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The relationship of renewable energy consumption to stock market development and economic growth in Iran

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ABSTRACT

This paper investigates the relationship of two types of renewable energy consumption (total hydropower, wind, solar and nuclear energies, and total combustible renewable and waste) to stock market value and economic growth in Iran. An autoregressive distributive lag (ARDL) model was used for data from 1990 to 2014 and results show that stock market value affects both groups of renewable energies in the long run. Growth rate significantly affects total hydropower, wind, solar, and nuclear energies in both the short and long run, although it is only significant in the short run for combustible renewable and waste energies. Neither type of renewable energy consumption affects growth in either the short or long run.

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1. Introduction

Sustainable development, as one of the main goals of every economy, encourages policymakers to use energy sources that emit the fewest pollutants to the environment. Today, renewable energy resources have become increasingly more important due to the fact that they have fewer negative impacts on the environment than other sources of energies and the growing limitations of fossil fuels. Most developed countries that are in agreement with the International Atomic Energy Agency and the Kyoto Protocol have established a framework to encourage greater usage of renewable energy sources Maji [1]. Consequently, countries that are rich in non-renewable energies should consider ways to offset the economic slowdown that would be caused due to the loss of demand from developed countries. Apart from environmental issues, substituting domestic renewable energies also protects countries against external economic crises. As countries reduce fuel imports, their economies become less vulnerable to external crises. The importance of economic growth as the main objective of all economies has led a lot of studies towards finding the impact of renewable energies on economic growth. For example, one study using the ARDL method discovered that renewable energy and economic growth have a negative relationship in the long run in Nigeria, although an insignificant relationship exists in the short run [1]. A negative impact of renewable energy on economic growth was also found in Turkey, South Africa, and Mexico by Ocal and Aslan [2]. However, Destek [3] found a positive relationship between the two variables was discovered for India. Aïssa et al. [4] tried to discover the relationship among renewable energy, output, and trade by using panel cointegration of 11 African countries. They did not find any causality between renewable energy with output and trade in the short run. However, in the long run, Jebli and Youssef [5] discovered the impact of renewable energy on output.

Apergis and Payne [6] employed panel cointegration for investigating the casual relationship between renewable energy consumption and economic growth for OECD countries. They found bidirectional causality between variables both in the short and long run. Similar results were discovered for Central American countries by Apergis and Payne [7]. Using panel data, Chang et al. [8] found bidirectional causality between economic growth and renewable energy for G7 countries. However, these results were not approved for individual countries. Tugcu et al. [9] also discovered similar results for G7 countries. Using the panel cointegration method, Pao et al. [10] investigated the causal effect of clean and non-clean

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energies on economic growth for Mexico, Indonesia, South Korea, and Turkey. They found one-way causality running from renewable energy to economic growth in the long-run and two-way causality in short-run.

Apart from economic growth, financial market development indexes are among the variables of interest to economists in energy studies. Financial market development can affect energy demand by influencing economic growth as well as reducing households' constraints [11]. Financial markets affect economic growth by transferring funds, determining capital prices, facilitating transactions, as well as distributing risk management. Facilitating consumer lending is another impact of financial markets on energy consumption, as easier access to financing for energy purchases increases consumer demand for energy [12–14]. In other words, financial market development may increase energy consumption by reducing financial risk and lending costs and increasing access to financial investments and advanced technologies. Financial market development can also reduce the risks to consumers and businesses and thereby become an important factor in generating wealth in the economy. Therefore, the existence of financial market development is considered as a reliable lever for consumers and businesses which increases economic activity and energy demand [15].

Kakar et al. [16] considered the relationship between financial market development, economic growth, and energy consumption in Pakistan in the 1980s. Using Johansen cointegration and Granger causality, the results showed the long-run effects of the financial market development on energy consumption, however its impact in the short run was negligible. Several studies have confirmed the relationship between financial development, energy consumption and economic growth [17–21]. Stock market developments also play an important role in allocating funds for clean energy projects. Sadorsky [22] stated that stock market developments would increase the demand for energy in emerging economies, while Chang [17] indicated that the development of market capitalism in emerging countries would stimulate investment and energy consumption. This study investigates the relationship between renewable energy consumption, the stock market value,[1] and GDP growth in Iran. It must be noted that, to the best knowledge of the authors, there have not been any studies on financial market development and renewable energies thus far; therefore, this research has referred to studies on total energy consumption and financial market development.

Renewable energies can play an important role in reducing emissions of pollutants, such as carbon dioxide and other greenhouse gases. Features such as environmental compatibility, fewer pollutive effects, renewability, and global replicability have led these types of energies to play an important role in the world's energy supply system on a day-to-day basis. Nowadays, Iran is suffering from air pollution, and the impact on public health is a well-known problem. Therefore, consuming renewable energies can be effective in both achieving clean air and increasing the overall health and well-being of the society. According to recent changes in Iran's energy consumption laws, governmental units such as the Ministry of Energy and the Ministry of Oil have been obliged to support clean energy consumption.

Iran has many capacities in which to use hydro, wind, solar and other kinds of renewable energies due to its geographic environment. Despite its high potential for employing renewable resources, renewable energies have not yet been properly exploited. Renewable energy consumption in Iran is still less than 4% of total energy consumption (refer to Fig. 1) [23]. Therefore, Iran needs to devote particular attention to the various aspects of renewable energies to maintain its position as an energy supplier. Regarding foreign sanctions that have reduced the speed of foreign investment in non-renewable energy, the Iranian government also needs to increase its support to the private sector to attract more investment in renewable energies. This research helps policymakers in Iran and other countries meet their goals for using renewable energies by investigating the relationships of the three aforementioned variables.

This study differs from other research on this issue as most papers in this field study economic growth, non-renewable energy consumption, and pollution (CO2) by panel data models. For our research objective, we make three key contributions. First, financial markets, especially the stock market, can help developing industries to raise and circulate capital within the broader economic system. While many studies have examined the relationship between financial development and economic growth with non-renewable energies, there is a gap in research pertaining to renewable energies. The study covers this gap by focusing on of renewable energy that have largely been ignored in prior research. Second, in contrast to the studies applying cross-country panel causality testing, especially in developed countries, we apply an ARDL model as a robust methodology for Iran's economy. Third, studies on renewable energies typically use one type of renewable energy source, while this study compares two groups of renewable energies: total hydropower, wind, solar, and nuclear energies and combustible renewable and waste energies. We examine the effect of economic growth on the two types of renewable energy consumption and conversely, the effect of the two types of renewable energy consumption on economic growth. This type of analysis has the potential to support future policy recommendations.

For our estimation model we have carried out the following steps (Fig. 2). First, after a thorough review of theoretical and empirical studies, we have selected our models. Next, we have verified the unit roots and cointegration tests for long-run relationships. Subsequently, we have applied two models for each of the long-run and short-run analyses. In each model, the dependent variables are: economic growth and renewable energy type. Finally, we have conducted diagnostic tests to confirm the reliability of the results.

The remainder of this study is formed as follows. Section 2 discusses the data and estimation of model, and Section 3 shows the empirical results. Section 4 provides concluding remarks and policy implications.

2. Data and methodology

Following Pesaran et al. [24], this study uses an Autoregressive Distributed Lag (ARDL) model to investigate the relationship

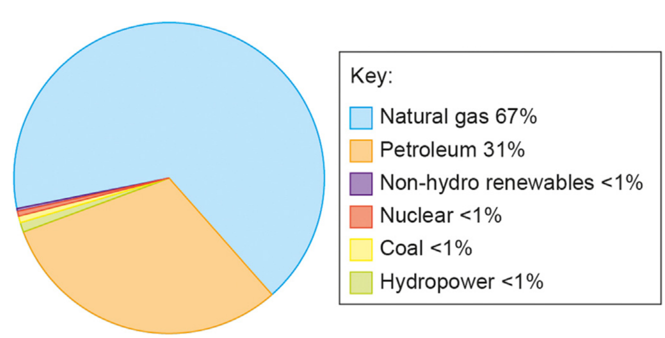

Fig. 1. Iran's total primary energy consumption, share by fuel, 2016
Source: BP statistical Review of World Energy 2017.

[1] stock market value is the total traded value of all securities on the Tehran Stock Exchange. However, for ease of reading, we have changed this throughout the document to stock market value.

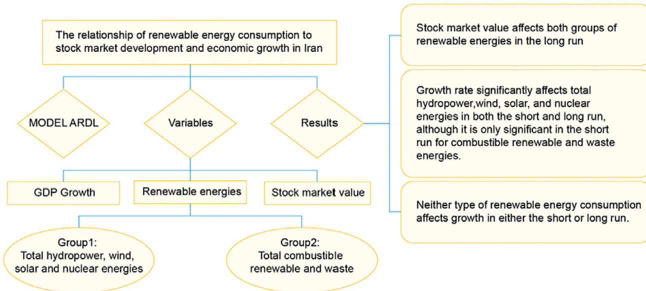

Fig. 2. Graphical abstract

between renewable energy with growth and stock market value as a proxy for stock market development. ARDL methodology has certain advantages over other methodologies. The most important advantage of employing ARDL is its applicability to the order of integration for the variables, as long as none of the variables are I (2). In smaller samples, the results of this method are more efficient than other methods. Using cointegration analysis, the study can identify both short-run and long-run relationships among the variables. Additionally, the speed of adjustment to long-run equilibrium after short-run shocks can be calculated by incorporating the use of an error correction model (ECM).

$$\varnothing(L,P)Y_t = \sum_{i-1}^{k} b_i(L,q_i)X_{it} + c^{'}w_t + u_t \tag{1}$$

Equation (1) shows the ARDL model in which Y_t represents the dependent variable, X_{it} indicates the independent variables, and w_t is the vector $S \times 1$ that represents the exogenous variables, including the intercept, dummy variables, time trend, and other exogenous variables. P is the number of lags for the dependent variable, and q the number of lags for the independent variables. This study compares the effects of GDP growth rate (*gr*) and stock market value (*st*) on two groups of renewable energies: water, solar, wind and nuclear energies (*re*) and combustible renewable and waste energies (*rec*). To conduct this analysis, the study uses two sets of variables *gr*, *st*, *re* and *gr*, *st*, *rec* in two ARDL models for yearly data from 1987 to 2014. Data are collected from the World Bank [25] and Iran Data Portal [26]. The unrestricted error correction equation of the ARDL model can be expressed as follows:

$$\Delta rec_t = a_{0rec} + \sum_{i=1}^{p} b_{irec}\Delta rec_{t-i} + \sum_{j=1}^{q} c_{jgr}\Delta gr_{t-j} + \sum_{k=1}^{r} d_{jrec}\Delta st_{t-k} + \alpha_{rec}\Delta rec_{t-1} + \beta_{gr}gr_{t-1} + \delta_{st}st_{t-1} + \varepsilon_t \tag{2}$$

The above ARDL equation can be extended to three other equations where *rec* is substituted with *re*, *gr*, and *st*. Variables *p*, *q*, and *r* show the optimum number of lags that can be calculated in accordance with the criteria established in prior research [27–29].

The first step in estimating the ARDL model is to examine the existence of a long-run relationship between all variables in the model using the F-statistics. The null hypothesis of this test indicates that there is no cointegration or long-term relationship between variables.

$$\begin{cases} H0: \alpha_{rec} = \beta_{gr} = \delta_{st} = 0 \\ H1: \alpha_{rec} \neq \beta_{gr} \neq \delta_{st} \neq 0 \end{cases} \tag{3}$$

The ARDL F-statistic creates two sets of critical values, upper bound and lower bound. If the value of the F-statistic is greater than the upper bound of the critical value at a specific significant level, the null hypothesis of no long-run relationship is rejected, and therefore, cointegration exists. Conversely, if the value of the F-statistic is lower than the lower bound of the critical value at a specific significant level, the null hypothesis of no long-run relationship cannot be rejected, and therefore, there is no cointegration relationship. If the F-statistics fall between low and high critical values, the result will be uncertain.

3. Empirical results

In the first step, we apply unit root tests for our variables. To avoid spurious regression, we should test the stationarity of the variables. Before proceeding, it is essential to find the order of integration for the variables as the F-statistics of the ARDL method cannot be relied upon if the order of integration is greater than 1 [30].

3.1. Unit root test

This study uses the Augmented Dickey and Fuller (ADF) [31] and Phillips and Perron (PP) [32] tests for testing the stationarity of the variables. Table 1 shows the results of these two tests for the variables by level and at first difference. None of the variables are stationary at level but are stationary at first difference, except for growth rate. Therefore, the ARDL approach is suitable for the mixed order of integration of this study.

3.2. ARDL cointegration test

To investigate the existence of a long-run relationship between variables, the null hypothesis that indicates all coefficients are zero in Relationship (3) must be tested by the ARDL F-statistic or bound test. This test must be done on the estimated OLS Equation (2). The results of the ARDL bound test in Table 2 indicate the existence of two cointegration relationships between variables in each model when *gr*, *re*, *rec*, and *st* play a role as a dependent variable. The existence of a long-run relationship depends on the F-statistics that are above upper bound, fair diagnostic tests and significant coefficient of the speed of adjustment. A long-run relationship exists for *gr*, *re*, and *rec* as dependent variables, but not for *st*.

Table 3 shows the short-run and long-run relationships between variables in the two models. The study chooses among ARDL estimations with different lags based on diagnostic checks and significant speed of adjustments. Variable *st* affects *re* in the short run slightly and significantly after one lag, but it has a positive and significant impact on *re* in the long run. Growth rate is an important element affecting *re* in both the short and long run. An increase in

Table 1
Unit root test.

variables	ADF		PP	
	Intercept	Intercept and trend	Intercept	Intercept and trend
gr	−3.15	−3.28	−2.87	−3.02
Δgr	−4.40	−4.30	−7.41	−9.11
re	−0.44	−1.50	−0.68	−1.74
Δre	−4.15	−4.18	−4.15	−4.22
rec	−2.30	−3.40	−2.24	−2.72
Δrec	−5.09	−5.04	−8.19	−9.18
st	4.176	3.58	−1.58	−2.90
Δst	2.26	−8.26	−7.36	−8.33

Notes: Δ denotes the first difference operator. ADF Critical values at 5% for intercept and for intercept and trend are respectively −2.99 and - −3.60.

Table 2
Cointegration test - ARDL approach.

	Model1			Model2		
Dependent variable	*re*	*gr*	*st*	*rec*	*gr*	*st*
	Long-run relationship	Long-run relationship	No Long-run relationship	Long-run relationship	Long-run relationship	No Long-run relationship

Table 3
ARDL long run and short run results.

Dependent Variables	Model1				Model2			
	re		*gr*		*rec*		*gr*	
Short run	D (GR)	0.335 (0.01)	D (RE)	−0.446 (0.06)	D (REC (-1))	0.484 (0.03)	D (REC)	−0.236 (0.46)
	D (GR (-1))	−0.273 (0.01)	D (ST)	0.376 (0.00)	D (ST)	0.001 (0.53)	D (REC (-1))	0.530 (0.11)
	D (ST)	0.001 (0.69)	D (ST (-1))	0.0014 (0.94)	D (GR)	−0.285 (0.04)	D (ST)	0.011 (0.07)
	D (ST (-1))	−0.028 (0.02)					D (ST (-1))	0.054 (0.02)
	CointEq (-1)	−0.391 (0.00)	CointEq (-1)	−0.435 (0.01)	CointEq (-1)	−0.795 (0.00)	CointEq (-1)	−0.437 (0.01)
Long run	GR	0.963 (0.00)	RE	−1.026 (0.22)	ST	0.007 (0.02)	REC	0.320 (0.57)
	ST	0.071 (0.00)	ST	−0.233 (0.01)	GR	−0.169 (0.35)	ST	−0.071 (0.08)

Notes: Number in parenthesis indicate probability.

both *gr* and *st* significantly increases *re* in the long run. Results for *gr* as the dependent variable show that *re* is not significant in both short run and long run. There are different results in other studies on the relationship between renewable energy consumption and economic growth for example Ocal and Aslan [2] found negative effect of renewable energy consumption on economic growth in Turkey. Kahia et al. [33] discovered two relationships between renewable energy consumption and economic growth in Mena countries. Lin and Moubarak [34] found two ways long run relationships between renewable energy consumption and economic growth in china. The results of Model 2, when *rec* is the dependent variable, indicate that *st* affects *rec* positively and significantly in the long run; however, it has no significant effect in the short run. Unlike Model 1, *gr* does not affect *rec* in the long run; it only affects *rec* negatively in the short run. Consumption of combustible energies does not affect growth rate either in the short run or in the long run. The speed of adjustment coefficient is −0.391 in first estimate of Model 1, which implies that 39.1% of short-run disequilibrium adjusts towards equilibrium within a year. A similar explanation can be used for rest of the results.

In summary, stock market development could increase consumption of the renewable energies of both groups in long run. Economic growth can also increase in renewable energy consumption for the first group, while consumption from either of the two groups of renewable energies does not appear to affect economic growth.

Table 4 illustrates the results of the diagnostic tests. The Breusch-Godfrey Serial Correlation LM Test up to 2 lags shows that there is no autocorrelation in the residuals. The ARCH LM test statistic also shows no incidence of ARCH effects in either model. CUSUM and CUSUM square in Fig. 3 indicate the stability of the two models. The model is stable while the inside lines move across the channel, and the outside lines show the confidence interval.

4. Conclusion

This paper examines the relationship between two types of renewable energy consumption, including consumption of hydro, solar, wind and nuclear energies as well as that of combustible renewables and waste energies, stock market value, and economic growth in Iran over the period 1990–2014 using the ARDL method. Such a study on Iran is very necessary, as studies in this area are rare, and only small steps have been taken towards using renewable energies. The use of renewable energy in Iran is still less than 4% of the total energy consumption in the country. Therefore, more robust studies must be done regarding renewable energies. Results show the existence of short- and long-run relationships between variables in two models where the dependent variables are *re* (consumption of water, solar, wind and nuclear energies), *gr* (economic growth rate), and *rec* (consumption of combustible renewable and waste energies).

The coefficient of *st* (stock market value) is insignificant for both *re* and *rec* as dependent variables in the short run, meaning that in the short run, financial markets have no effect on renewable energy consumption; however, it is positively significant in the long run for both groups. Therefore, the stock market value is an important positive factor affecting renewable energies in the long run. Growth rate significantly affects *re* in both the short and long run, although it is only significant in the short run for *rec* as a dependent variable. Neither type of renewable energy affects growth in the short run and long run. This result is similar to Dogan [35] that found little effect of renewable energy consumption on economic growth in Turkey. Destek [3] found negative effect of renewable energy consumption for South Africa and Mexico. However, Adams et al. [36] discovered positive effect of renewable energy consumption on economic growth in 30 Sub-Saharan African (SSA) countries.

By examining the relationship among two groups of renewable energy consumption, stock market value, and economic growth, the results of this study highlight a few points for policymakers in Iran who are looking for ways to improve public health by using clean energies. First, stock market development in Iran has led to an increase in renewable energy consumption for total hydropower, wind, solar, and nuclear energies, while has not affected the consumption of combustible renewable and waste energies. The

Table 4
ARDL diagnostic tests.

Dependent Variable	Model1		Model2	
	re	*gr*	*rec*	*gr*
Breusch-Godfrey Serial Correlation LM Test (lag 2)	4.59 (0.10)	5.17 (0.07)	2.81 (0.24)	2.39 (0.30)
Heteroskedasticity Test: ARCH	0.18 (0.66)	0.12 (0.71)	0.69 (0.40)	2.52 (0.11)

Notes: the numbers show Obs*R-squared and number in parenthesis indicate probability.

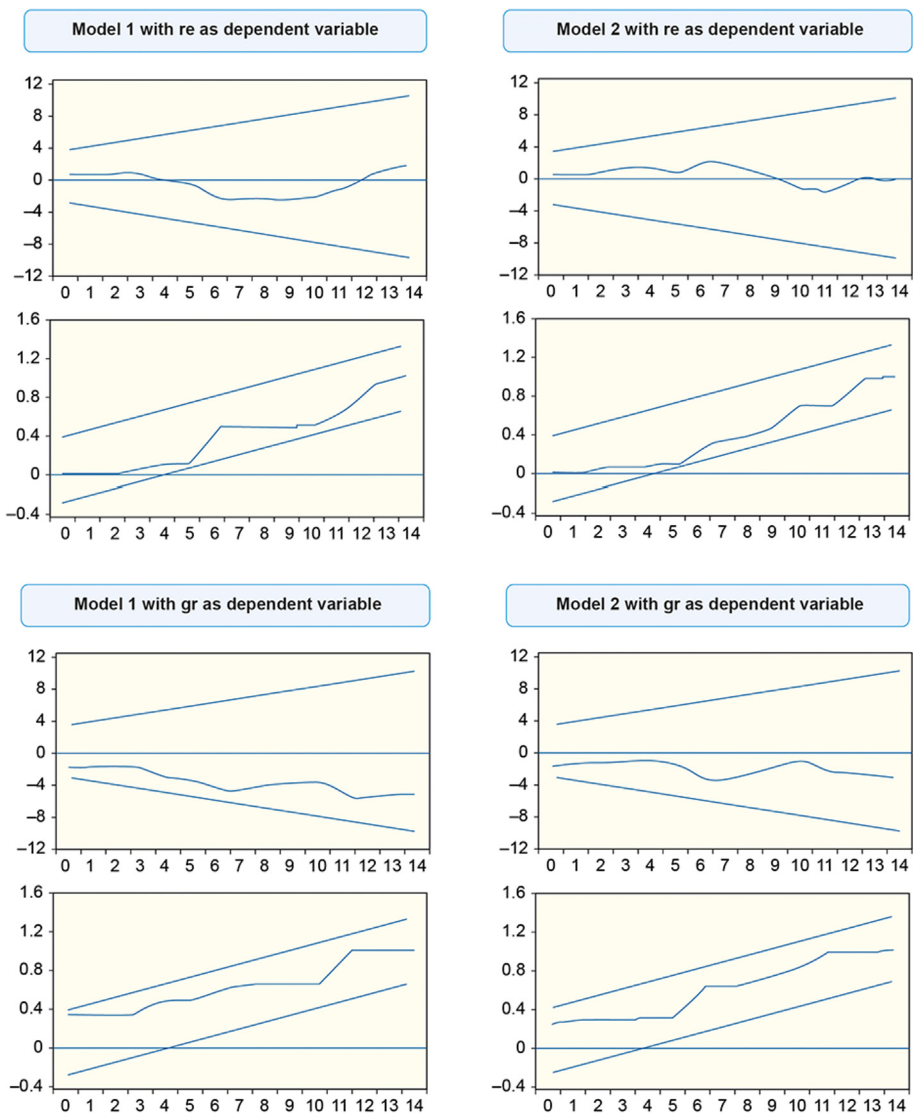

Fig. 3. Stability tests of ARDL models.

positive effect of stock market value on long-run economic growth shows that stock market development can increase renewable energy consumption in the long run. Second, economic growth can also lead to an increase in renewable energy consumption of the first group so policies towards increasing economic growth also lead to renewable energy consumption of first group. Third, given Iran's recent investments in the development and use of renewable energy technologies, the results of this research show that the country should continue to develop its renewable energy infrastructure in order to reap the full benefits.

Responses to the following questions can be a guide for policymakers to achieve sustainable development and to increase the health and well-being of the society.

- Do renewable energies have a positive effect on economic growth?
- Does the value of the stock market have a positive effect on economic growth?
- Does the value of the stock market have a positive effect on renewable energy?

If the value of the stock market affects both economic growth and renewable energy consumption, it can serve as a stimulus for using renewable energy and achieving sustainable development. Economic policymakers can increase renewable energy consumption by better understanding the nuances of the effects of stock market value and economic growth on each group of renewable energy and use this knowledge to facilitate the development of the applicable renewable energies for the improvement and spread of clean air.

References

[1] I.K. Maji, Does clean energy contribute to economic growth? Evidence from Nigeria, Energy Rep. 1 (2015) 145–150.
[2] O. Ocal, A. Aslan, Renewable energy consumption–economic growth nexus in Turkey, Renew. Sustain. Energy Rev. 28 (2013) 494–499.
[3] M.A. Destek, Renewable energy consumption and economic growth in newly industrialized countries: evidence from asymmetric causality test, Renew. Energy 95 (2016) 478–484.
[4] M.S.B. Aïssa, M.B. Jebli, S.B. Youssef, Output, renewable energy consumption and trade in Africa, Energy Policy 66 (2014) 11–18.
[5] M.B. Jebli, S.B. Youssef, Output, renewable and non-renewable energy consumption and international trade: evidence from a panel of 69 countries, Renew. Energy 83 (2015) 799–808.
[6] N. Apergis, J.E. Payne, Renewable energy consumption and economic growth: evidence from a panel of OECD countries, Energy Policy 38 (1) (2010) 656–660.
[7] N. Apergis, J.E. Payne, The renewable energy consumption–growth nexus in Central America, Appl. Energy 88 (1) (2011) 343–347.
[8] T. Chang, R. Gupta, R. Inglesi-Lotz, B. Simo-Kengne, D. Smithers, A. Trembling, Renewable energy and growth: evidence from heterogeneous panel of G7 countries using Granger causality, Renew. Sustain. Energy Rev. 52 (2015) 1405–1412.
[9] C.T. Tugcu, I. Ozturk, A. Aslan, Renewable and non-renewable energy consumption and economic growth relationship revisited: evidence from G7 countries, Energy Econ. 34 (6) (2012) 1942–1950.
[10] H.-T. Pao, Y.-Y. Li, H.-C. Fu, Clean energy, non-clean energy, and economic growth in the MIST countries, Energy Policy 67 (2014) 932–942.
[11] F. Karanfil, How many times again will we examine the energy-income nexus using a limited range of traditional econometric tools? Energy Policy 37 (4) (2009) 1191–1194.
[12] H. Hou, S.-Y.J. Cheng, The dynamic effects of banking, life insurance, and stock markets on economic growth, Jpn. World Econ. 41 (2017) 87–98.
[13] R.P. Pradhan, M.B. Arvin, S. Bahmani, J.H. Hall, N.R. Norman, Finance and growth: evidence from the ARF countries, Q. Rev. Econ. Financ. 66 (2017) 136–148.
[14] Ü. Seven, H. Yetkiner, Financial intermediation and economic growth: does income matter? Econ. Syst. 40 (1) (2016) 39–58.
[15] P. Sadorsky, Financial development and energy consumption in Central and Eastern European frontier economies, Energy Policy 39 (2) (2011) 999–1006.
[16] Z.K. Kakar, B.A. Khilji, M.J. Khan, Financial development and energy consumption: empirical evidence from Pakistan, International Journal of Trade, Economics and Finance 2 (6) (2011) 469.
[17] S.-C. Chang, Effects of financial developments and income on energy consumption, Int. Rev. Econ. Financ. 35 (2015) 28–44.
[18] Z.K. Kakar, Financial development and energy consumption: evidence from Pakistan and Malaysia, Energy Sources B Energy Econ. Plan. Policy 11 (9) (2016) 868–873.
[19] M. Shahbaz, S. Khan, M.I. Tahir, The dynamic links between energy consumption, economic growth, financial development and trade in China: fresh evidence from multivariate framework analysis, Energy Econ. 40 (2013) 8–21.
[20] M. Shahbaz, H.H. Lean, Does financial development increase energy consumption? The role of industrialization and urbanization in Tunisia, Energy Policy 40 (2012) 473–479.
[21] M. Shahbaz, T.H. Van Hoang, M.K. Mahalik, D. Roubaud, Energy consumption, financial development and economic growth in India: New evidence from a nonlinear and asymmetric analysis, Energy Econ. 63 (2017) 199–212.
[22] P. Sadorsky, The impact of financial development on energy consumption in emerging economies, Energy Policy 38 (5) (2010) 2528–2535.
[23] U.S.E.I.A. (EIA), Total primary energy consumption, in: U.S.E.I.A. (EIA), 2018.
[24] M.H. Pesaran, Y. Shin, R.J. Smith, Bounds testing approaches to the analysis of level relationships, J. Appl. Econom. 16 (3) (2001) 289–326.
[25] T.W. Bank, in: T.W. Bank (Ed.), World Development Indicators, 2018.
[26] I.D. Portal, Energy and Environment, Energy balance sheet, 2017.
[27] H. Akaike, Information Theory and an Extension of the Maximum Likelihood Principle, Selected Papers of Hirotugu Akaike, Springer, 1998, pp. 199–213.
[28] E.J. Hannan, B.G. Quinn, The determination of the order of an autoregression, J. R. Stat. Soc. Ser. B 41 (2) (1979) 190–195.
[29] G. Schwarz, Estimating the dimension of a model, Ann. Stat. 6 (2) (1978) 461–464.
[30] B. Ouattara, Foreign Aid and Fiscal Policy in Senegal, Mimeo University of Manchester Manchester, 2004.
[31] D.A. Dickey, W.A. Fuller, Distribution of the estimators for autoregressive time series with a unit root, J. Am. Stat. Assoc. 74 (366a) (1979) 427–431.
[32] P.C. Phillips, P. Perron, Testing for a unit root in time series regression, Biometrika 75 (2) (1988) 335–346.
[33] M. Kahia, M.S.B. Aïssa, C. Lanouar, Renewable and non-renewable energy use-economic growth nexus: the case of MENA Net Oil Importing Countries, Renew. Sustain. Energy Rev. 71 (2017) 127–140.
[34] B. Lin, M. Moubarak, Renewable energy consumption–Economic growth nexus for China, Renew. Sustain. Energy Rev. 40 (2014) 111–117.
[35] E. Dogan, Analyzing the linkage between renewable and non-renewable energy consumption and economic growth by considering structural break in time-series data, Renew. Energy 99 (2016) 1126–1136.
[36] S. Adams, E.K.M. Klobodu, A. Apio, Renewable and non-renewable energy, regime type and economic growth, Renew. Energy 125 (2018) 755–767.