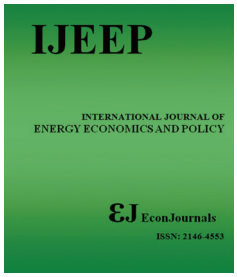

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Energy Consumption and Economic Growth: Empirical Evidence from MENA Region

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ABSTRACT

This paper examines the causal relationship between energy consumption and real GDP of the fourteen MENA Countries over the period 1987-2019 by using bivariate Vector Auto-regression model and Granger causality approach. This study shows the existence of unidirectional, bidirectional or no causal relationship between energy consumption and economic growth of different countries in MENA Region. The study also suggests the environmental and energy policies should recognize the relationship between energy consumption and economic growth in order to maintain sustainable economic growth in MENA region.

Keywords: Energy Consumption, Economic Growth, Causality, Cointegration
JEL Classifications: C3, O4, Q43

1. INTRODUCTION

The relationship between energy consumption and economic growth has been the subject of considerable academic research over the past few decades. The Economic growth is closely linked to energy consumption since higher level of energy consumption leads to higher economic growth. However, it is also likely that more efficient use of energy resources requires a higher level of economic growth.

In literature, the relationship between energy–growth has attracted attention of researchers in different countries for a long time. Several studies focus on the nexus between energy consumption and economic growth. This nexus suggests that higher economic growth requires more energy consumption and more efficient energy use needs a higher level of economic growth. The idea of causal relationship between energy consumption and economic growth was pioneering by Kraft and Kraft (1978) for the period 1947-1974 by employing causality test for examined the relationship between these variables for USA, Granger causality test approach has become a popular tool for studying the relationship between economic growth and energy consumption in different countries, e.g. Stern (1993), Belloumi (2009), Pao (2009) and Ghosh (2010). However, Belloumi (2009) has used a vector error-correction model (VECM) and showed that, in Tunisia, there is a causal relationship between energy consumption and income over the period of 1971-2004. Similarly, Altinay and Karagol (2004) investigated the causal relationship between energy consumption and economic growth in Turkey over the period of 1950-2000. They showed that both used tests have yielded a strong evidence for unidirectional causality running from the energy consumption to economic growth. This implies that energy consumption is vitally important to sustain economic growth in Turkey.

Whereas there is extensive research over the issue of causality between energy consumption and economic growth but research on the MENA region is inadequate. In view of the fact that, this study investigates the direction of causality in between

energy consumption and economic growth for selected MENA countries over the period 1987-2019 by using Granger causality methodology developed by Toda and Yamamoto (1995). Study determining the causal relationship between energy consumption and economic growth and also proposed appropriate policies to promote energy preservation in MENA countries.

The main stream of literature concerning the causality directions in between energy consumption and economic growth could be categorized into four common hypothesis and each of which has great important for energy policy Mozumder and Marathe (2007), Apergis and Payne (2009a), Ozturk (2010) and Magazzino (2011). First, growth hypothesis indicates unidirectional causality running from energy consumption to economic growth implies that constraints on energy consumption may obstruct economic growth whereas increases in energy consumption may contribute to economic growth. Second, conservation hypothesis indicates unidirectional causality running from economic growth to energy consumption implies that energy consumption conservation policies may have little or no impact on economic growth of less energy-dependent economies whereas an increase in economic growth causes an increase in energy consumption. Third, feedback hypothesis indicates bidirectional causal relationship between energy consumption and economic growth implies that energy consumption and economic growth are simultaneously affected and determined. Finally, a fourth is neutrality hypothesis indicates no-causal relationship means there is no interdependence between energy consumption and economic growth, so neither inclusive nor exclusive policies concerning energy consumption have any effect on economic growth.

The rest of the paper is structured as follows. Section II, gives a brief review of theoretical background and empirical studies. Section III discusses the modelling framework and estimation results. Final section concludes the study and discusses the policy implications.

2. LITERATURE REVIEW

A considerable number of empirical studies have attempted to establish the causal relationship between energy consumption and economic growth in the energy literature. An overview of these studies is the mix of results, the causal relationship between energy consumption and GDP are somewhat contradictory in terms of the four hypotheses. An overview on the different papers and their results for the energy-growth nexus can be found for example a meta-study was conducted by Menegaki (2014) and Iyke (2015).

Lee and Chang (2008) investigated the causal relationship between energy consumption and real GDP for 16 Asian countries for the period 1971-2002 by using panel cointegration and panel error correction model. The study found that economic growth and energy consumption has no-causality in short-run but there is long-run unidirectional causality running from energy consumption to economic growth.

Narayan and Smyth (2008) also examines the causal relationship between energy consumption and real GDP for G-7 countries over the period 1972-2002 by using Panel co-integration, Granger causality and long-run structural estimation. The study found that economic growth and energy has long-run unidirectional causality running from energy consumption to economic growth. More studies found same results by using different econometric techniques on different group of countries such as Lee (2005) for developing countries, Glasure and Lee (1998) for Singapore and Masih and Masih (1996) for Asian Countries.

Lee and Chang (2008) examine the relationship between energy consumption and economic growth of 22 OECD countries over the period of 1960-2001 by using Panel co-integration, Panel VEC model. The study found the dynamic bi-directional causal linkage exist in between energy consumption and economic growth. For Tunisia, Sebri and Ben-Salha (2014) found a bidirectional, positive relationship between energy consumption and economic growth.

Eden and Jin (1992) and Ozturk (2010) proposed that energy consumption is not correlated with economic growth, which means that neither conservative nor expansive policies in relation to energy consumption have any influence on economic growth. Some of the studies that found evidence of neutrality hypothesis include the following: Akarca and Long (1980), Eden and Hwang (1984), Eden and Jin (1992), and Payne (2009) for the U.S.

Zhang and Cheng (2009) investigated the causality in between energy consumption and economic growth for China over the period of 1960-2007 by using Granger causality. Study found a unidirectional Granger causality running from GDP to energy consumption so China can tighten conservative energy policy without hampering economic growth. More studies found same results by using different econometric techniques on different countries such as Cheng and Lai (1997) for Taiwan, Vietnam and Souhila and Kourbali (2012) for Algeria, Zamani (2007) for Iran and Aqeel and Butt (2001) for Pakistan.

Narayan and Parasad (2008) examined the relationship between energy consumption and economic growth of 10 European countries for the period 1960-2002 by using Panel co-integration, VECM model. The study found that economic growth and energy consumption has bi-directional causality in most of the European countries. Belke et al. (2011) and Dobnik (2011) examined the relationship between energy consumption and economic growth of OECD countries for the period of 1981-2007 and 1971-2009 respectively. Both studies found that economic growth and energy consumption has bi-directional causality.

Narayan and Smyth (2009) examined the relationship between energy consumption and economic growth of 6 MENA countries for the period 1974-2002 by using Panel co-integration, VECM model. The study found that economic growth and energy consumption has bi-directional causality. Saqib (2018) also examined the relationship between energy consumption and economic growth with panel data of the six gulf cooperation council (GCC) countries over the period 1996-2017. Study concluded that there is a bidirectional causal relationship between energy consumption and economic growth in GCC region.

Kaplan et al., (2011) examined the causal relationship in between energy consumption and economic growth for Turkey over the period of 1971-2006 by applying vector error correction model and also tested Granger causality after they found cointegration among energy consumption and economic growth. Study concluded that energy consumption and economic growth are cointegrated and there is availability of feedback hypothesis. More studies found same results by using different econometric techniques on different group of countries such as Erol and Yu (1987) for industrialized countries, Nachane et al. (1988) for 16 cross-country and Lee (2006) for developed countries.

Al-Mulali (2011) also investigated the relationship between energy consumption and economic growth for the period of 1980-2009 of MENA region and showed bidirectional causal relationship but Arouri et al. (2012) investigated the relationship between energy consumption and economic growth for the period of 1981-2005 and showed unidirectional relationship from energy consumption to economic growth in MENA region.

Bouoiyour and Selmi (2013) investigated the relationship between energy consumption and economic growth for MENA countries in which seven energy exporters and five energy importers countries over the period 1975-2010 by using the panel cointegration methods and panel causality test and result found that most of the energy exporter countries have feedback hypothesis but for energy importer countries have conversion hypothesis. However, there is no unanimity on the results originated. This issue has been gauged and the results have varied extensively.

Bouoiyour et al. (2014) examined the causal relationship in between energy consumption and economic growth by applying meta-analysis techniques on the sample of forty-three studies that published between 1996 and 2013. Study found that the relationship is more multifaceted than it appeared so nine studies supporting growth hypothesis, nine studies supporting conservation hypothesis, ten studies supporting neutrality hypothesis and fifteen supporting the feedback hypothesis, the results are varies due to the different country samples, econometric.

Kayıkc and Bildirici (2015) investigated the the causality in between energy consumption and economic growth for the GCC and MENA countries over the period of 1972-2011 by applying autoregressive distributed lag bounds and granger causality tests. Study concluded that directions of causalities differ for the countries according to their natural resource levels like higher energy consumption leads to higher economic growth for most abundant resource countries whereas the causality is inversed for most of the countries with low natural resources so countries implemented conservation energy policy.

Esen and Bayrak (2017) also examined the relationship between energy consumption and economic growth of seventy-five energy importing countries for the period 1990-2012 by using Panel co-integration model. The study concluded that there is a positive and statistically significant relationship between energy consumption and economic growth for the long term and furthermore, the effect of energy consumption on economic growth declines as the income level of the country increases.

Gorus and Aydin (2019) examined the relationship between energy consumption, economic growth, and pollution emission for 8 MENA Region Countries over the period from 1975 to 2014. The results of this study showed that energy conservation policies do not have an adverse effect on economic growth both in the short but their effects are negative in the long-run. Likewise, policies to control air pollution can be considered by policymakers because of the absence of the causal nexus between economic growth and pollution emission.

Muhammad (2019) also examined the effect of economic growth, energy consumption and pollution emissions for 68 countries over the period from 2001 to 2017 for developed, developing and MENA Countries by using generalized method of moments (GMM) for data analysis. The results of this study showed that economic growth increase with increase in energy consumption in developed and developing countries while declined in MENA countries; pollution emissions increase in all countries due to increase in energy consumption. Energy consumption increase in all countries but economic growth increase in all countries except MENA due to increase in pollution emissions.

Recently, Qahtan et al. (2021) investigated the convergence of disaggregated energy consumption in the MENA region by using the Residual Augmented Least Squares-Lagrange multiplier (RALS-LM) method. They found most of the countries have stochastic convergence in energy consumption. They also concluded that with convergence, shocks to the global energy market will have temporary effect and no convergence, shocks to the global energy market will have permanent effect.

Reliant to economy-to-economy variant its observed that the directions of causality are different from each other's. These unrelated findings could be unsettled to different countries' physiognomies for example political measures, the excellence of establishments and the diverse implemented energy policies (Chen and Kuo, 2007; Ozturk, 2010). Furthermore, studies based on different economies, different econometric approaches and different development phases also generated mixed results (Yuan et al., 2008; Halkos and Tzermes, 2009).

Thus, more research should be carried out to establish the direction of causality between the energy consumption and economic growth.

3. MODELLING FRAMEWORK AND RESULTS

The study is conducted using annual time series data of energy use per capita (kg of oil equivalent per capita, EC) and real GDP per capita (constant 2005 US$, GDP) for MENA region countries including Algeria, Bahrain, Cyprus, ran, Egypt, Kuwait, Malta, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Turkey and UAE. The time span for each country is determined by the availability of the data and ranges within the period of 1987-2019. All the data are obtained from World Bank World Development Indicators. All of the variables based of natural logarithms.

Table 1: ADF test results of stationarity test with and without time trend

ADF test								
Countries	GDP				EC			
	I (0)		I (1)		I (0)		I (1)	
	C	C & T	C	C & T	C	C & T	C	C & T
Algeria	−0.62	−4.25*	−6.92*	−−6.60*	−3.94*	−2.90***	−1.39	−1.54
Bahrain	−1.18	−1.89	−3.60*	−3.54*	−3.20**	−3.91***	−6.96*	−6.86*
Cyprus	−1.23	−1.41	−2.48	−2.24	−2.34*	−2.69**	−5.67*	−5.90*
Egypt	−2.98**	−2.69*	−2.94*	−3.56*	−2.45***	−2.13	−3.99*	−4.78*
Iran	−0.97	−0.99	−1.96**	−4.58*	−0.46	−2.93***	−7.49*	−7.37*
Kuwait	−1.77	−1.04	−3.53*	−3.45*	−0.43	−1.98	−7.11*	−7.23*
Malta	−3.89	−1.25*	−3.61*	−4.02*	−1.14*	−1.20***	−9.39*	−9.33*
Morocco	0.27	−1.33	−9.99*	−9.78*	−1.15	−2.10	−4.65*	−5.34*
Oman	−1.45	−1.98	−3.95*	−3.77*	−0.76	−1.78	−7.71*	−7.59*
Qatar	−2.80	−2.01	−4.06*	−4.34*	−1.33	−1.99	−6.55*	−6.01*
Saudi Arabia	−2.12	−1.21	−3.57**	−5.54*	−1.98	−2.67	−3.01**	−5.32*
Tunisia	0.19	−1.55	−5.76*	−5.75*	−2.01	−2.81	−8.45*	−9.02*
Turkey	−0.49	−2.94	−6.22	−6.10	−1.30	−3.08	−5.97*	−5.45*
UAE	−0.35	−1.68	−4.22*	−4.12*	−4.45*	−2.33	−5.18*	−8.92*

*, **, and ***Indicate significance at 1%, 5%, and 10%, respectively. C and C& T are the test statistics for a unit root with a constant and with constant and trend. The lag lengths are selected based on SIC. Source: Authors' estimation. ADF: Augmented dickey fuller

Table 2: Selection of the order of the VARs (p*)

Country	AIC			SIC			Optimal (p*)
	1	2	3	1	2	3	
Algeria	−7.01	−6.94	−6.87*	−6.78*	−6.57	−6.44	3
Bahrain	−6.33	−6.03*	−5.95	−5.96*	−5.61	−5.67	2
Cyprus	−3.11	−3.01	−2.89	−2.84	−2.31	−2.10	1
Egypt	−8.10	−8.18*	−8.28	−7.83*	−7.54	−7.51	2
Iran	−5.55	−5.96*	−5.48	−5.30	−5.46*	−5.09	2
Kuwait	−5.49	−5.68	−5.53*	−5.47*	−5.13	−4.90	3
Malta	−5.05	−5.32*	−5.24	−4.99	−4.93*	−4.65	2
Morocco	−7.71	−7.91*	−7.85	−7.45	−7.47*	−7.23	2
Oman	−3.65	−3.16	−3.51*	−3.16*	−3.85	−2.98	3
Qatar	−4.67	−4.43	−4.21	−4.11	−4.37*	−4.10	3
Saudi Arabia	−5.59	−5.69	−5.68*	−5.47*	−5.59	−5.47	3
Tunisia	−7.90	−8.01	−8.42*	−8.19*	−8.01	−7.80	3
Turkey	−3.76	−3.65	−3.33*	−3.44*	−3.85	−2.98	2
UAE	−4.620*	−4.522	−4.368	−4.351*	−4.369	−4.154	1

(p*) indicates the selected order of the VARs. Source: Authors' estimation

Table 3: Misspecification tests for the VARs (p*)

Country	Autocorrelation test		Normality test		Heteroskedasticity test	
	F-statistic	Probability	F-statistic	Probability	F-statistic	Probability
Algeria	3.56	0.49	3.68	0.49	45.87	0.11
Bahrain	2.22	0.70	4.56	0.27	27.37	0.24
Cyprus	2.12	0.51	6.90	0.11	21.89	0.45
Egypt	0.40	0.97	1.56	0.79	21.37	0.79
Iran	1.49	0.81	6.11	0.19	28.80	0.31
Kuwait	2.45	0.52	1.09	0.81	56.12	0.23
Malta	2.64	0.69	9.30	0.05	58.97	0.51
Morocco	9.01	0.06	3.39	0.45	24.68	0.56
Oman	3.34	0.54	2.99	0.59	52.61	0.23
Qatar	5.21	0.20	3.33	0.40	67.56	0.12
Saudi Arabia	5.69	0.22	3.11	0.58	76.12	0.31
Tunisia	2.65	0.61	1.29	0.81	46.01	0.10
Turkey	3.54	0.50	2.65	0.66	34.56	0.33
UAE	5.60	0.22	1.83	0.70	47.81	0.61

Autocorrelation test is the residual serial correlation LM test. Normality test is the residual normality test of orthogonalization: Cholesky (Lutkepohl). Heteroskedasticity test is the test for residual heteroskedasticity. The values in the parentheses are the *P* values. Source: Authors' estimation

The Toda and Yamamoto (1995) approach is used in this research to assess Granger's causality. The Toda and Yamamoto method's benefit over the other causality tests is that this method is valid even if the model's variables are or are not co-integrated in distinct integration orders. This method requires an estimation of VARs with incorporated variables. The empirical analysis therefore starts with the estimation of stationary tests in order to determine the order of time

Table 4: Granger Causality test results based on the T-Y methodology

Country	GDP Granger causes EC		EC Granger causes GDP		Direction of causality
	F-statistic	Probability	F-statistic	Probability	
Algeria	14.26	0.002	1.57	0.665	GDP→EC
Bahrain	4.19	0.122	3.47	0.175	None
Cyprus	14.98	0.0009	15.15	0.002	GDP↔EC
Egypt	4.36	0.112	4.67	0.09	EC→GDP
Iran	2.54	0.280	16.78	0.0002	EC→GDP
Kuwait	8.40	0.06	3.32	0.06	GDP→EC
Malta	3.82	0.57	2.70	0.74	None
Morocco	9.19	0.02	3.37	0.33	GDP→EC
Oman	7.78	0.09	16.28	0.002	GDP↔EC
Qatar	7.80	0.06	7.45	0.019	GDP→EC
Saudi Arabia	10.94	0.05	6.42	0.26	GDP→EC
Tunisia	2.01	0.56	6.46	0.09	EC→GDP
Turkey	9.78	0.005	6.13	0.001	GDP→EC
UAE	21.12	0.0003	13.12	0.01	GDP↔EC

The reported estimates are asymptotic Wald statistics. The [p+d] th-order level VAR is estimated with maximal order of integration (d) being 1.Source: Authors' estimation

series integration. Later the following p-lag VAR (p) model is estimated in levels:

$$Y_t = c + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 Y_{t-3} + \ldots\ldots\ldots + \beta_p Y_{t-p} + e_t$$

where Y_t is kx1 vector of two endogenous variables (EC and GDP), c is a k × 1 vector of constants, β is a time-invariant k × k matrix, and is a k × 1 vector of error terms.

As a next step, the augmented (*p* + d) VARs are estimated, where d indicates the maximal order of integration. Finally, Granger non-causality is tested based on a Block Exogeneity Wald test. Before proceeding further it is imperative to ensure that the underlying data are stationary. For this Augmented Dickey Fuller (ADF) test an extension of the Dickey Fuller (DF) method (see Dickey and Fuller, 1981) can be is used. As an initial phase, the unit root tests are estimated using Augmented Dickey Fuller (ADF) tests to determine the order of integration of EC and GDP time series. These tests are applied to check the stationarity at levels and at first differences of the GDP and EC variables with intercept as well as with intercept and trend. The findings of the unit root tests are shown in Table 1. The results reveal that most of the variables are integrated of order one I(1). Then, the optimal lag lengths for the variables in the VAR, (p*), are chosen based on the Akaike Information Criterion and Schwarz Information Criterion (thereafter AIC and SIC, respectively) to check the quality of the model. The selected order of the VARs (p*) is reported in Table 2.

Next, the usual misspecification tests are applied to determine whether the estimated VARs (p*) are well-defined. The results of these tests for serial correlations, normality, and heteroskedasticity are presented in Table 3. These test results reveal that the estimated VARs (p*) are well-defined.

Finally, the augmented VARs (p + d) are estimated and then the Granger non-causality hypothesis is tested using a Wald test. Table 4 specifiess the Granger non-causality test results based on the T-Y methodology. The results from causality tests reveal as mention from Table 4, (1) unidirectional causality running from energy consumption to real GDP in Egypt, Iran, and Tunisia; (2) unidirectional causality running from real GDP to energy consumption in Algeria, Kuwait, Morocco, Qatar, Saudi Arabia and Turkey; (3) bidirectional causality in Cyprus, Oman and United Arab Emirates; and (4) no causality between energy consumption and real GDP in Bahrain and Malta so the neutrality hypothesis is supported. For Cyprus, Oman and the United Arab Emirates, the presence of bidirectional causality provides support for the feedback hypothesis in which energy consumption and real GDP are interdependent. These findings indicate that energy conservation policies can be implemented in Algeria, Kuwait, Morocco, Qatar, Saudi Arabia and Turkey.

4. CONCLUSION AND POLICY RECOMMENDATIONS

We examined the relationship between energy consumption and real GDP of the fourteen MENA Countries over the period 1987-2019 by using bivariate Vector Auto-regression model and Granger causality approach. The results show no causality runs from energy consumption to real GDP and no causality runs from real GDP to energy consumption in Bahrain and Malta. The existence of unidirectional causality running from energy consumption to real GDP in Egypt, Iran and Tunisia and from real GDP to energy consumption in Algeria, Kuwait, Morocco, Qatar, Saudi Arabia and Turkey respectively. The bidirectional relationship exists for Cyprus and Oman only. This implies that changes in economic growth are unlikely to have significant effect on energy consumption but energy is a determinant factor of the GDP growth in these countries, and, therefore, a high-level of economic growth leads to a high level of energy demand and vice versa.

The policy recommendations from this study are:

1. Firstly MENA region needs to embrace more energy conservation policies to reduce pollution emissions and consider strict environmental and energy policies. The research and investment in clean energy should be an integral part of the process of controlling the pollution emissions and find sources of energy to oil alternative for the environment free from pollution
2. Secondly, high economic growth gives rise to environmental degrading but the reduction in economic growth will

increase unemployment. The policies with which to tackle environmental pollutants require the identification of some priorities to reduce the initial costs and efficiency of investments. Reducing energy demand, increasing both energy supply investment and energy efficiency can be initiated with no damaging impact on the MENA Region's economic growth and therefore reduce emissions. At the same time, efforts must be made to encourage industries to adopt new technologies to minimize pollution

3. Lastly, MENA Region Countries' Government should subsidize in appropriate use of the energy and erudite technology to promote new resources of energy and sources of renewable energy. The results also suggest that countries which are plenty of natural resources and emissions of pollution may get more economic benefits.

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REFERENCES

Akarca, A.T., Long, T.V. (1980), On the relationship between energy and GNP: A reexamination. The Journal of Energy and Development, 1980, 326-331.

Al-Mulali, U. (2011), Oil consumption, CO_2 emission and economic growth in MENA countries. Energy, 36(10), 6165-6171.

Altinay, G., Karagol, E. (2004), Structural break, unit root, and the causality between energy consumption and GDP in Turkey. Energy Economics, 26(6), 985-994.

Apergis, N., Payne, J.E. (2009a), Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. Energy Policy, 38(1), 656-660.

Aqeel, A., Butt, M.S. (2001), The relationship between energy consumption and economic growth in Pakistan. Asia-Pacific Development Journal, 8(2), 101-110.

Arouri, M. E. H., Youssef, A. B., M'henni, H., Rault, C. (2012), Energy consumption, economic growth and CO_2 emissions in Middle East and North African countries. Energy Policy, 45, 342-349.

Belke, A., Dobnik, F., Dreger, C. (2011), Energy consumption and economic growth: New insights into the cointegration relationship. Energy Economics, 33(5), 782-789.

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

Bouoiyour, J., Selmi, R. (2013), The nexus between electricity consumption and economic growth in MENA countries. Energy Studies Review, 20(2), 25-41.

Bouoiyour, J., Selmi, R., Ozturk, I. (2014), The Nexus between Electricity Consumption and Economic Growth: New Insights from Meta-analysis. MPRA Paper No. 55238.

Chen, J.J., Kuo, C.F. (2007), Energy-efficient Scheduling for Real-time Systems on Dynamic Voltage Scaling (DVS) Platforms. In: 13th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2007). p28-38.

Cheng, B.S., Lai, T.W. (1997), An investigation of co-integration and causality between energy consumption and economic activity in Taiwan. Energy Economics, 19(4), 435-444.

Dickey, D.A., Fuller, W.A. (1981), Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica: Journal of the Econometric Society, 1057-1072.

Dobnik, F. (2011), Energy consumption and economic growth revisited: structural breaks and cross-section dependence. Ruhr Economic Papers, No. 303.

Eden, S.H., Hwang, B.K. (1984), The relationship between energy and GNP: Further results. Energy Economics, 6(3), 186-190.

Eden, S.H., Jin, J.C. (1992), Cointegration tests of energy consumption, income, and employment. Resources and Energy, 14(3), 259-266.

Erol, U., Yu, E.S. (1987), On the causal relationship between energy and income for industrialized countries. The Journal of Energy and Development, 13(1), 113-122.

Esen, Ö., Bayrak, M. (2017), Does more energy consumption support economic growth in net energy-importing countries? Journal of Economics, Finance and Administrative Science, 22, 42.

Ghosh, S. (2010), Examining carbon emissions economic growth nexus for India: A multivariate cointegration approach. Energy Policy, 38(6), 3008-3014.

Glasure, Y.U., Lee, A.R. (1998), Cointegration, error-correction, and the relationship between GDP and energy: The case of South Korea and Singapore. Resource and Energy Economics, 20(1), 17-25.

Gorus, M.S., Aydin, M. (2019), The relationship between energy consumption, economic growth, and CO_2 emission in MENA countries: Causality analysis in the frequency domain. Energy, 168, 815-822.

Halkos, G.E., Tzeremes, N.G. (2009), Electricity generation and economic efficiency: Panel data evidence from world and East Asian countries. Global Economic Review, 38(3), 251-263.

Iyke, B.N. (2015), Electricity consumption and economic growth in Nigeria: A revisit of the energy-growth debate. Energy Economics, 51, 166-176.

Kaplan, M., Öztürk, İ., Kalyoncu, H. (2011), Energy consumption and economic growth in Turkey: Cointegration and causality analysis.

Kayıkc, F., Bildirici, M.E. (2015), Economic growth and electricity consumption in GCC and MENA countries. South African Journal of Economics, 83(2), 303-316.

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

Lee, C.C. (2006), The causality relationship between energy consumption and GDP in G-11 countries revisited. Energy Policy, 34(9), 1086- 1093.

Lee, C.C., Chang, C.P. (2005), Structural breaks, energy consumption, and economic growth revisited: Evidence from Taiwan. Energy Economics, 27(6), 857-872.

Lee, C.C., Chang, C.P. (2008), Energy consumption and economic growth in Asian economies: A more comprehensive analysis using panel data. Resource and Energy Economics, 30(1), 50-65.

Magazzino, C. (2011), Energy Consumption and Aggregate Income in Italy: Cointegration and Causality Analysis. MPRA Paper, No. 28494. Germany: University Library of Munich.

Masih, A.M., Masih, R. (1996), Energy consumption, real income and temporal causality: Results from a multi-country study based on cointegration and error-correction modelling techniques. Energy Economics, 18(3), 165-183.

Menegaki, A.N. (2014), On energy consumption and GDP studies; A meta-analysis of the last two decades. Renewable and Sustainable Energy Reviews, 29, 31-36.

Mozumder, P., Marathe, A. (2007), Causality relationship between electricity consumption and GDP in Bangladesh. Energy Policy, 35(1), 395-402.

Muhammad, B. (2019), Energy consumption, CO_2 emissions and economic growth in developed, emerging and Middle East and North Africa countries. Energy, 179, 232-245.

Nachane, D.M., Nadkarni, R.M., Karnik, A.V. (1988), Co-integration and causality testing of the energy-GDP relationship: A cross-country study. Applied Economics, 20(11), 1511-1531.

Narayan, P.K., Prasad, A. (2008), Electricity consumption-real GDP causality nexus: Evidence from a bootstrapped causality test for 30 OECD countries. Energy Policy, 36(2), 910-918.

Narayan, P.K., Smyth, R. (2008), Energy consumption and real GDP in G7 countries: New evidence from panel cointegration with structural breaks. Energy Economics, 30(5), 2331-2341.

Narayan, P.K., Smyth, R. (2009), Multivariate Granger causality between electricity consumption, exports and GDP: Evidence from a panel of Middle Eastern countries. Energy Policy, 37(1), 229-236.

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

Pao, H.T. (2009), Forecasting energy consumption in Taiwan using hybrid nonlinear models. Energy, 34(10), 1438-1446.

Payne, J.E. (2009), A survey of the electricity consumption-growth literature. Applied Energy, 87(3), 723-731.

Qahtan, A.S.A., Xu, H., Abdo, A.B. (2021), Stochastic convergence of disaggregated energy consumption per capita and its catch-up rate: An independent analysis of MENA net oil-exporting and importing countries. Energy Policy, 150, 112151.

Saqib, N. (2018), Greenhouse gas emissions, energy consumption and economic growth: Empirical evidence from gulf cooperation council countries. International Journal of Energy Economics and Policy, 8(6), 392-400.

Sebri, M., Ben-Salha, O. (2014), On the causal dynamics between economic growth, renewable energy consumption, CO_2 emissions and trade openness: Fresh evidence from BRICS countries. Renewable and Sustainable Energy Reviews, 39, 14-23.

Souhila, C., Kourbali, B. (2012), Energy consumption and economic growth in Algeria: Cointegration and causality analysis. International Journal of Energy Economics and Policy, 2(4), 238-246.

Stern, D.I. (1993), Energy and economic growth in the USA: A multivariate approach. Energy Economics, 15(2), 137-150.

Toda, H.Y., Yamamoto, T. (1995), Statistical inference in vector autoregressions with possibly integrated processes. Journal of Econometrics, 66(1-2), 225-250.

Yuan, J.H., Kang, J.G., Zhao, C.H., Hu, Z.G. (2008), Energy consumption and economic growth: Evidence from China at both aggregated and disaggregated levels. Energy Economics, 30(6), 3077-3094.

Zamani, M. (2007), Energy consumption and economic activities in Iran. Energy Economics, 29(6), 1135-1140.

Zhang, X.P., Cheng, X.M. (2009), Energy consumption, carbon emissions, and economic growth in China. Ecological Economics, 68(10), 2706-2712.