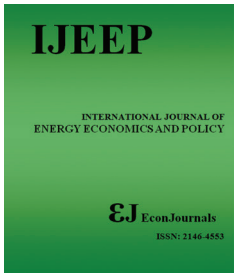

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Reducing Unemployment Malaise in Nigeria: The Role of Electricity Consumption and Human Capital Development

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ABSTRACT

One of the greatest challenges that Nigeria is confronted with and which on the average has continued to witness a rising trend over the years is unemployment. Its scourge is known to be responsible for a high level of poverty, inequality, increasing rate of criminality and general low level of living in the country. This study examined how electricity consumption and human capital can be used to reduce unemployment in Nigeria. The study obtained secondary data and analysed the data with the Johansen co-integration technique. The study found out that electricity consumption negatively impact unemployment, so also is government education expenditure. The result showed that a 1% increase in electric power consumption will lead to about 0.22% decline in the level of unemployment and 1% increase in education expenditure will bring about 0.17% decrease in the rate of unemployment. Therefore, the study recommends that the government should put in place policies and measures that will enhance the turn-out of quality graduates with skills and competence to chant the course of development by all stakeholders in the education sector.

Keywords: Unemployment, Electricity Consumption, Government Education Expenditure
JEL Classifications: E24, L94, H52

1. INTRODUCTION

One of the greatest challenges that Nigeria is confronted with and which on the average has continued to witness a rising trend over the years is unemployment (Torruam and Abur, 2014; Njoku and Ihugba, 2011). Its scourge is known to be responsible for a high level of poverty, inequality, increasing rate of criminality, and general low level of living in the country. The International Monetary Fund (2016) noted the rise in the unemployment rate in Nigeria from 13.1% to 14.8% and subsequently, to 23.9% in 2000, 2003 and 2012 respectively. Apart from representing a colossal waste of country's manpower resources, Akinboyo (1987); Raheem (1993) cited in Obadan and Odusola (2001) noted that unemployment generates welfare loss in terms of lower output. This automatically will culminate into low growth in the economy over time if it persists. The realization of this fact made Iyoha (1978) cited in Kareem (2015) reiterated the significance of employment generation in driving the growth rate of gross domestic product (GDP) in Nigeria.

From the viewpoints of ecological-economics, energy (one form of which is electricity) is a necessary input in economic production process as much as do the classical determinants of growth (that is, conventional inputs like labour and capital) recognized by the proponents of the neoclassical theories. Based on the argument of Beaudreau (1995), production is not feasible without energy consumption. Studies at one point or the other have alluded to the view that provision of access to quality electric power and its consumption is very crucial for socio-economic development of any nation (George and Oseni, 2012; Alaali et al., 2015). According to Onakoya et al. (2013), energy is the pillar of wealth creation in Nigeria, evident by being the nucleus of operations and engine of growth for all sectors of the economy. Aligning with this stance, Lee and Chang (2008) and Stern (2011) conceded with the fact

that economic activities either at home or large scale industries regard energy as a mandatory input in the production process and therefore, it is regarded as a limiting factor to economic growth (Ghali and El-Sakka, 2004).

Onakoya et al. (2013) noted that the output of energy sector (for instance; electricity, petroleum products among others.) usually consolidate the activities of the other sectors which provide essential services to direct the production activities in agriculture, manufacturing and mining This suggests that the supply and consumption of electricity is even critical for improving education and health outcomes (the essential components of quality human capital) required for positive contributions to socio-economic advancement of any nation. To explore this issue, this study seeks to examine the impact of the measure of human capital and electricity consumption on unemployment in Nigeria. The role of human capital as a significant contributor to the growth and development of a nation has been emphasized by the endogenous model (Galor and Weil, 2000; Lucas, 1988). This implies that electricity and human capital can actually complement and synergize each other for greater impacts on the economy and most importantly to reduce the rate of unemployment, with a consequent enhancement of economic growth. Okun (1962) in his pioneering and seminal contribution to unemployment-economic growth link concluded that a decrease in unemployment by 1% will lead to an increase in GDP growth rate by 2%.

However, previous studies on energy consumption and the economy reflect some methodological issues. Most are based primarily on bivariate models with investigations mainly conducted to determine the link between either real GDP/growth and energy consumption (Stern, 2000; Soytas and Sari, 2003; Fatai et al., 2004; Onakoya et al., 2013) or employment/unemployment and energy consumption (George and Oseni, 2012; Bilgili et al., 2017). This could lead to misleading results due to the possibility of bias created by omitted variables. Few studies that adopted trivariate model did not incorporate any human capital variable in the specified energy model (Narayan and Smyth, 2005; Mahadevan and Asafu-Adjaye, 2007; Shahiduzzaman and Alam, 2012). The general observation from the studies revealed conflicting results based on the existence and direction of causality between energy consumption and the economic phenomenon of study.

This study differs by integrating the ecological/energy economics approach with the endogenous theory in order to study the relationship between electricity consumption, human capital development and unemployment in Nigeria. Although Stern (2011); Ayres and Warr (2009) integrated two models (that is, neoclassical growth theory with the ecological-economics approach), specific studies incorporating human capital variables (as the thrust of endogenous theory) in the model of energy economics are somehow not common. In his study, Gylfason (2001) illustrated that most countries that are rich in natural resources are disillusioned and usually build a false understanding of security by considering this wealth their most significant asset, ignoring investment in other sources of growth represented in inexhaustible resources such as human capital. This, according to Barro (1996; 1998) may inadvertently lead to the neglect of other resources for development, such as expenditure on education, since education persistently expands labour efficiency.

Corroborating the aforementioned stance, Alaali et al., (2015) opined that the level of endowments and natural resources that the state owns, and as a consequence the availability of cheap energy sources may affect economic growth. They posited that in the long run, most oil rich countries, show slower growth than less endowed countries. This may have justified why Nigeria still grapples with economic advancement (using diverse indicators of economic development), in spite of the available deposit of vast energy and natural resources (such as coal, natural gas, crude oil, hydro, solar and so on) in the country. To explore these issues, this study will integrate energy economics with endogenous human capital model to examine the impact of measures of human capital (along with that of electricity) on unemployment (a feat scarcely explored in previous studies). Although, the studies by Alaali et al., (2015); Matthew et al. (2018) integrated energy economics approach with endogenous theory, the examination is conducted with reference to economic growth and not specifically on unemployment/employment. By this, the study is distinguished from those conducted previously.

The rest of the paper is structured as follows; section two presents the review of some extant literature related to the topic under consideration and stylized facts while the third section presents the methodology of the study. This is followed by section four which presents and discusses the empirical results of the econometric estimation. Finally, section five which is the concluding section summarizes the findings of the study and provides policy recommendations.

2. LITERATURE REVIEW AND STYLIZED FACTS

2.1. Review of Extant Literature

The literature has continued to witness an increasing growth in the studies that examine the relationship between energy consumption and the economy. There is no doubt as to the critical role of energy on socio-economic development of any nation. Nearly all the reviewed studies concede to the fact that adequate provision and consumption of electricity play a significant role in negatively impacting unemployment, as it is a major factor in industrialization with high capacity to absorb a large proportion of labour (Dinkelma, 2008; Rabiu, 2009; Khan and Khan, 2010), and stimulate economic growth (Aqeel and Butt, 2001; Shiu and Lam, 2004; Onakoya et al., 2013; Osabohien et al., 2019). However, with respect to the causal relationship, empirical studies on the link between energy and the economy reported mixed and conflicting results. The inconsistency in results has partly been attributed to the issue of omitted variables bias where bivariate analysis is conducted (Stern, 2000; Payne, 2010), as well as the difference in the adopted measures of energy and econometric methods applied.

The study of Francis et al. (2007) on Haiti, Jamaica and Trinidad and Tobago using Engle-Granger co-integration and error correction model through the adoption of an aggregate measure

of energy, reports bidirectional causality for energy consumption and real GDP. In other words, adequate energy consumption Granger-causes growth as well as economic growth causing a growth in the energy sector which subsequently influences its consumption. Other studies which fall to this category include that of Paul and Bhattacharya (2004), Mahadevan and Asafu-Adjaye (2007), and Shahiduzzaman and Alam (2012). In addition to adopting Engle-Granger/Johansen-Juselius co-integration and error correction models, Shahiduzzaman and Alam (2012) also used Toda-Yamamoto causality tests to determine a causal relationship. However, the use of Engle-Granger/Johansen-Juselius co-integration procedures and corresponding error correction models to study a causal relationship between energy consumption and economic growth has been criticized. According to Harris and Sollis (2003), this is owing to the low power and size properties of small samples associated with conventional unit root and co-integration tests.

Authors such as Lee (2005); Mehrara (2007); Narayan and Smith (2007); Lee and Chang (2008) adopted the panel co-integration tests to address the concerns of low power and size properties of small samples associated with conventional unit root and co-integration tests. According to them, panel co-integration tests provide additional power by combining both the cross-section and time series data allowing for heterogeneity across countries. All the reviewed studies in this regard report unidirectional causality from energy consumption to the adopted measures of economic development. For instance, Lee (2005) reported that energy consumption leads to real GDP growth for the developing countries panel while Mehrara (2007) shows that commercial energy usage per capita results to real GDP per capita growth for the oil-exporting countries panel. On their own part, the study of Narayan and Smith (2007) on the G7 panel revealed unidirectional causality from energy consumption per capita to real GDP growth per capita and in the same vein, Lee and Chang (2008) showed that increased energy consumption lead to real GDP growth for the Asian panel, APEC panel and the ASEAN panel.

Realizing the fact that adoption of aggregated energy consumption measures by most studies could cover up or mask the differential impact of the various sub-component measures on the economy, few authors attempted to investigate the impact of the sub-components of energy consumption on the economy (Shiu and Lam, 2004; Yoo and Kim, 2006; Jinke et al., 2008; Orhewere and Machame, 2011; Dantama et al., 2012; Pirlogea and Cicea, 2012; Onakoya et al., 2013; Matthew et al., 2018; Matthew et al., 2019). Again, the outcomes of the studies regarding causal relationships are inconsistent and reveal no consensus between the two variables within and across countries. Shiu and Lam (2004) shows that real GDP and electricity consumption for China using error correction models are co-integrated, and there is unidirectional Granger causality running from electricity consumption to real GDP.

Furthermore, to determine if different time periods matter for influencing causality between sub-components of energy consumption and the economy, Orhewere and Machame (2011); Dantama et al. (2012) examined the importance of the influence of time periods. In the study by Orhewere and Machame (2011), they reported a unidirectional causality running from electricity consumption to GDP, both in the short run and long run. The result further showed a unidirectional causality from gas consumption to GDP in the short run and bidirectional causality in the long run. There is unidirectional causality from oil consumption to GDP in the long run while no causality exists between the two variables in the short run. The study of Dantama et al. (2012) using the ARDL approach to co-integration analysis revealed a statistically significant long run relationship between each of the petroleum and electricity consumptions and economic growth. However, coal consumption showed a statistically insignificant relationship with economic growth also in the long run.

Conclusions from the surveyed literature show that directional relationship between diverse sub-components of energy consumption and the economy varies for different time periods. It also reveals that the impact of aggregate measure of energy consumption differs from that of its disaggregated components on the economy. This may have arisen from the issue of aggregation bias which usually interferes with the outcomes of econometric investigations to produce misleading statistical results. One thing is however common and that is, the consensus about the impact of energy consumption on socio-economic development and welfare in a country are not in doubt. Equally observed is that no study in the reviewed literature incorporates any measure of human capital development in the energy model to examine their impacts on the economy. As a major thrust of the endogenous growth theory, Romer (1986); Lucas (1988) and other new growth theorists like Barro (1991); Barro and Sala-i-Martin (1995) as well as different empirical studies have identified the role of human capital development in stimulating economic growth and development (Anyanwu et al., 2015; Matthew, 2011; Izedonmi and Urhie, 2005). Not including human capital measure therefore will constitute the issue of bias due to omitted variables. Hence, incorporating human capital development measures into the energy model and investigating their impact on unemployment in Nigeria will distinguish this study from the previous ones.

2.2. Stylized Facts

In this subsection, the researchers examined the patterns and trends of the key concepts relating to the study which include unemployment, electricity consumption and one of the human capital development indicators. Figure 1 shows that the rate of unemployment in Nigeria has averagely been on the increase during the period under review. For instance on the basis of 5-year average, unemployment consistently increased from 5.58% in (1980-1984) through to 23.28% in the period (2010-2015).

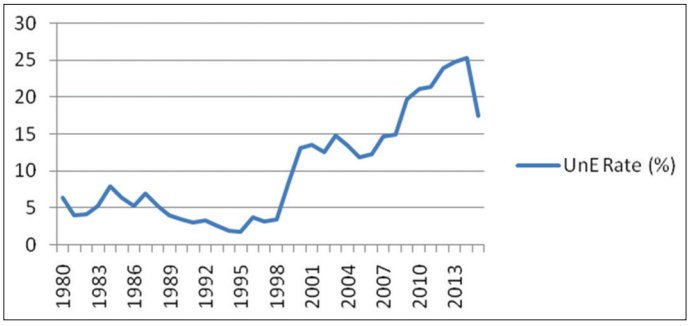
Statistics presented in Figure 2 shows that electricity consumption in Nigeria measured by KWh per capita (International Energy Agency, IEA, 2016) has been on the fluctuating trend since 1980, but witnessed a consistent decrease from 1998 to 2000 while on the average, it witnessed an upward trend from 2001 to 2015.

In spite of an average upward trend in electricity consumption during the review period as revealed in Figure 2, the level of unemployment has not been impacted negatively as no fair inverse relationship is observed between the variables. As revealed, unemployment is

seen to exhibit nearly the same trend with electricity consumption during the period. This may not be unconnected with the outcome of electricity supply-demand gap which makes the quantum of supplied electricity not to measure up with the quantity required to keep up with the pace of economic activities both in the large scale industries, businesses of the middle class as well as the cottage industries. The resultant effect will be an increase in the level of unemployment as observed. In order to further justify the position highlighted and to corroborate the stance, Table 1 shows the values of electricity generation and consumption in Nigeria between 1995 and 2004 to reveal the outputs that are lost or wasted in the course of distribution and transmission during the period.

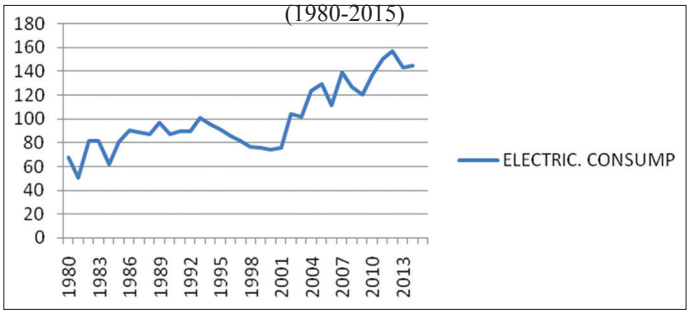
Table 1 reveals an average increase in electricity wastages/losses during transmission and/or distribution between 1995 and 2004. The proportion of electricity generation that was lost increased first from 41.9% in 1995 to 45.1% in 1997, thereafter it reduced to 43.6% in 1998 followed by an increase to 52.5% in 1999. The percentage loss in 2003 was 75.4% before witnessing a downward trend to 33.9% in 2004 (CBN, 2004). This has made the quantum of electricity available for consumption inadequate in the area of powering of industrial machines with a view to enhancing economic activities required to generate employment opportunities. In fact, many businesses owned by foreign nationals that could have boosted the capacity to generate employment have had to flee the country and relocated to neighbouring countries where the environment is more conducive and enabling for their activities.

Figure 1: Trends in unemployment rate (%) in Nigeria (1980-2015)



Source: Authors' computation from IMF World Economic Outlook Database

Figure 2: Total electricity consumption (KWh per capita) in Nigeria (1980-2015)



Source: Compiled by the Authors (2019) from the International Energy Agency, IEA Database

Figure 3 indicates the level of education using the university graduation rate as an indicator of human capital development. As revealed in the figure, university graduation rate initially witnessed an insignificant fluctuating trend from 19.1% in 1980 to 12.4% in 2005. Thereafter, it consistently witnessed an upward trend from 16.4% in 2006 to 86.9% in 2015. Incidentally, the level of unemployment between 2006 and 2015 equally experienced on the average an upward trend (Figure 1).

The implications of the scenarios playing out in Figures 1 and 3 is that in spite of possessing a minimum requisite condition in educational qualification necessary for gaining productive employment or creating one with a consequent reduction in the level of unemployment, the issue of inadequate access to power attributed to wastages/losses (Table 1) remains a great challenge and may have constituted a major constraint to Nigerian economic development. The high cost associated with independent power generation does not encourage individuals to source power through an alternative means such as the use of power generating sets for economic activities. This may eat deeply into their profit margin thereby making the business not worthy of venturing into. Although, the issue of skills gap and quality in human capital development can also be a contributory factor to rising unemployment and cannot be disregarded with the wave of a hand, this however cannot be determined by intuition but through a scientific analysis which will be the focus of the next section.

3. METHODOLOGY

3.1. Theoretical Framework

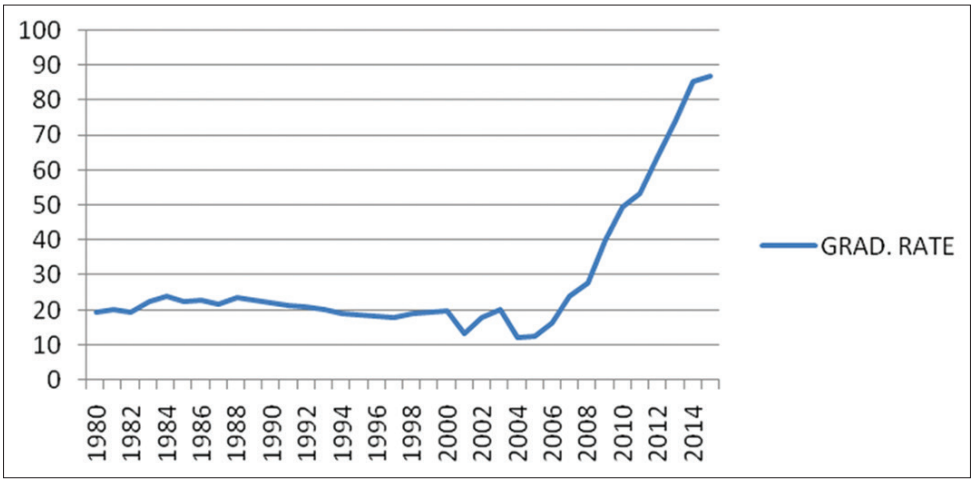
The thrust of this study is on the integration of two approaches that are critical for enhancing the development of any economy.

Table 1: Electricity generation, consumption and losses or wastages

Year	Installed capacity (mw)	Total Gen. (MWh)	Total consumption (MWh)	Wasted outputs/loss	Losses (% of total Gen.)
1995	4,548.6	1,810.1	1,050.9	759.2	41.9
1996	4,548.6	1,854.2	1,033.3	820.9	44.3
1997	4,548.6	1,839.8	1,009.6	830.2	45.1
1998	4,548.6	1,724.9	972.8	752.1	43.6
1999	5,580.0	1,859.8	883.7	976.1	52.5
2000	5,580.0	1,738.3	1,017.3	721	41.5
2001	6,180.0	1,689.9	1,104.7	585.2	:34.6
2002	6,180.0	2,237.3	1,271.6	965.7	43.2
2003	6,130.0	6,180.0	1,519.5	4,660.5	75.4
2004	6,130.0	2,763.6	1,825.8	937.8	33.9

Source: Authors' Compilation, (2019) using data from CBN Statistical Bulletin (2004).

Figure 3: University graduation rate in Nigeria (graduates turn-out as % of total enrolment)



Source: Authors' Compilation (2019) using Available Data from National Universities Commission, NUC (Various Issues).

These are the energy-economics approach and endogenous human capital theory. Energy-economics as an approach underscores the imperative of energy (for example; electricity) input in production process to enhance the development of an economy (Lee and Chang, 2008; Stern, 2011; Alaali et al., 2015), while endogenous human capital theory emphasizes the development of human capital within the economic system to engender a long run economic development (Romer, 1986; Lucas, 1988; Barro and Sala-i-Martin, 1995). According to the proponents of endogenous human capital theory, adequate investments in education and health will accumulate and build human capital necessary for enhancing the productive capacity of a population. This implies that the better educated and healthy the group, the lower the unemployment rate and the higher the rate of growth in the economy is. The theory emphasizes the role of institutions through their policies in developing quality human capital required for enhancing the economy.

Integrating the two approaches will have a far reaching effect on the economy due to the fact that electricity sector and the sectors responsible for producing quality human capital (i.e., education and health) have critical roles to play in influencing the level of unemployment, and consequently economic growth. The integration of the approaches is equally justified because adequate supply of electricity enhances the performance of the education and health sectors. It aids effective studying and learning, enables the use of high-powered hospital machines and equipment for curing and managing life-threatening diseases, thereby producing quality manpower with a subsequent negative impact on unemployment. Using Cobb-Douglas functional form, the unemployment model from the integration of the approaches of energy-economics and endogenous theory for the study is presented in equation (1):

$$UnE = AK^{\alpha} H^{\beta} ELEC^{\theta} \quad (1)$$

Where,

UnE: Unemployment rate in per cent (%); *A*: Total factor productivity as defined by level of technology; K: Physical capital input; *H*: Human capital variables; *ELEC*: Energy proxied by electric power; while α, β, and θ are output elasticity coefficients due to physical capital, human capital, and electric power respectively. Taking the natural log of equation (1) and introducing the stochastic term produces equation (2) as follows:

$$InUnE_t = InA + \alpha InK_t + \beta InH_t + \theta InELEC_t + \varepsilon_t \quad (2)$$

In its estimable form, equation (3.2) is transformed to:

$$InUnE_t = \alpha_0 + \alpha_1 InK_t + \beta InH_t + \theta InELEC_t + \varepsilon_t \quad (3)$$

3.2. Model Specification and Data Sources

The model specified for the study is similar to the growth model of Alaali et al. (2015), which examines the impact of differential measures of electricity and human capital development on GDP per capita, but with little modifications. The model of Alaali et al. (2015) is of the form:

$$Growth_{it} = \alpha_0 + \sum_{j=1}^{J} \gamma_j X_{jit} + \varepsilon_{it} \quad (4)$$

Where; $Growth_{it}$ is the GDP per capita in country, *i* over time *t*; X_{jit}: Vector of explanatory variables *j* = (1… *J*); $\mathcal{E}_{it}$ is the stochastic term respectively. The study of Alaali et al. is based on panel analysis and the investigation is on economic growth while this study is premised on time series analysis, and has its focus on unemployment. Following from the aforementioned, the operational definition of the model for the study is as presented in equation (3). In line with the objective of the study, equation (3) is extended to include the variables of human capital development and electric power that are of interest as:

$$InUnE_t = \alpha_0 + \alpha_1 InGFCF_t + \beta_1 InGEE_t + \beta_2 InGHE_t + \beta_3 InGRAD_t + \beta_4 InECON_t + \varepsilon_t \quad (5)$$

Where,

GFCF: Gross fixed capital formation as proxy for physical capital is measured as a per cent of GDP. Gross fixed capital formation according to World Bank (2012), includes investments in land improvements; plant, machinery and equipment purchases; construction of roads, railways, schools,

offices, hospitals, private residential dwellings, commercial and industrial buildings; and net acquisitions of valuables. Data are obtained from World Bank (2016) national accounts data.

GEE and *GHE*: Total government education and health expenditures are measured as per cent of total expenditure. Adequate government expenditure in education and health through her quality policies is expected to enhance access to education and quality health care facilities. This way, production of quality human capital is enhanced, ceteris paribus. Values of these in per cent are computed using data from CBN Annual Report and Statement of Accounts, various issues.

GRAD: Graduation rate as proxy for educational attainment/output is derived from available data from the Nigerian National Universities Commission, (NUC) on graduate turn out as a per cent of total university enrolment. Incorporating this as a measure of human capital development will examine how outcome (completion rate) from the education system impacts the level of unemployment rather than relying solely on input and flow measures.

ECON: Total electric power consumption according to International Energy Agency, IEA (2016) is measured as total net consumption (that is, gross consumption less energy consumed by the generating units). Electric power consumption is measured in kilowatt-hour (kWh) per capita. Total electricity consumption includes the aggregated consumption values of the industrial sector, commercial activities as well as the residential areas. The adoption of its total value is because in Nigeria, economic activities which require electricity are performed substantially in all these areas which generate employment opportunities for a considerable proportion of the populace. Data for this measure are obtained from the database of IEA.

4. DISCUSSION OF EMPIRICAL RESULTS

The starting point is to first present the summary statistics of the six selected variables which are: Unemployment rate, gross fixed capital formation, government education expenditure, government health expenditure, graduation rate and electricity consumption. These include the mean, standard deviation and the range (minimum and maximum values) of the variables as shown in Table 2.

The results showed that the mean value of unemployment rate is approximately 10.17, with the standard deviation of 7.2, while the minimum and the maximum values are 1.80 and 25.30 respectively. Similarly, gross fixed capital formation has a mean value of 12.71 which ranges from 5.46 to 35.22 with a standard deviation of 6.41. Government education and health expenditure has mean values of approximately 6.11 and 3.07 with the standard deviations of 2.06 and 1.75, while their minimum and maximum values range from 0.73 to 9.21 and 1.10 to 7.30 respectively. Graduation rate has the mean value of 28.57 and ranges from 12.03 to 86.90 respectively. The mean of 100.05 for electricity consumption depicts that on the average, the value of electric power consumption is about 100.05KWh per capita with the minimum value of 50.87 and the maximum of 156.73 KWh per capita. The standard deviations of 19.74 and 26.99 further reveal that a high degree of variations is associated firstly, with electricity consumption followed by graduation rate in Nigeria compared with the other variables in the model.

Following the summary statistics of the variables, the unit root test was conducted using the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) statistics in order to ascertain the trend of the variables, and results are presented in Table 3. Pesaran et al. (2001) posit that before conducting a long-run relationship among variables, it is necessary to know the variables level of stationarity. A major condition for a co-integration test to be conducted is that the unit root test result should indicate that all the series are stationary. From the stationarity test carried out as presented in Table 4, all the variables were non-stationary at levels. Therefore, a further run of the test at first difference was carried out and the result showed that the variables are stationary at first difference. A variable is stationary when the absolute value of ADF and PP t-stat is greater than its critical value. From Table 3, all the variables are stationary at first difference, I(1). When all the variables are I(1), they produce a stationary series which serves as an indication of co-integration among them in the long run.

In order to examine the long run relationships, co-integration test is carried out using Johansen approach and the results presented in Table 4. The co-integration tests were undertaken based on the Johannsen (1988) and the Johansen and Juselius (1990) maximum likelihood framework. The essence was to establish whether long-run relationships exist among the variables of interest. The Johannsen technique was chosen not only because it is vector auto-regression based, but also because it performs better than the single equation and its alternative multivariate methods. The method produces asymptotically optional estimates since it incorporates a parametric correction for serial correlation. The nature of this estimator means that the estimates are robust to simultaneity bias, and also to departure from normality.

From the results in Table 4, the Johansen method showed a number of co-integrating vectors in non-stationary time series. It allows

Table 2: Summary statistics of variables

Variable	Mean±standard deviation	Minimum	Maximum
Unemployment rate	10.1666±7.21704	1.80	25.30
Gross fixed capital formation	12.7177±6.4141	5.46	35.22
Government expenditure on education	6.1094±2.0606	0.73	9.21
Government expenditure on health	3.0677±1.7519	1.10	7.30
Graduation rate	28.5688±19.7467	12.03	86.90
Electricity consumption	100.0514±26.9908	50.87	156.73

Source: Authors' compilation, 2019

Table 3: Unit root test for stationarity

Variable	ADF test	Critical values					PP Test	Critical values				
	statistics	@ 1%	@ 5%	@ 10%	Integration order	Remark	statistics	@ 1%	@ 5%	@ 10%	Integration order	Remark
Unemployment rate	−5.016	−4.262	−3.552	−3.209	1(1) at 1st difference	Stationary	−5.016	−4.262	−3.552	−5.016	1(1) at 1st difference	Stationary
Government expenditure on education	−6.346	−4.273	−3.557	−3.212	1(1) at 1st difference	Stationary	−9.804	−4.2627	−3.209	−3.204	1(1) at 1st difference	Stationary
Government expenditure on health	−5.989	−4.284	−3.562	−3.215	1(1) at 1st difference	Stationary	−6.995	−4.243	−3.544	−3.204	1(1) at 1st difference	Stationary
Graduation rate	−3.750	−2.627	−3.555	−3.209	1(1) at 1st difference	Stationary	−11.038	−2.608	−2.369	3.209	1(1) at 1st difference	Stationary
Electricity consumption	−7.841	−4.262	−3.552	−3.209	1(1) at 1st difference	Stationary	−8.035	−4.262	−3.552	−3.209	1(1) at 1st difference	Stationary

Source: Authors' Computation, 2019. ADF means Augmented Dickey-Fuller, while PP means Phillips-Perron

for the hypothesis testing regarding the elements of co-integrating vectors and loading matrix. The co-integrating test includes six variables which are of interest in this study: Unemployment, gross fixed capital formation, government education expenditure, government health expenditure, graduation rate and electricity consumption. The outcome in specific term shows that from the trace test statistics, there exist at least one co-integrating equation significant at 5% level among the series in the model. Co integration starts at the point where 5% critical value (68.52) begins to be greater that the value of the trace statistics (67.8928) as presented in Table 4.

Since there is an existence of long run relationships among the series as established, in order to capture short run dynamics that might have occurred in estimating the long-run co- integrating equations, a vector error correction model (VECM) was estimated as shown in Table 5. The error correction term (ECterm) depicts the speed of adjustment to equilibrium when the system experiences shock. The VECM result presented in Table 5 revealed that electricity consumption negatively impact unemployment, so also is government education expenditure. Their impact however is insignificant ($P > 0.05$). The coefficient of government health expenditure is on the contrary, positive but significant in explaining unemployment ($P < 0.05$). Specifically, the result showed that a 1% increase in electric power consumption will lead to about 0.22% decline in the level of unemployment and 1% increase in education expenditure will bring about 0.17% decrease in the rate of unemployment. Other insignificant and negative coefficient in the VECM is that of gross fixed capital formation, GFCF. The VECM estimates thus indicate that the impact and lagged effect of increased electricity consumption, an increase in government education expenditure and in the proportion of GDP allocated to physical capital formation would negatively influence the level of unemployment. This result validates the expectation in the literature that an increased consumption of energy (for example, electricity) and an increase in public education investment will enhance economic development. The insignificance of electricity variable in Nigeria can be linked to the inadequacy of electricity output available for consumption, wastages or loss of output incurred during the processes of transmission and distribution. Equally, government investment in education and other social services is characterized by an inefficient and ineffective allocation which makes it inadequate to impact unemployment significantly in Nigeria.

Furthermore, graduation rate (measure of education output) which is supposed to enhance skills acquisition, competence and quality of human capital has a positive coefficient and its impact on unemployment is insignificant. This depicts that the higher the rate of graduation, the more the rate of unemployment. This may be attributed to insufficient job openings in the economy to match the ever increasing turn-out of graduates from the proliferated educational institutions in the country. This issue was firstly referred to by Oladeji (1989a) in his paper by coming up with the proposition: Overproduction hypothesis and due to the persistence of the social problem till date, the hypothesis was revisited in his study in 2014 (Oladeji, 2014).

Table 4: Johansen's tests for co-integration

Maximum rank	Parms	LL	Eigen value	Trace statistic	5% critical value
0	42	29.7860	.	111.5855	94.15
1	53	51.6323	0.7447	67.8928*	68.52
2	62	64.1747	0.5433	42.8080	47.21
3	69	75.3191	0.5016	20.5191	29.68
4	74	81.8722	0.3360	7.4130	15.41
5	77	85.5787	0.2067	0.0000	3.76
6	78	85.5787	0.0000	-	-

Source: Authors' computation, 2019

Table 5: Estimates from vector error-correction mechanism

	Regressand					
	D_UNE	D_ GFCF	D_GEE	D_ GHE	D_GRAD	D_ECON
Regressors						
ECterm	−0.0291*	0.1721*	−0.1315	0.0821	−0.0345	0.0247*
	[0.033]	[0.039]	[0.119]	[0.071]	[0.041]	[0.026]
	(0.000)	(0.000)	(0.267)	(0.247)	(0.401)	(0.000)
UNE(LD)	0.2407**	−0.3347*	0.1315**	0.1617	−0.0304	−0.0163
	[0.213]	[0.143]	[0.119]	[0.262]	[0.152]	[0.095]
	(0.026)	(0.019)	(0.026)	(0.538)	(0.842)	(0.864)
GFCF(LD)	−0.1788	0.4539*	−0.1592**	0.481***	−0.0410	0.2198*
	[0.548]	[0.120]	[0.478]	[0.286]	[0.166]	[0.103]
	(0.852)	(0.000)	(0.013)	(0.093)	(0.805)	(0.000)
GEE(LD)	−0.169	−0.0265	0.0452	0.1308	−0.0984	−0.0218*
	[5.2906]	[0.0744]	[0.2301]	[0.138]	[0.799]	[0.050]
	(0.137)	(0.723)	(0.207)	(0.342)	(0.218)	(0.000)
GHE(LD)	0.4075	−0.0242	−0.0914	−0.2022	0.1405	0.0219
	[0.075]	[0.118]	[0.363]	[0.217]	[0.126]	[0.038]
	(0.021)	(0.838)	(0.801)	(0.352)	(0.265)	(0.564)
GRAD(LD)	0.4938	0.7493*	−0.2044	−0.7971	0.19229	0.0231***
	[0.319]	[0.213]	[0.655]	[0.392]	[0.227]	[0.033]
	(0.201)	(0.000)	(0.768)	(0.042)	0.398)	(0.098)
ECON(LD)	−0.2153	0.4999	[0.4780]	[0.1516]	[0.0591]	−0.7180*
	[0.385]	[0.258]**	[0.792]	[0.4705]	[0.275]	[0.078]
	(0.576)	(0.030)	(0.546)	(0.749)	(0.830)	(0.000)
AIC: 0854776, HQIC: 0.8901666, SIC: 2.513103						

Source: Authors' Computation, 2019. *.**.***Means significant at 1%, 5% and10% levels of significance respectively. LD signifies that they were lagged and differenced. The probability values are in parenthesis (.). AIC: Akaike information criterion, HQIC: Hannan–Quinn information criterion, SIC: Schwarz information criterion

The result of this study is consistent with that of Alva and Entwisle (2002); Calves and Schoumaker (2004); Morgan and Morgan (2004). Alva and Entwisle (2002) conducted a similar research for Nang Rong, Thailand; Calves and Schoumaker (2004) did for Burkina Faso while Morgan and Morgan (2004) found that a severe economic decline in the 1980s in Kano, Nigeria, negatively impacted the professionals the most. On the whole, it appears that lack of absorptive capacity by a country to employ a surplus of educated individuals probably due to economic deterioration make schooling appear unbeneficial, by not impacting the levels of unemployment negatively. Another plausible reason however may be that the education received is insufficient due to insignificant public investment in the sector. The subsequent effect is that the graduates turned out will not to be well-equipped with the requisite skills, competence and the zeal for self-employment where and when job openings are insufficient with capacity for full absorption of those that seek paid employment.

Further analysis of the VECM results indicates that the ECterm/ speed of adjustment coefficient is negative, statistically significant and within the magnitude of 0 and 1 as expected. This implies that the speed of adjustment to a long run co integrating relationship when the system experiences any shock in the short run is different from zero. In other words, the error correction coefficient depicts the rate of adjustment of any distortion in the short run as it converges to its long run state. From the co integrating vector estimates, about 3% of the shock to the rate of unemployment at time t, in the short run can be corrected per time as it returns to the long run equilibrium state.

To ensure that the estimated results are not spurious, test for muliticollinearity was conducted using the correlation matrix. The result of the correlation matrix in Table 6 shows that there exists no incidence of multiccollinearity among the six selected variables as their degree of collinearity is <80% (0.8).

5. CONCLUSION AND RECOMMENDATIONS

This study examined the role of electricity consumption and human capital in reducing the menace of unemployment in Nigeria, with a view to enhancing growth and development. The empirical results revealed that the critical role of electric power consumption and

Table 6: Correlation matrix for multicollinearity

	Unemployment rate	Gross fixed capital formation	Government health expenditure	Government education expenditure	Graduation rate	Electricity consumption
Unemployment rate	1.0000					
Gross fixed capital formation	−0.0906	1.0000				
Government health expenditure	0.4737	0.2855	1.0000			
Government educational expenditure	0.7645	−0.1343	0.6015	1.0000		
Graduation Rate	0.7393	0.1855	0.3443	0.4741	1.0000	
Electricity consumption	0.7904	−0.2042	0.2692	0.7078	0.6738	1.0000

Source: Authors' computation, 2019

human capital investment in enhancing development and reducing unemployment in an emerging economy like Nigeria is not in doubt. This outcome is consistent with the findings of studies like (George and Oseni, 2012; Izedonmi and Urhie, 2005; Khan and Khan, 2010; Matthew, 2011; Omodero and Azubike, 2016; Rabiu, 2009; Matthew et al., 2019).

Further evidence from the study showed that electricity consumption and human capital are insignificant in explaining unemployment in Nigeria. This can be attributed to a loss of significant proportion of electricity output in the course of transmission and distribution which leaves an insignificant proportion for consumption. This is grossly inadequate to spur economic activities necessary for generating employment opportunities. Furthermore, the level of education measured by the rate of graduation from the tertiary institution depicts the inadequacy of education to stimulate employment and enhance development in Nigeria. The acquired skills seem to be low compared with what the economy requires for its vibrancy.

Based on the findings, this study therefore, recommends the imperative of putting in place policies and measures that will enhance the turn-out of quality graduates with skills and competence to chant the course of development by all stakeholders in the education sector. The era of teaching or learning just for its sake should be put behind and rather embrace education for the reason of development, with the consciousness that it is the knowledge economy that stands the chance of competing favourably in the international space and global arena. There is the need for government to also ensure effective and efficient allocations to the education and other social sectors, and also avert any form of instability in the government-owned educational institutions.

The need to enhance adequate energy consumption particularly, electricity is essential and therefore cannot be over-emphasized considering its critical, sensitive and strategic role in economic development. This can be made possible through the adoption of policies aimed at minimizing wastages during the course of transmission and distribution, as well as the prevention of erratic supply and frequent power outages that characterize Nigeria as a nation for socio-economic development.

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