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Energy-GDP Nexus for Oil-Exporting Country: The Case of Bahrain

Mohamed Sayed Abou Elseoud[1,2]*, Fuad M. Kreishan[3]

[1]College of Business Administration, University of Bahrain, Bahrain, [2]Sadat Academy for Management Sciences, Egypt, [3]Faculty of Business Administration and Economics, Al-Hussein Bin Talal University, Jordan. *Email: msayed@uob.edu.bh

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ABSTRACT

The main objective of this paper is to investigate the relationships between electricity consumption and economic growth in Bahrain between 1980 and 2019, utilizing the Autoregressive Distributed Lag (ARDL) model. Estimates revealed the existence of a long run equilibrium relationship between the electricity consumptions per capita and GDP per capita. The Pairwise Granger Causality Test results indicated a unidirectional causality running from electricity consumption to economic growth. The estimation results provide a strong support for the Growth hypothesis in Bahrain, suggesting that Bahrain economy is Energy-dependent. Therefore, it should be taken into consideration that energy consumption has effect on economic growth rates by policy makers.

Keywords: Economic growth, Energy, Autoregressive Distributed Lag, Granger Causality, Bahrain.
JEL Classifications: O13, Q43, C33

1. INTRODUCTION

Since energy is a key source in production and in many consumption activities, the causal relationship between energy consumption and economic growth has been the subject of intense research and empirical studies over different countries and regions around the world, using different econometric techniques (e.g. ECM, ARDL, VAR, OLS-EG, DOLS, FMOLS, etc.). On the energy economics, four hypotheses have been widely subject to testing. Sometimes these hypotheses are named neutrality, conservation, growth and feedback hypotheses. As shown soon in the literature, each one of these hypothesis has different implications for designing suitable energy policy for each given country.

In fact, the pioneer empirical work by Kraft and Kraft (1978), in which causality was found to run from GNP to energy consumption in USA. Yet, the question, whether or not energy consumption promotes economic activates or economic growth is still a controversial issue among applied and theoretical researchers. Recent studies on the relationship between the two variables have provided mixed results up till date. However, according to Abosedra et al. (2009) and Chen et al. (2007) this inconsistency is due to differences in data set, different analytical and econometric methods utilized, country and reigns (developed or developing country) and model variables used. The findings from the previous studies vary not only across countries, but depend also on methodologies within the same country (Soytas and Sari, 2003). While a country-specific causality study between energy consumption and economic growth can provide insight for the design of future energy policies, it is also important to reach unambiguous results for policy implementation (Erol and Yu 1987). Therefore, it is important for policy makers to have a clear understanding of the causal relationship between energy consumption and economic growth.

Despite Bahrain is an oil-based economy, and enjoy its rent revenue, Bahrain was among the first countries in the Gulf region adapted a policy of diversification, and this is reflected in the country's GDP. The non-oil GDP accounted for about 80 percent of total GDP. It dominated by infrastructure and services sectors, has recorded tremendous growth over time (Kreishan et al., 2018). It has also been argued that the possible impact of energy consumption on growth will depend on the structure of the economy and the level of economic growth of the country concerned (Naser, 2017). As the economy grows, its production structure is likely to shift towards services, which are not energy intensive activities (Solow, 1978, Denison, 1985, Cheng, 1995 and Belloumi, 2009). Bahrain has become the center of finance in the region, thus is an essential factor for the effectiveness of the banking and other services sectors. The role of electricity for Bahrain economy seems to be crucial to continue the country plan of diversification. In fact without electricity Bahrain will not be able to achieve this goal. Currently, per capita energy consumption among Bahrainis is one of the highest in the world, it uses two folds more energy per capita than Japan. In 2018, an average Bahraini consumed 9456 kg oil equivalent of energy. By comparison, Japan and the US have per capita energy uses of 4033 and 7747 kg, respectively (World Development Indicator, 2019).

This study attempts to examine empirically the existence and direction of causal relationship between electricity consumption and economic growth rate as proxy for economic activates in Bahrain for the period between 1980 and 2019. Doing this study for Bahrain can be justified on three reasons: examining the role of energy consumption in stimulating economic growth in Bahrain, testing the direction of causality between energy consumption and economic growth and finally investigating which one of the four above-mentioned hypotheses is applicable for Bahrain. Therefore, the empirical results of this study might provide policymakers in Bahrain with some insights towards formulating appropriate energy development policies in Bahrain. Finally, the study uses the ARDL methodology of cointegration, as recommended by Ozturk (2010) and (Emeka and Aham, 2016) which has a number of advantages over other methods of cointegration.

The paper is organized as follows: Section 2 reviews the literature on the subject. A discussion on the methodology and description of the data used are presented in Section 3. Section 4 reports on empirical results. Conclusions of the study and the policy implications are produced in Section 5.

2. LITERATURE REVIEW

The debate among energy economists about the relationship between energy consumption and GDP has led to emergence of four hypotheses which has been widely subject to testing. As summarized in Payne (2009) the first one is the Neutrality hypothesis which suggests that energy consumption has only minor effect on the production of real output. It declares that there is no causality in either direction between economic growth and electricity consumption. Therefore, neither conservative nor expansive energy consumption policies have any effect on economic growth. The second hypothesis which might be called Conservation hypothesis suggests that the economy is less dependent on energy (Hwang and Gum 1992). Consequently, implementing an energy conserving policy does not have an adverse impact on economic growth. Therefore it presumes the existence of uni-directional causality running from economic growth to energy consumption. The Growth hypothesis however, suggests that energy consumption affects economic growth directly, implying that there is causality from energy consumption to economic activity. Accordingly, implementing an energy conserving policy will slow economic growth. This hypothesis, posits that unidirectional causality running from energy consumption to economic growth. It can be theoretically inferred that the economy is energy-dependent. The fourth mainstream known as the Feedback hypothesis posits that a bi-directional causality between energy consumption and economic growth, which implies that energy consumption and economic growth complement each other or are determined together.

Empirically, various studies have focused on different countries, time periods and have used different proxy variables for both energy consumption and economic activates. In general, the empirical work could be classified into two groups: a country-specific studies and multi-country studies. Among multi-country studies, Hossein et al. (2012) test the Granger causality between energy consumption and economic growth for Organization of Petroleum Exporting Countries (OPEC) countries for the period 1980-2008. They conclude that reducing energy consumption will not negatively affect economic growth rather it will reduce CO_2 emissions. Narayan and Popp (2012) investigate the long-run impact of energy consumption on real GDP for 93 countries over the period 1980-2006 using panel fully modified ordinary least squares. They find that the impact is minimal for all the panels, therefore energy conservation policies will benefit some but not all the countries.

Asafu-Adjaye (2000) used cointegration and Error Correction Modeling techniques to estimate the causal relationships for 6 Asian countries. His results indicated a short-run unidirectional Granger causality running from energy to GDP for India and Indonesia, but a bidirectional relationship for the other four countries. Moreover, the author includes energy prices in his study, and finds that energy, income, and prices are mutually causal for the Philippines and Thailand. For India and Indonesia, however, the causality is unidirectional, running from energy and prices to income. However, Asafu-Adjaye's empirical results for Indonesia and the Philippines are different from other studies (Yu and Choi, 1985; Cheng and Lai, 1997; Masih and Masih, 1998 ; Chen et al., 2007; James, 2009) using single data set and panel data procedure for 10 industrializing and developing Asian countries, showed a unidirectional short-run causality running from economic growth to electricity consumption in the panel data. Ozturk and Acaravci (2011) investigate the short-run and long-run causality between electricity consumption and economic growth for 11 selected Middle East and North Africa (MENA) countries using (ARDL) bounds testing approach of cointegration and vector error-correction models. The overall results of this study indicate that there is no relationship between the electricity consumption and the economic growth in most of the MENA countries.

At the level of single countries, Ghosh (2002) has applied Granger causality test on the bivariate vector autoregressive model (VAR) to test for causal relationship for India. He focuses on a particular form of energy, i.e. electricity. The results indicate that there is unidirectional Granger causality running from economic growth to electricity consumption without any feedback effect. However, Ghosh (2009) has re-examined the relationship between electricity supply, employment and real GDP for India within a multivariate framework using (ARDL). Although a long-run equilibrium relationship has been established among these variables, the study found absence of causality running from electricity supply to real GDP. Shiu and Pun-Lee (2004) investigate the causal relationship between electricity consumption and real GDP for China during 1971-2000. The results indicate that real GDP and electricity consumption for China are cointegrated and there is unidirectional Granger causality running from electricity consumption to real GDP but not vice versa.

Baranzini et al. (2013) investigate the relationship between energy use and economic growth for Switzerland over the period 1950-2010 using (ARDL). They find that conserving energy policies do not necessarily have negative impact on Swiss economic growth. Shahbaz and Feridun (2012) using (ARDL) approach, found a unidirectional causality running from economic growth to electricity consumption in Pakistan. In Malaysia, Abosedra et al. (2009) utilize the Granger-Causality method within VAR framework, revealed unidirectional causality running from electricity consumption to economic growth in Malaysia. Adebola and Opeyemi (2011) using the (ARDL) approach to cointegration, showed that there is a long-run causal relationship running from electricity to economic growth in Nigeria.

Looking at the Arab region the empirical results are still mixed, for example Belloumi (2009) has studied the causal relationship between energy consumption and GDP for Tunisia during the period 1971-2004. The estimation results indicate that there is a long-run bi-directional causal relationship between the two series and a short-run unidirectional causality from energy to (GDP). Ajlouni (2015) employs ARDL bounds test to examine the short-run and long-run relationship between energy consumption and economic growth in Jordan using annual data over the period 1980-2012. The result demonstrates a positive bidirectional relationship between energy consumption and economic growth supporting a feedback hypothesis.

On the Gulf countries, Al-Iriani (2006) investigates the causality relationship between (GDP) and energy consumption in the six countries of the Gulf Cooperation Council (GCC). The results indicate a unidirectional causality running from GDP to energy consumption. Evidence shows no support for the hypothesis that energy consumption is the source of GDP growth in the GCC countries. In the same context, Hamdi et al. (2014) explores the relationship between electricity consumption, foreign direct investment, capital and economic growth in the case of Bahrain. Using (ARDL) a cointegration relationship has been detected among the series. It is found that electricity consumption, foreign direct investment and capital add in economic growth.

As highlighted above, the results are varying not only across countries but also on methodologies and time period within the same country. According to Masih and Masih (1997) the factors that produce conflicting findings are methodological differences, definitional specifications of the variables, as well as the type of causality techniques, tests, and lag structures employed in these studies. On the other hand, Ozturk (2010) agrees with the conclusion of Masih and Masih (1997) and adds that the empirical findings are mixed and sometimes contradictory for the same country. He attributes this to differences in data sets, econometric methods and to the variables used in these empirical models, in addition to differences in countries' characteristics. Accordingly, it is worth having an in-depth investigation of the relationship between electricity consumption and economic activities in order to make appropriate energy policies.

3. METHODOLOGY AND DATA

In order to establish the Energy- GDP nexus in Bahrain economy, the study uses secondary data collected from World Development Indicator's (WDI), in addition to Bahrain Electricity and Water Authority (EWA) and Central Bank of Bahrain (CBB). The dataset starts with 1980 and ends in 2019. For uniformity in measurement and clarity in the interpretation of results; the natural log differences approach has been used to compute and eliminate any serial correlation that might be exist between the variables under study. The following equation has been applied for each variable.

$$LX_i = \text{Ln}\,[X_{it}/X_{it-1}] \tag{1}$$

Where (X_{it}) is the value of the variable for current year (t), while (X_{it-1}) is the value of the variable for previous year. The study uses electric power consumption per capita denoted by ($LECp_t$) and measured by KWh per capita, and Real GDP per capita (2005=100) denoted by ($LRGP_t$) as the proxies for energy consumption and economic growth respectively. Figure 1 illustrates the values of both variables-before taking the logarithm-during the period (1980-2019), where the average electricity consumption per capita during the period of the study is 17673.3 Kwt, with a maximum of 22845.30 Kwt in 2019 and a minimum of 4612.5 Kwt in 1980. The average growth rate electricity consumption per capita is 6.2%. Regarding to the Real GDP per capita, the mean is $14711.90, with a maximum of $24989.40 and a minimum of $7041.600 in 2104 and 1986 respectively. The average Real GDP per capita is 3.04%.

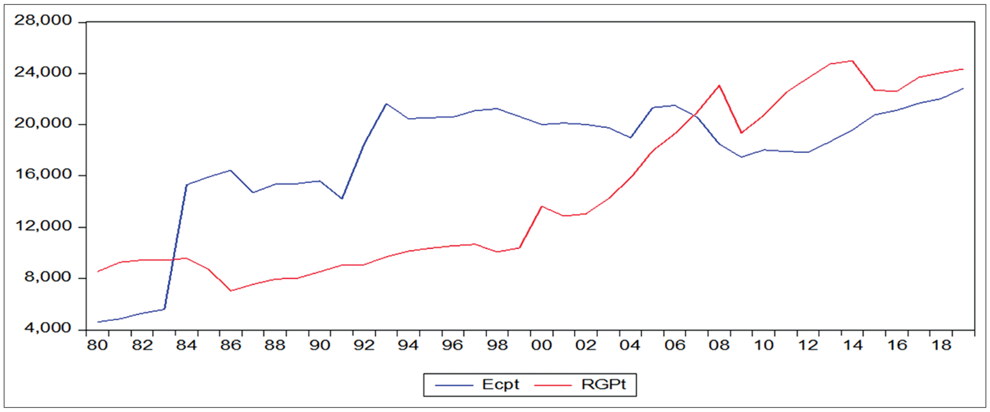
The following two equations are specified for testing the existence and direction of causal relationship between electricity consumption and economic growth:

$$\begin{aligned} LECp_t = {} & \alpha_1\, LRGP_{t-1} + \alpha_j\, LRGP_{t-j} + \beta_1\, LECp_{t-1} \\ & + \beta_j\, LECp_{t\,t-j} + u_{1t} \end{aligned} \tag{2}$$

$$\begin{aligned} LRGPt = {} & \lambda_1\, LRGP_{t-1} + \lambda_j\, LRGP_{t-j} + \delta_1\, LECp_{t\,t-1} \\ & + \delta_j\, LECp_{t\,t-j} + u_{2t} \end{aligned} \tag{3}$$

In order to achieve the objective of this study, we have examined the time series properties of the data and establish their order of integration by using Augmented Dickey Fuller (ADF), Phillips and Perron (PP) tests, and Kwiatkowski et al. (KPSS). The study uses the minimum Akaile's Information Criteria (AIC) to determine the

Figure 1: Electric power consumption per capita and real GDP per capita during the period (1980-2019)



appropriate number of lags before performing these tests. The study employs the tests that include intercept and trend term at the level and first differences in case the variables have unit root at level (Im et al., 1995). The null hypothesis (H_0) states that the variables are not stationary; while the alternative hypothesis (H_1) indicates that the variables are stationary and have the same order of integration.

The results from ADF, PP tests are differ from results of KPSS test, where KPSS test does not provide a P-value, showing different critical values instead; therefore, the test statistic value is compared with the critical value on desired level of significance. If the values of ADF, PP and KPSS are less than its critical values this means accepting (H_0), while if the values of ADF, PP and KPSS values are greater than its critical values it means accepting (H_1) and the underlying series are stationary.

If the study variables are stationary, the study will apply one of the cointegration tests which is (ARDL) cointegration technique or Bound test of cointegration (Pesaran et al., 1996 and Pesaran and Shin, 1999) in order to detect the presence of steady state equilibrium between variables by regressing the above equations (2) and (3). After estimating the two equations; the long run relationship of the underlying variables is detected through comparing the F-statistic (Wald test) with critical values (Engle and Granger, 1987). The lower bound critical values assumed that the explanatory variables are integrated at order I(0), while the upper bound critical values assumed that the explanatory variables are integrated at order I(1). When the F-statistic is greater than the upper bound value; this indicates that the Energy- GDP nexus in Bahrain economy has long run relationship, but if the F-statistic falls between the upper and lower bounds values; the results are inconclusive.

The study selected (ARDL) model rather than other tests such as (residual-based Engel and Granger test and the maximum likelihood-based by Johansen) because (ARDL) can be used irrespective whether the variables are Stationary I (0) or integrated of order one I (1) or mixed of both, but it will not apply if they are I (2). This helps to avoid the pretesting problems that related to standard cointegration analysis that needs to classify variables into I (0) and I (1). This means that the procedures of (ARDL) test do not require the pre-testing of the study varibles for unit roots and is robust when there is a single long run relationship between these variables. In addition to when the F-stat. establishes that there is a single long run relationship and the sample data size is small or finite, the error correction representation of (ARDL) becomes relatively more efficient (Emeka and Aham, 2016).

The direction of causality between the two varibles will be examined by Granger causality test (1969) that determines whether 1 time series of a variable is useful to predict another variable. In other word, variable (X) is said to cause variable (Y) if the history of (X) can explain variation in (Y). The test involves estimating the following pair of regressions, assuming that the disturbances (u_{1t}) and (u_{2t}) are uncorrelated (Gujarati and Porter, 2009).

Since we have two variables, we are dealing with bilateral causality. Equations postulate that current (Y) is related to past values of itself as well as that of (X), and postulates a similar behavior for (X). Fisher statistic is used to recognize the causality direction between both varibles by comparing the p-value with 5% significant level (Rod and Glenn, 1984). To complete the interaction analysis between the two variables, and based on the results of causality test; the study will investigate the impulse response reaction one variable in relation to other variable changes (Koop et al., 1996; Aktan, 2018). Impulse response function represents “a method employed to show the responsiveness of one variable to shocks a function of time or some other independent variables” (Hatemi, 2014, p. 22). The study will trace the effect of one variable on another variable. The main assumption of the impulse analysis is that a shock happens only in one variable at 1 time (David, 2011).

4. DATA ANALYSES AND DISCUSSIONS

4.1. Descriptive Analysis

Figure 2 Presents the main statistics associated to the study variables, and it shows the variability for both variables. Skewness index and probability of Jarque-Bera normality test show the normality of the variables.

4.2. Unit Root and Stationary Tests

Table 1 shows the test statistic of ADF, PP and KPSS tests at the level and first differences for intercept and trend term. Both variables are non-stationary at level where the statistic values of ADF, PP and KPSS tests are less than the critical ones’ therefore the study performs the tests for first differences. The tests results show that statistic values exceeds the critcal values, and we reject the

Figure 2: Statistical properties of study varibles

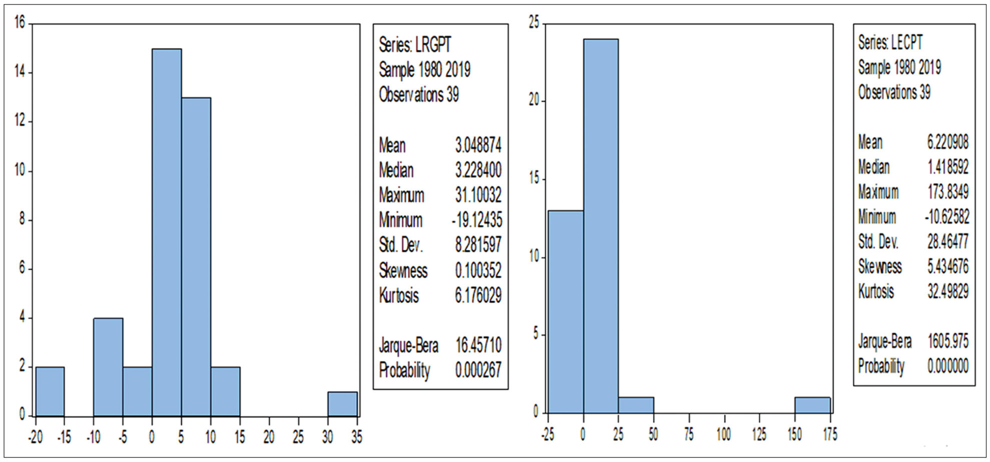


Table 1: Results of unit root and stationary tests

Exogenous: Constant, linear trend		LRGP		LECP	
		t-stat.	Prob.*	t-stat.	Prob.*
ADF test	Level	−2.099	0.529	−1.302	0.868
	First differences	−5.959	0.0001	−6.37	0.0001
PP. test adj.	Level	−2.074	0.5433	−2.79	0.209
	First differences	−5.966	0.0001	−5.985	0.0001
KPSS test stat.	Level	0.1108	-	0.098	-
	First differences	0.162	-	0.1489	-
ADF test critical values	1% level=−4.296	5%level=−3.568		10% level=−3.218	
PP test critical values	1% level=−4.219	5% level=−3.53		10% level=−3.198	
KPSS asymptotic critical values**	1% level=0.216	5% level=0.146		10% level=0.119	

*MacKinnon (1996) one-sided P-values ** Kwiatkowski et al. (1992, Table 1)

null hypothesis that means underlying series are stationary at first differences, and they are integrated of order one I (1). According to Pesaran et al. (2001) the cointegration test can be carried out because both variables are not I (2) or higher.

4.3. Cointegration Test

In order to detect the presence of state equilibrium between the two variables, the study employs (ADRL) bounds test for cointegration by computing bounds F-test in equations (2) and (3). Table 2 shows that the F-statistic exceeds the upper bound value critical value at 5% in both equations, which indicates there is long run relationship between electricity consumption and economic growth.

Table 3 illustrates the estimated long run coefficients using ARDL, and it revealed a long run relationship in both equations. The long run coefficient of Real GDP per capita variable in equation (2) is positive and has significant impact on KWh per capita at 5% level. A 1% increase in Real GDP per capita leads to increasing the electricity consumption by 0.52%. Equation (3) shows the importance of electricity to economic growth in Bahrain, where electricity consumption variable is positive and it has significant effect on Real GDP per capita. The increasing in electricity consumption by 1% will increase economic growth by 0.87%.

4.4. Causality Tests

To test for the existence and the direction of causality, the study employed Pairwise Granger Causality Tests. Table 4 results suggest rejecting the null hypothesis that states that, electricity consumption does not Granger Cause economic growth, and accepting the alternative hypothesis which indicates there is causality from electricity consumption to economic growth. On the other hand, we accept the null hypothesis that states that, economic growth does not Granger Cause electricity consumption. Accordingly, there is unidirectional causality running from electricity consumption to economic growth. These results consist with the third hypothesis that called "the Growth hypothesis" that suggest that electricity

Table 2: Bound cointegration test outcomes

T and F tests	Equation (2)	Equation (3)
Test statistic	Value	Value
F-statistic	5.75	6.56
Critical values	(0) bound	(0) bound
10%	4.04	4.78
5%	4.94	5.73
1%	6.84	7.84

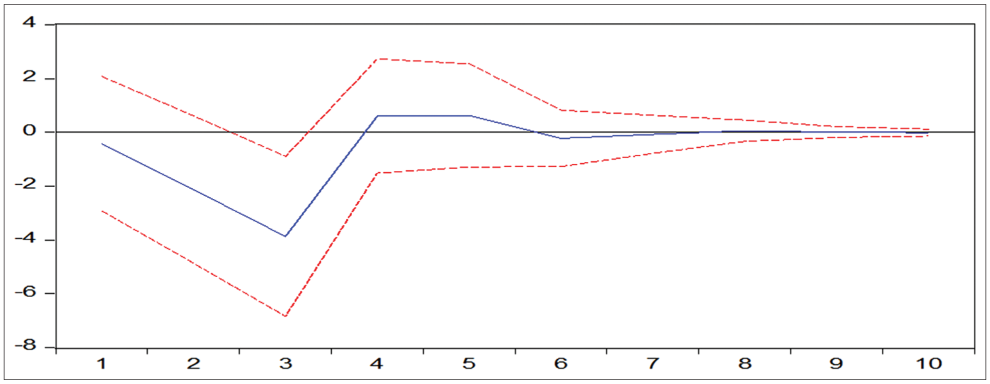
Table 3: ARDL cointegration estimation for long run (8,5)

Estimations	Equation (2)	Equation (3)
Coefficient	0.52	0.87
t-stat. (Prob.)	2.13 (0.049)	8.735091 (0.0002)

Table 4: Pairwise granger causality tests

Sample:1980-2109 Lages:2	Obs.	F-statistic	Prob.
Null hypothesis:			
LRGPT does not Granger Cause LECPT	37	0.509	0.729
LECPT does not Granger Cause LRGPT	37	5.613	0.008

Figure 3: Response of economic growth to Cholesky one S.D. electricity consumption innovation



consumption affects economic growth directly, which inferred that the Bahrain economy is Energy-dependent.

4.5. Impulse Response

According to causality results, we can forecast the effect and the impulse response function of electricity consumption on economic growth for the next 10 years. Figure 3 shows the impulse response functions where the adjustment process of economic growth could be completed within these 10 years.

5. CONCLUSION AND POLICY IMPLICATION

This study investigates the relationship between energy consumption and economic growth rate using Bahrain case during the period from 1980 to 2019. According to the ADF, PP and KPSS unit root test results, we find that both series are integrated of order one I (1). In order to detect the presence of state equilibrium between the two variables, the study employs (ADRL) bounds test for cointegration by computing bounds F-test. The test predicts that such relationship indeed exists. The estimated long run coefficients using (ARDL) revealed that electricity consumption variable is positive and it has significant effect on Real GDP per capita. Thus increasing in electricity consumption by 1% will increase economic growth by 0.87%.

As for causality relationship, we conclude that there is a unidirectional causality relationship between the energy consumption and economic growth in Bahrain during the period from 1980 to 2019. According to results there is causality relationship is from energy consumption to economic growth that means changes in energy consumption affects economic activates. Consequently, it should be taken into consideration that energy consumption has effect on economic growth rate by policy makers in Bahrain.

REFERENCES

Abosedra, S., Dah, A., Ghosh, S. (2009), Electricity consumption and economic growth, the case of Lebanon. Applied Energy, 86(4), 429-432.

Adebola, S., Opeyemi, B. (2011), Multivariate causality test on electricity consumption, capital, labour and economic growth for Nigeria. Journal of Business and Economics, 3(1), 1-29.

Ajlouni, S. (2015), Energy consumption and economic growth in Jordan: An ARDL bounds testing approach to cointegration. Jordan Journal of Economic Sciences, 2(2), 143-161.

Aktan, B. (2018), Hype vs. Reality on US and BRICS stock markets going their separate ways: Post-crisis evidence. Investment Management and Financial Innovations, 15(2), 203-212.

Al-Iriani, M. (2006), Energy-GDP relationship revisited: An example from GCC Countries using panel causality. Energy Policy, 34(17), 3342-3350.

Asafu-Adjaye, J. (2000), The relationship between energy consumption, energy price and economic growth: Time series evidence from Asian developing countries. Energy Economics, 22, 615-625.

Baranzini, A., Weber, S., Bareit, M., Mathys, N. (2013), The causal relationship between energy use and economic growth in Switzerland. Energy Economics, 36, 464-470.

Belloumi, M. (2009), Energy consumption and GDP in Tunisia: Cointegration and causality analysis. Energy Policy, 37(7), 2745-2753.

Central Bank of Bahrain. (2000-2019), Annual Reports. Bahrain: Central Bank of Bahrain.

Chen, S., Kuo, H., Chen, C. (2007), The relationship between GDP and electricity consumption in 10 Asian countries. Energy Policy, 35(4), 2611-2621.

Cheng, B. (1995), An investigation of cointegration and causality between energy consumption and economic growth. Journal of Energy Development, 21, 73-84.

Cheng, S., Lai, W. (1997), An investigation of cointegration and causality between energy consumption and economic activity in Taiwan, Province of China. Energy Economics, 19, 435-444.

David, R. (2011), Which Impulse Response Function, The Warwick Economics Research Paper Series (TWERPS). United Kingdom: Department of Economics, University of Warwick.

Denison, E. (1985), Trends in American Economic Growth, 1929-1982. Washington, DC: Brookings Institution.

Dickey, D., Fuller, W. (1979), Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74, 427-431.

Electricity and Water Authority. (2000-2019), Annual Reports. Bahrain: Electricity and Water Authority.

Emeka, N., Aham, K. (2016), Autoregressive distributed lag (ARDL) cointegration technique: Application and interpretation. Journal of Statistical and Econometric Methods, 5(4), 63-91.

Engle, R., Granger, G. (1987), Cointegration and error correction: Representation, estimation and testing. Econometrica, 55, 251-276.

Erol, U., Yu, E. (1987), On the causal relationship between energy and income for industrializing countries. Journal of Energy and Development, 13, 113-122.

Ghosh, S. (2002), Electricity consumption and economic growth in India.

Energy Policy, 30(2), 125-129.

Ghosh, S. (2009), Electricity supply, employment and real GDP in India: Evidence from cointegration and granger-causality test. Energy Policy, 37, 26-29.

Granger, C. (1969), Investigating causal relation by econometric and cross-sectional method. Econometrica, 37, 424-438.

Gujarati, D., Porter, D. (2009), Basic Econometrics. Irwin: McGraw-Hill.

Hamdi, H., Sbia, R., Shahbaz, M. (2014), The nexus between electricity consumption and economic growth in Bahrain. Economic Modelling, 38, 227-237.

Hatemi, J. (2014), Asymmetric generalized impulse responses with an application in finance. Economic Modelling, 36(C), 18-22.

Hossein, A., Yazdan, G., Ehsan, A. (2012), The relationship between energy consumption, energy prices and economic growth: Case study (OPEC Countries). OPEC Energy Review, 36(3), 272-286.

Hwang, D., Gum, B. (1992), The causal relationship between energy and GNP: The case of Taiwan. The Journal of Energy and Development, 12, 219-226.

Im, K.S., Pesaran, M.H., Shin, Y. (1995), Testing for Unit Roots in Dynamic Heterogeneous Panels, Department of Applied Economics Working Paper No. 9526.

James, P. (2009), On the dynamics of energy consumption and employment in Illinois. Journal of Regional Analysis and Policy, 39(2), 126-130.

Koop, G., Pesaran, M., Potter, S. (1996), Impulse response analysis in nonlinear multivariate models. Journal of Econometrics, 74(1), 119-147.

Kraft, J., Kraft, A. (1978), On the relationship between energy and GNP. Journal of Energy Development, 3, 401-403.

Kreishan, F.M., Elseoud, M.S.A., Selim, M. (2018), Oil revenue and state budget dynamic relationship: Evidence from Bahrain. Journal of Energy Economics and Policy, 8(6), 175-179.

Kwiatkowski, D., Phillips, P., Schmidt, P., Shin, Y. (1992), Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? Journal of Econometrics, 54(1-3), 159-178.

MacKinnon, J.G. (1996), Numerical distribution functions for unit root and cointegration tests. Journal of Applied Econometrics, 11(6), 601-618.

Masih, A., Masih, R. (1998), A multivariate cointegrated modelling approach in testing temporal causality between energy consumption, real income and prices with an application to two Asian LDCs. Applied Economics, 30, 1287-1298.

Narayan, P., Popp, S. (2012), The energy consumption-real GDP nexus revisited: Empirical evidence from 93 countries. Economic Modelling, 29(2),303-308.

Naser, H. (2017), Analyzing long-run relationship between energy consumption and economic growth in the Kingdom of Bahrain. E3S Web of Conferences, 23(3), 07001.

Ozturk, I. (2010), A literature survey on energy-growth nexus. Energy Policy, 38(1), 340-349.

Ozturk, I., Acaravci, A. (2011), Electricity consumption and real GDP causality nexus: Evidence from ARDL bounds testing approach for MENA Countries. Applied Energy, 88, 2885-2892.

Payne J., (2009), On the Dynamics of Energy Consumption and Output in the US. Applied Energy, 86(4), 575-577.

Pesaran, M., Smith, R. (1999), An autoregressive distributed lag modeling approach to cointegration analysis. In: Strom, S., Holly, A., Diamond, P., ediotrs. Centennial Volume of Ragnar Frisch. Cambridge: Cambridge University Press.

Pesaran, M., Smith, R., Shin, Y. (1996), Testing for the Existence of a Long Run Relationship, DAE Working Paper, Department of Applied Economics No. 9622. Cambridge: University of Cambridge.

Pesaran, M., Smith, R., Shin, Y. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16, 289-326.

Phillips, P., Perron, P. (1988), Testing for a unit root in time series regression. Biometrika, 75, 335-346.

Rod, F., Glenn, S. (1984), Granger causality and U.S. Crop and livestock prices. Southern Journal of Agricultural Economics, 16(1), 115-120.

Shahbaz, M., Feridun, M. (2012), Electricity consumption and economic growth empirical evidence from Pakistan. Quality and Quantity, 46, 1583-1599.

Shiu, A., Pun-Lee, L. (2004), Electricity consumption and economic growth in China. Energy Policy, 32(1), 47-54.

Solow, R. (1978), Resources and economic growth. American Economic Review, 22, 5-11.

Soytas, U., Sari, R. (2003), Energy consumption and GDP: Causality relationship in G7 countries and emerging markets. Energy Economics, 25, 23-37.

World Development Indictors. (2019), Data Catalog, the World Bank. United States: World Development Indictors.

Yu, E., Choi, J. (1985), The causal relationship between electricity and GNP: An international comparison. Journal of Energy and Development, 10, 249-272.