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Electricity consumption and economic growth in Nigeria: Evidence from Bounds test

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ABSTRACT

This paper investigated the relationship between electricity consumption and economic growth in Nigeria during the period 1970 to 2011, using the Autoregressive Distributed Lag (ARDL) bounds testing procedure to identify the long run equilibrium relationship and VECM Granger causality tests to identify the direction of the causal relationship between these two variables. Our result revealed the existence of long run equilibrium between the variables when Real GDP is treated as the dependent variable and electricity consumption is treated as its long run forcing variable. The VECM Granger causality test results show no evidence of short run causality. However, the results suggest the existence of a long run bidirectional causal relationship between electricity consumption and Real GDP. This implies that over time higher electricity consumption can give rise to more economic growth just as economic growth may stimulate increased consumption of electricity in the long run.

Keywords: Electricity Consumption, Economic growth, ARDL Bounds Test, Long run

JEL Classification: C32; C33; Q43

1. Introduction

The need to understand the complex links between energy consumption and economic growth has underscored the renewed interest in energy-growth nexus by economists and policymakers. An adequate and regular power supply is required to meet growing electricity consumption, and is the most crucial factors which can support and sustain paths of economic growth in developing countries. Huang and Yang (2012) opined that, not only can electricity consumption improve quality of living and poverty; it is instrumental to industrialization and technological advances. A good electricity supply not only improves the quality of life of its users, but also has the potential to improve the industrial output of a country and therefore, can have positive impacts on a country's growth and development prospects. According to Krizanic (2007), one importance of power supply is the fact that it has become equally indispensable as food supply. Just as Food is a necessity for the survival of all life forms in the world, electricity energy in the like manner, is also a necessary condition for an economy to thrive.

Nigerian since decades have been battling with situations such as electricity black-outs and pervasive reliance on self-generated electricity to meet domestic demand and propel the needed economic development. However, awareness at improving the electric power sector as pivot for economic growth in Nigeria has commenced since year 2000 yet the generation capacity growth is relatively slow. Today, power outages have metamorphosed into complete darkness in most parts of Nigeria, while many urban cities and towns across the country hardly enjoy three to four hours of uninterrupted power supply. The dwindling electricity per capita consumption in the face of the numerous problems, according to experts, cannot support any serious economic growth. The huge investment committed to make more recovery from existing plant capacities and increase generation through National Integrated Power Projects (NIPPs) and Independent Power Producers (IPPs), through the birth of the enactment of the Electricity Power Sector Reform Act (2005), by various governments were thwarted by bureaucracy and corruption (Koledoye et al, 2013). Inspite of this political lock jam and corruption, the Federal Government is undertaking comprehensive reforms to address the electricity situation in the country through the unbundling of PHCN so as to create concrete legal, regulatory and institutional steps that will begin to address the challenges of the sector. Presently, a new wave of investments in the power generation championed both by the government and the private sector has commenced. Recently, a number of potential private investors have been selected through a competitive bidding process for all the successor companies so as to ensure proper privatization of the unbundled entities. All these are aimed at creating a power - business environment that can propel the required economic growth and development in the country.

With this background and in the face of the electricity crisis in Nigeria, it is important for policy makers to understand the relationship between electricity consumption and economic growth in order to effectively design power policy. The issue of whether electricity can affect growth is particularly important in the Nigeria case, given the central role of electricity in the country's efforts to promote growth and development in virtually all aspects of the economy. An interesting aspect of the existing literature is that the relationship between electricity consumption and growth may differ between short run and long run. For this reason, the present paper uses the Autoregressive Distributed Lag (ARDL) bounds testing procedure to complement the current literature by analyzing the long run equilibrium relationship between electricity consumption and economic growth as well as causality tests to identify the direction of the causal relationship between these two variables using annual data from 1970 to 2011.

2. Literature Review

Empirical literatures on energy consumption and growth are quite rich and diverse. However, the relationship and direction of causality between electricity energy consumption and economic growth has been rather mixed. There are two strands of studies on the direction of causal relationship between electricity consumption and economic growth. The first strand of empirical literature focused on multi-countries studies, while the second strand of literature focused on single-country studies. There have been four synthesized hypotheses on this relationship, both at aggregate and country specific studies; the growth hypothesis, the conservation hypothesis, the feedback hypothesis and the neutrality hypothesis (Jumbe, 2004, Payne, 2008).

The growth hypothesis suggests that electricity consumption plays an important role in economic growth. If the causality is from the electricity consumption to economic growth, any decrease/increase in the electricity consumption could lead to a fall (rise) in income. The country specific studies that found uni-directional relationship running from electricity to economic growth include: Sarker and Alam (2010) for Bangladesh, Solarin (2011) for Bostwana, Atif and Sidiqqi (2012) for Pakistan, (Javi et al, 2013) for Pakistan.

The conservation hypothesis is based on the contention that energy consumption should not affect economic growth because it represents too small of a proportion of a country's gross domestic product. Unidirectional causality running from economic growth to electricity consumption lend support for this hypothesis. It implies that energy conservation policies that curtail energy consumption would have little or no adverse effects on economic growth. Studies that found uni-directional causality running from economic growth to electricity consumption include Ho and Siu (2007), Ciarreta and Zarraga (2010) and Shahbaz and Feridun (2011) in Hong Kong, Hungary, Spain and Pakistan, respectively

The feedback hypothesis implies that there is two-way (bidirectional) causality between electricity consumption and economic growth. This suggests that electricity consumption and economic growth are interdependent and thus complement each other. A country specific studies that support the feedback hypothesis include: Öztürk and Acaravci (2010) for Hungary and Shahbaz et al. (2011) for Romania, Shahbaz and Ozturk (2012) for Turkey. Lastly, the neutrality hypothesis suggests the absence of a causal relationship between electricity consumption and real GDP. This implies that any policy aimed at either increasing or decreasing the electricity consumption and/or economic growth will have no negative effect on the other. The following country level studies showed no causality between electricity consumption and economic growth: Narayan & Singh (2007) for China, Narayan and Prasad (2008) for Turkey, Halicioglu (2009) for Turkey and Payne (2010) for USA.

For the case of multi-countries studies, Wolde-Rufael (2006) also investigated the long-run equilibrium and the causality relationship between electricity consumption and real GDP per capita (economic growth) for 17 African economies using the Bounds testing approach to cointegration developed by Pesaran et al. (2001). The results show that cointegration is only found in nine out of seventeen countries. However, causality analysis implies that electricity consumption Granger-causes economic growth in Tunisia, Benin, Congo and the Democratic Republic of Congo whereas economic growth Granger-causes electricity consumption in Nigeria, Senegal, Cameroon, Ghana, and Zimbabwe. Furthermore, there exists bi-directional causality between the variables in case of Egypt, Gabon, and Morocco. Chen et al. (2007) investigated the relationship between electricity consumption and economic growth using panel cointegration approach in 10 industrialized and low income countries of Asian region. The panel causality shows bi-directional causality for said variables but causality is running from GDP per capita to electricity consumption per capita in heterogeneous causality approach. Bildirici et al,(2012) using the auto regressive distributed lag

(ARDL) method for some developed and developing countries, including the US, UK, Canada, Japan, China, India, Brazil, Italy, France, Turkey and South Africa. There is evidence to support the growth hypothesis for the US, China, Canada and Brazil. There is evidence to support the conservation hypothesis for India, Turkey, South Africa, Japan, UK, France and Italy

In the case of Nigeria, only a few studies investigated the causality between electricity consumption and economic growth. Akinlo (2009) investigated the relationship between energy consumption proxies by electricity consumption and real GDP for the case of Nigeria between 1980 and 2006. The empirical shows cointegration for both variables and electricity consumption seems to granger cause real GDP. Emeka (2010), by using annual data covering the period 1978 to 2008 estimated that real GDP and electricity consumption for Nigeria are co-integrated and there is unidirectional Granger causality running from real GDP to electricity consumption with no feedback effect. Akinwale et al, (2013) employed the Vector Auto Regressive (VAR) and Error Correction Model (ECM) to test the causality between real GDP and electricity consumption in Nigeria during the period 1970-2005. The result shows that there is unidirectional causality from real GDP to electricity consumption without a feedback effect. Similarly Ogundipe (2013) examined the relationship between electricity consumption and economic growth in Nigeria using the Johansen and Juselius Co-integration technique based within the Vector Error Correction Modelling and the Pairwise Granger Causality test for the period 1980-2008. The study found the existence of a unique co-integrating relationship among the variables in the model with the indicator of electricity consumption impacting significantly on growth. Also, the study shows an evidence of bi-directional causal relationship between electricity consumption and economic growth.

3 Data and Methodology

3.1 ARDL Cointegration

The time series data used in the present analysis is in annual frequency and spans the period from 1970 to 2011. Data series have been obtained from the World Bank's world development indicators (WDI).

While several econometric methods have been proposed for investigating long-run equilibrium (cointegration) among time series variables, the few studies in Nigeria have used conventional methods such as Vector Auto Regressive (VAR) and Error Correction Model (ECM), Vector Error Correction Modelling and the Pairwise Granger Causality test. To empirically establish the long-run relationships and the direction of causation between variables, this paper adopts the recently developed bounds testing (or autoregressive distributed lag (ARDL)) cointegration procedure, developed by Pesaran et al. (2001). distributive lag modeling is preferred over conventional cointegration techniques due to following advantages. Firstly, the bounds testing procedure allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the pre-testing of unit roots is not required and it is possible to investigate co-integration of variables irrespective of their order i:e irrespective of whether the regressors in the model are purely I(0), purely I(1) or mixture of both. Thirdly, the autoregressive distributive lag modeling assimilates long run and short run dynamics without losing information about long run relationship. Lastly, the ARDL bounds testing approach is suitable for small samples and provides consistent results. The procedure will however crash in the presence of I(2) series so, the unit root test is carried out to ensure that all variables are stationary at most in their first differences. Another advantage of ARDL bounds testing is that unrestricted model of ECM seems to take satisfactory lags that captures the data generating process in a general-to-specific framework of specification (Laurenceson and Chai, 2003).

However, Pesaran and Shin (1999) contented that, “appropriate modification of the orders of ARDL model is sufficient to simultaneously correct for residual serial correlation and problem of endogenous variables”. The equations of unrestricted error correction methods are being modeled as:

$$\Delta InGDP = \alpha_1 + \alpha_1 t + \sum_{i=1}^{p} \alpha_2 \Delta InGDP + \sum_{i=1}^{p} \alpha_3 \Delta InEC_{i-1} + \alpha_4 InGDP_{i-1} + \alpha_5 InEC_{i-1} + \mu_i \qquad 1$$

$$\Delta InEC = \beta_1 + \beta_1 t + \sum_{i=1}^{p} \beta_2 \Delta InEC + \sum_{i=1}^{p} \beta_3 \Delta InGDP_{i-1} + \beta_4 InEC_{i-1} + \beta_5 InGDP_{i-1} + \mu_i \qquad 2$$

Where Δ the first difference operator p is the lag order selected by Schwarz information criterion (SC). $InEC$ and $InGDP$ denote the natural logarithm of real GDP per capita and electricity consumption respectively. The residuals μ_i are assumed to be normally distributed and white noise. The ARDL process begins with a test of the presence of a long-run relationship between the variables using the bounds testing procedure of Pesaran *et al* (2001). The bounds testing procedure is based on the F-statistics for the joint significance of the coefficients of the lagged levels of the variables. The null hypothesis of no cointegration i:e ; $H_0 : \alpha_4 = \alpha_5$ is testedagainst the alternative hypothesis $: \alpha_4 \neq \alpha_5$ for equation 1 and $H_0 : \beta_4 = \beta_5$against the alternative hypothesis $: \beta_4 \neq \beta_5$ for equation 2. Next step is to compare the calculated F-statistics with LCB (lower critical bound) and UCB (upper critical bound) by Pesaran and Pesaran (1997) or Pesaran et al. (2001). There is cointegration among variables if calculated value of F-statistics is more than UCB. If LCB is more than computed F-statistics then hypothesis of no cointegration may be accepted. Finally, if calculated F-statistics is between lower and upper critical bounds then decision about cointegration is inconclusive.

3.2 Granger Causality Test

After examining the long run relationship between the variables, we use the Granger causality test with a lagged error-correction term to determine the causality between the variables. The Granger representation theorem suggests that there will be Granger causality in at least one direction if there exists cointegration between the variables provided the variables are integrated at I(1). Engle and Granger (1987) cautioned that if the Granger causality test is conducted at first difference through vector auto regression (VAR) method then it will be misleading in the presence of cointegration. Therefore, an inclusion of an additional variable to the VAR method such as the error-correction term would help us to capture the long run relationship. To this end, an augmented form of Granger causality test is involved to the error-correction term and it is formulated in a bi-variate vector error-correction model (VECM) as follows:

$$\Delta InGDP = \alpha_1 + \alpha_1 t + \sum_{i=1}^{p} \alpha_2 \Delta InGDP + \sum_{i=1}^{p} \alpha_3 \Delta InEC_{i-1} + \delta_1 ECT_{i-1} + \mu_i \qquad 3$$

$$\Delta InEC = \beta_1 + \beta_1 t + \sum_{i=1}^{p} \beta_2 \Delta InEC + \sum_{i=1}^{p} \beta_3 \Delta InGDP_{i-1} + \delta_2 ECT_{i-1} + \mu_i \quad 4$$

Where Δ is a difference operator, residuals, μ_i are independently and normally distributed (i.i.d.) with zero mean and constant variance and ECT_{i-1} is the error correction term resulting from the long-run equilibrium relationship via ARDL model and α and β are parameters to be estimated. δ is a parameter indicating the speed of adjustment to the equilibrium level after a shock. The F statistics or Wald test on the lagged explanatory variables of the ECT indicates the significance of the short-run causal effects. The ECT_{t-1} variable will be excluded from that model if the variables are not cointegrated. The optimal lag length *p* is determined by the Akaike's Information Criterion (AIC) because of its superior performance in small sample (Lütkepohl, 2005). Next, we apply the Likelihood Ratio (LR) statistics to ascertain the direction of Granger causality between the variables of interest. In this study, we test the following hypotheses:

$H_0 : \alpha_2 = \alpha_3 = 0$ implying that GDP does not Granger-cause EC.

$H_0 : \beta_2 = \beta_3 = 0$ implying that GDP does not Granger-cause GDP

4. Empirical Results and Discussions

4.1 Unit Root Test Results

The analysis of empirical results starts with the examination of the integration order of each of the time series included in the model. Unit root analysis ensures that no variable is integrated at I(2) to keep away from spurious results. According to Ouattara (2004), if any variable is integrated at I(2) then computation of F-statistics for ARDL cointegration becomes senseless. Pesaran et al. (2001) critical bonds are based on assumption such as variables should be stationary at I(0) or I(1). Therefore, application of unit root tests is still necessary to ensure that no variable is integrated at I(2) or beyond. We have applied both Augmented Dickey Fuller (1979) and Philips Perron (1988) tests. We include trend and constant term in both tests. The results of both tests are reported in Tables 2 and 3. The results disclose that both variables are integrated at I(0) and I(1). The likeness of order of integration supports the use of ARDL bounds testing approach for cointegration.

TABLE 1. The Results of ARDL Cointegration Test

Variables	Levels		First Difference		Order of Integration
	ADF	PP	ADF	PP	
LRGDP	-6.505094*	-6.533916*	-8.616415	-34.31832	I(0)
LEC	-1.792407	-1.018020	-6.312933*	-9.487481*	I(1)

* denote the significance level at 1%.

Table 1: The summary of Single-country studies on the electricity-growth nexus

No	Authors	Period	Countries	Methodology	Direction of Granger causality
			Growth Hypothesis		
1.	Sarker and Alam (2010)	1973-2006	Bangladesh	Granger-causality test	EC → GDP
2.	Solarin A. A (2011)	1980-2008	Bostwana	Cointegration, and Granger causality test	EC → GDP
3.	Atif and Sidiqqi (2012)	1971-2007.	Pakistan	Granger Causality test and Modified WALD test (T-Y test)	EC → GDP
4.	Javid et al (2013)	1971- 2008.	Pakistan	Dolado–Lutkepohl test -Vector Autoregression (VAR) Granger causality test	EC → GDP
			Conservative Hypothesis		
5	Ho and Siu (2007)		Hong Kong	Unit root test; Error correction model	GDP → EC
6.	Ciarreta and Zarraga(2010)	1971-2005	Spain	Toda and Yamamoto (1995) Granger Causality Test	GDP → EC
7	Shahbaz and Feridun (2012)	1971 - 2008.	Pakistan	(ARDL) boundsTest, Toda-Yamamoto andWald-test causality tests	GDP → EC
			Feedback Hypothesis		
8.	Öztürk and Acaravcı (2010)	1980 - 2006	Hungary	Bound test (ARDL)	EC ↔ GDP
9.	Shahbaz, Mutascuand Tiwari (2011)	1980 - 2008	Romania	Bound test (Toda Yamamoto)	EC ↔ GDP
10.	Shahbaz and Ozturk (2012)	1971-2009	Turkey	ARDL and Granger causality–VECM	EC ↔ GDP
			Neutrality Hypothesis		
11.	Narayan & Singh (2007)		China	ARDL, VECM	No Causality
12.	Narayan and Prasad (2008)	1960-2002	Turkey	Bootstrapped Granger-causality	No Causality

13.	Halicioglu (2009)	Turkey	Granger causality, ARDL cointegration	No Causality
14.	Payne (2010)	USA	Toda-Yamamoto causality tests; Granger-causality test	No Causality

TABLE 2. The summary of multi-country studies on the electricity-growth nexus

No.	Authors	Period	Countries	Methodology	Direction of Granger causality
1.	Wolde-Rufael (2006)	1971–2001	17 African	ARDL Bounds testing; Toda-Yamamoto's test for causality – Augmented VAR	EC → GDP (Benin, Congo DR, Tunisia)
					GDP → EC (Cameroon, Ghana, Nigeria, Senegal, Zambia, Zimbabwe)
					EC ↔ GDP (Egypt, Gabon, Morocco)
2.	Chen et al. (2007)	1971–2001	10 Asian	Johansen-Juselius; Granger causality–VECM	EC → GDP (Hong Kong)
					GDP → EC (India, Malaysia, Philippines, Singapore)
					EC↔/GDP (China, Indonesia, Korea, Taiwan, Thailand)
3.	Bildirici et al,(2012)			ARDL Bounds testing;	EC → Y (US, UK, Canada, Japan, China, India, Brazil, Italy, France, Turkey and South Africa)
					GDP→EC (India, Turkey, South Africa, Japan, UK, France and Italy)

TABLE 3. The summary of Nigeria studies on the electricity-growth nexus

1.	Akinlo (2009)	1980-2006	Nigeria	Cointegration, granger causality	EC → GDP
2.	Emeka (2010),	1978-2008	Nigeria		GDP → EC
3.	Akinwale et al, (2013)		Nigeria	VAR,ECM	GDP → EC
4.	Ogundipe (2013)	1980 - 2008	Nigeria	Johansen and Juselius Co-integration, VECM and Pairwise Granger Causality	EC ↔GDP

Notes: Direction of Causality Column: The uni-directional causality from electricity consumption to economic growth is indicated by GDP→EC, uni-directional causality from electricity consumption to economic growth by EC → GDP, bi-directional causality between electricity consumption and economic growth by EC↔GDP and no causal relation between both variables by *EC*↔GDP. /

4.2 Cointegration Analysis

The unique order of integration of the variables supports us to investigate the long run relationship between the variables by applying ARDL bounds testing approach to cointegration.

An important issue in applying bounds testing approach to cointegration is the selection of the optimal lag length .The appropriate lag length is prerequisite to continue the ARDL bounds testing to examine cointegration between the series. The SBC criterion are followed to choose lag length.

TABLE 5. The Results of ARDL Cointegration Test

Model for estimation	Lag	*F*-statistics	
F_{LRGDP}(*L*GDP/*EC)*	1	14.22943	Co-integration
FEC *(*EC/*GDP)*	1	3.274842	No Cointegration
Critical bounds	Lower bound	Upper bound	
1%	7.057	7.815	
5%	4.934	5.764	
10%	7.057	7.815	

The results of the bounds test for cointegration, together with critical values of Pesaran and Pesaran (1997) are reported in Table 3. The bounds test indicates that the estimated F-statistic is above the upper bound critical value provided by Narayan (2005) at 1% level of significance when R*GDP* is treated as the dependent variable and EC is treated as its long run forcing variable. Hence, we reject null hypothesis of no cointegration relationship. However, when electricity consumption is the dependent variable, there is no cointegration. The existence of a long run relationship between the variables in question is only a necessary but not a sufficient condition for rejecting the non-causality hypothesis (Morley 2006).

TABLE 6. Results of Granger Causality and ECM

Null Hypotheses	Source of Causation		
	Short-run		Long-run
	ΔLRGDP	ΔLEC	
	[F-statistic] (p-value)		**ECT_{t-1} [t-statistic] (p-value)**
Economic Growth does not cause economic growth	0.7836 0.3819	-	-1.1437 -1.6692 0.1045
Electricity consumption does not cause electricity consumption	-	2.3086 0.1152	-0.1406 -2.1599 0.0381

Notes: The lag lengths are chosen by using Akaike's information criterion. * Denotes the rejection of the null hypothesis at 5% level of significance.

The existence of cointegrating relationship between RGDP and electricity consumption suggests that there must be Granger causality in at least one direction, but it fails to signify the direction of temporal causality between the variables. The VECM specification of both the short-run and long-run causality direction are reported in Table 4. The short results show that, there is no causality running from either Real GDP to electricity consumption or from electricity consumption to Real GDP. This implies that any policy aimed at either increasing or decreasing the electricity consumption and/or economic growth will have no negative effect on the other. On the other hand, long run results show that feedback hypothesis is validated between electricity consumption and Real GDP. The long coefficient (ECT_{t-1}) is rightly signed with negative in the two equations showing that both variables adjust any disequilibrium once the system is shocked. The significance of ECT_{t-1}indicates the convergence rate is high in Real GDP (-1.1437), as compared to electricity consumption (-0.1406).

The findings of feedback effect found between electricity consumption and economic growth are contradictory with the line of literature in Nigeria such as Akinlo (2009), Emeka (2010) and Akinwale et al, (2013). However, our results is consistent with the findings by Ogundipe (2012) who found feedback hypothesis between the variables in case of Nigeria over the period 1980-2008.

TABLE 7. Results of Granger Causality and ECM

Type of Tests	F-Statistics / coefficient	P-Value
Normality	1462.205	0.0000
Serial Correlation LM-Test	1.011994	0.3745
ARCH	0.016702	0.8979
Ramsey RESET Test	8.787830	0.0009

The study applies a number of diagnostic tests to the ARDL estimates in Table 7. The tests suggest that no autocorrelation in the disturbance of the error term. The RESET test indicates that the model is correctly specified and no functional form problem. The model passes the Jarque-Bera normality tests, signifying that the errors are normally distributed. Moreover, the ARCH test denotes that the errors are homoskedastic and independent of the regressors parameter.

5. Conclusion and policy implications

This paper examined the relationship between electricity consumption and economic growth in Nigeria by applying the Autoregressive Distributed Lag (ARDL) bounds testing procedure to identify the long run equilibrium relationship and VECM Granger causality tests to identify the direction of the causal relationship between these two variables both in the short run and long run. Our results from ARDL bounds test show the existence of long run equilibrium between the variables when Real GDP is treated as the dependent variable and EC is treated as its long run forcing variable. The VECM Granger causality tests results suggest the existence of a long run bidirectional causal relationship between electricity consumption and Real GDP but there is no evidence of short run causality running from either.

The policy implication that emerges from the study is that economic growth causes expansion of major industrial and commercial sectors of the economy where electricity has been used as basic energy input. Similarly, Electricity consumption has also accelerated to keep pace with country's economic growth in the long run. This implies that over time higher electricity consumption give rise to more economic growth just as economic growth may stimulate increased consumption of electricity. The validation of feedback hypothesis in the long run between electricity consumption and Real GDP has serious implication for policy. To cope with the perceived increase in Nigeria's GDP reported in recent time electricity generation capacity must increase. Therefore, there is no other alternative for economic growth than to generate more power for Nigeria, which is needed especially for achieving the vision 20: 2020.

REFERENCES

Acaravci, A. and I. Ozturk. 2009. Electricity Consumption-Growth Nexus*:* Evidence from Panel Data for Transition Countries. *Energy Economics* 32, 604-60.

Akinwale, Y., Jesuleye O. and W. Siyanbola. 2013. Empirical analysis of the causal relationship between electricity consumption and economic growth in Nigeria.

Atif, S.M. and M.W. Siddiqi. 2010. The Electricity Consumption and Economic Growth Nexus in Pakistan: A New Evidence.

Bildirici, M. E. 2013. The analysis of relationship between economic growth and electricity consumption in Africa by ARDL method. *Energy Economics Letters,* 1, 1-14.

Chen, S.T., Kuo, H.I.,and C.C. Chen. 2007. The Relationship between GDP and Electricity Consumption in 10 Asian Countries. *Energy Policy*, 35, pp. 2611– 2621.

Ciarreta, A. and A. Zarraga. 2010. Electricity consumption and economic growth in Spain. *Applied Economics Letters*, (14), pp. 1417–1421

Emeka, E. 2010. Causality Analysis of the Nigerian electricity Consumption and Economic growth. *Journal of Economics and Engineering.* Pg 80-85.

Engle, R. F. and C. W. J. Granger. 1987. Co-integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55: 251-276.

Ho, C.Y. and K.W. 2007. A Dynamic Equilibrium of Electricity Consumption and GDP in Hong Kong: An Empirical Investigation. Energy Policy, 35(4), 2507- 2513.

Huang, B. N. and Yang. C.W. 2012. New Evidence on Electricity Consumption and Economic Growth Nexus from the Four Asian Economies.

Javid, A. Y., Javid, M. and Z.A. Awan. 2013. Electricity consumption and economic growth: evidence from Pakistan *Economics and Business Letters* 2(1), 21-32.

Jumbe, C.B.L 2004, Cointegration and Causality between electricity consumption and GDP.Empirical Evidence from Malawi. *Energy Economics*, 26: 61-68.

Koledoye, T. O., Jumah A. A. and D.A. Phillips. 2012. The Current And Future Challenges of Electricity Market in Nigeria in the face of deregulation process,EIE's 2nd Intl' Conf.Comp. Energy, Net., Robotics and Telecom. eieCon

Krizanic. F. 2007. The European market of Electricity and Natural Gas.EIB forum, Ljubljana.

Laurenceson, J. and J.C.H. Chai. 2003. Financial reform and economic development in China. Edward Elgar, Cheltenham, UK

Lütkepohl, H. 2005. *New* Introduction to multiple time series analysis. Germany: Springer-Verlag. Manchester.

Narayan, P.K. and A. Prasad. 2008. Electricity Consumption-Real GDP Causality Nexus: Evidence from a Bootstrapped Causality Test for 30 OECD Countries. *Energy Policy* 36, 910-918.

Narayan, P.K.C and B.Singh. 2007. The electricity consumption and GDP nexus for the Fiji Islands. *Energy Economics*, 29: 1141-1150.

Narayan, P.N. 2005. The saving and investment Nexus for China: evidence from co-integration tests. *Appl.Econ*. 37, 1979–1990.

Ogundipe, A. A. 2013. Electricity Consumption and Economic Growth in Nigeria, *Journal of Business Management and Applied Economics*

Ouattara, B. 2004. Foreign Aid and Fiscal Policy in Senegal. Mimeo University of Manchester.

Ozturk, I. and A. Acaravci. 2010. The causal relationship between energy consumption and GDP in Albania, Bulgaria, Hungary and Romania: Evidence from ARDL bound testing approach. *Applied Energy*, 87: 1938-1943.

Payne, J. E. 2010. A Survey of the Electricity Consumption-Growth Literature," *Applied Energy*, 87, 723-731.

Pesaran, M. H. and Pesaran, B. 1997. Working with Microfit 4.0: interactive econometric analysis. Oxford University Press, Oxford.

Pesaran, M. H., Shin, Y. and R. J. Smith. 2001. Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16: 289-326

Pesaran, M.H. and Shin, Y. 1999. An autoregressive distributed lag modelling approach to cointegration analysis. S.Strom, (eds.) Econometrics and economic theory in 20th Century: the Ragnar Frisch Centennial Symposium, Chapter 11, Cambridge University Press, Cambridge.

Sarker, A.R., and K. Alam 2010.Nexus between Electricity Generation and Economic Growth in Bangladesh, *Asian Social Science* Vol. 6, No.12.

Shahbaz, M. and Feridun. M. 2011. Electricity Consumption and Economic Growth Empirical Evidence from Pakistan. *Quality & Quantity: International Journal of Methodology*, 46: 1583-1599.

Shahbaz, M., Lean, H. H., Shahbaz, M., Mihai, M., and A.V. Tiwari. 2011. Revisiting the Relationship between Electricty Consumption and Economic Growth: Cointegration and Cusality Analysis in Romania. Romanian *Journal of Economic Forcatsing*, 3: 97-120.

Solarin, S.A. 2011. Electricity Consumption and Economic Growth: Trivariate investigation in Botswana with Capital Formation, *International Journal of Energy Economics and Policy* Vol. 1, No. 2, 2011, pp.32-46.

Wolde-Rufael, Y. 2006. Electricity Consumption and Economic Growth: A Time Series Experience for 17 African Countries. *Energy Policy*, 34: 1106-1114.