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CAUSALITY RELATIONSHIP BETWEEN ELECTRICITY CONSUMPTION AND ECONOMIC GROWTH: INVESTIGATION FOR AZERBAIJAN, KAZAKHSTAN AND KYRGYZSTAN

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ABSTRACT

This research examines the causality relationship between electricity (energy) consumption and economic growth for Azerbaijan, Kazakhstan and Kyrgyzstan. The data set used in the research covers the years 1992-2015. Hacker and Hatemi-J (2006) for the non-asymmetric causality analysis and Hatemi-J (2012) for the asymmetric causality analysis were used as the research method. According to the results of the non-asymmetric causality analysis, while the Neutrality Hypothesis is supported for Azerbaijan and Kazakhstan, the Conservation Hypothesis for Kyrgyzstan is supported. However, according to the results of asymmetric causality analysis, while the Neutrality Hypothesis is supported for Azerbaijan in both positive and negative shocks, this hypothesis is supported by negative shocks in Kazakhstan and Growth Hypothesis is supported in positive shocks. In Kyrgyzstan, the Conservation Hypothesis is supported in negative shocks and the Neutrality Hypothesis remains supported in positive shocks. According to this, energy conservation policies have no effect on Azerbaijan's economic growth. However, it is seen that electricity (energy) consumption increases economic growth in Kazakhstan and that economic growth will increase with the increase of electricity (energy) consumption in Kyrgyzstan. This shows that in the electricity (energy) consumption of these countries, more effective results can be obtained by taking into account the positive and negative shocks and the determination of energy policies in economic development processes.

JEL Classification Codes: Q43, R11,P52, P25,P28

Key words: Electricity (energy) consumption, Economic growth, Asymmetric causality, Non-asymmetric causality

1. INTRODUCTION

Knowing the energy consumption and economic growth nexus is an important issue in determining energy policies of countries(Mukhtarov, Mikayilov, and İsmayılov, 2017). For that reason, studies related to the energy consumption-economic growth nexus are the focus of interest for both theoreticians and practitioners. Energy consumption contributes to increasing efficiency and national income (Alshami and Sabah, 2020), hence energy is an important input of production processes and can be regarded as a component of labor and capital production factors.

In literature four different hypotheses analyze the relationship between electricity consumption and economic growth. These hypotheses are the growth hypothesis, conservation hypothesis, feedback hypothesis and neutrality hypothesis. When electricity consumption is used as energy consumption data, the relationship in these hypotheses can be expressed as follows. In the growth hypothesis the direction of causality is from electricity consumption to economic growth. In such a case, electricity consumption contributes to economic growth as an integral element of labor and capital in the production process (Shahbaz et al., 2017). In the conservation hypothesis there is a unidirectional causality from economic growth to electricity consumption. According to this hypothesis, protective policies for electricity consumption do not affect economic growth (Paul and Bhattacharya, 2004). In the feedback hypothesis there is a bi-directional causality between economic growth and electricity consumption (Esso, 2010). In this case the implemented policies should also be appreciated in terms of energy supply. In the neutrality hypothesis electricity consumption has either a few or no effects on economic growth. For that reason, conservative energy policies will not have a negative effect on economic growth (Ghali and El-Sakka, 2004).

Azerbaijan, Kazakhstan and Kyrgyzstan which are analyzed in this study are among the countries which declared their independence following the dissolution of the Soviet Union in 1991. These three countries have rich energy resources and also show significant differences in terms of development. The question “Why was the relationship between energy consumption and economic growth of Azerbaijan, Kazakhstan and Kyrgyzstan analyzed in the

study?" will be answered. By answering this question the authentic value of the study and its contribution to the literature were emphasized. The first reason is that the geographical region of these three countries has the most important energy resources in the world. Rich oil and natural gas resources owned by Azerbaijan and Kazakhstan and hydro electric energy resources owned by Kyrgyzstan increase the strategic importance of these countries both in the region and in the world. Kazakhstan and Azerbaijan have important reserves in terms of non-renewable energy resources such as crude oil, oil products, natural gas and coal. Kyrgyzstan is an important country in terms of hydroelectric potential. So, the energy sector is the important component of economic growth for Azerbaijan, Kazakhstan and Kyrgyzstan (Aydın and Esen, 2017).

With the collapse of the Soviet Union, these countries with important energy resources came into prominence in energy production and energy export after they declared their independence especially Kazakhstan, which has important oil reserves. The petroleum and mining industries accounted for 33% of GDP in 2010 and 82% of exports (Hasanov et al., 2019). When considered in terms of energy consumption, Kazakhstan has a potential to be in the top 20 countries in the world. Kazakhstan's GDP was 179.3 billion USD in 2018 (World Bank, 2018).

Azerbaijan also has very important oil and natural gas resources, like Kazakhstan. Azerbaijan aims at accelerating its economic development by exporting its oil. Azerbaijan's oil and gas agreements with international companies and joint activities contributed to rapid development of its energy sector (Mehdiyev, 2001). Kyrgyzstan is not as lucky as Azerbaijan and Kazakhstan in terms of oil and gas resources. Kyrgyzstan, however, has rich water resources. This is an indicator of having rich hydro energy potential. This indicates that Kyrgyzstan has a potential to play an active role in today's economies in which sustainable development is a target.

The second reason is that there are not enough academic studies analyzing the electricty (energy) consumption and economic growth relationship in these countries with an important share in the world energy resources ranking (Mukhtarov et al., 2020; Aydın and Esen, 2017; Mukhtarov et al., 2017; Bildirici and Kayıkçı, 2012). Although the electricity consumption and economic growth relationship is commonly studied in literature, the issue has not been addressed in terms of the transition economies trying to change from centrally planned economies to free markets (Aydın and Esen, 2017).

The first study analyzing the relationship between electricity consumption and economic growth for Azerbaijan, Kazakhstan and Kyrgyzstan with CIS countries was done by Bildirici and Kayıkçı (2012). In the literature there are either no studies analyzing the electricity consumption-economic growth relationship of these countries as time series rather than group countries (for Kazakhstan) or these studies are uncommon (for Azerbaijan) (Mukhtarov et al., 2017).

Azerbaijan, Kazakhstan and Kyrgyzstan mostly constitute a very small part of the analyzed sample in conducted studies. These countries were mostly included in the studies within the countries of the Commonwealth of Independent States and their panel data analyses and evaluations were conducted. However, these studies are very limited in number in current literature. At this point, this study in which Azerbaijan and Kazakhstan with important oil and gas reserves are analyzed will fill the important gap in the literature. Including Kyrgyzstan in the study is important because it has hydro energy resources that would be a popular future energy resource in energy conversion processes in the world.

Electricity consumption was used as the energy consumption data in the study. Electricity is a production output obtained from renewable and non-renewable energy resources. It plays an active role in realizing economic growth as the complement of labor and capital that are production factors. Besides, electricity shortage in a country prevents effective use of other production factors and leads to problemsin production. For that reason, the continuity of electricity supply is very important for countries (Shahbaz et al., 2017). So, electricity consumption is a key component of economic growth (Costantini and Martini, 2010).

Another important point that constitutes the authentic value of the study is related with the method. The method used in this study is asymmetric causality analysis. No other study was found in the current literature review analyzing the effect of energy consumption on economic growth in these countries through asymmetric causality analysis. This is important in terms of evaluating the positive and negative shocks in electricity (energy) consumption and economic growth separately. In addition, discussing the obtained results in the study for each country separately is important for comparability of the results and the strategic decisions that would be developed by policy practitioners. This method used in the study will make significant contributions to the studies in future in order to evaluate the obtained results. It will

also help policy makers to explain how an increase or decrease in one variable would affect other variables and enable understanding of the causality between the economic variables.

The causality between electricity consumption and economic growth for Azerbaijan, Kazakhstan and Kyrgyzstan was analyzed in this study. Therefore, for which countries the four main theories expressing the relationship between electricity consumption and economic growth was valid could be analyzed. In addition, discussing the causality for positive and negative shocks separately is important for determining the effect of electricity consumption on economic growth in detail. Knowing the direction of causality relationships in question for different shocks can make important contributions to policy makers in making appropriate decisions.

This study consists of five parts. Following the introduction comes the literature review, then the used data set and method in the third part and empirical findings in the fourth part and finally the evaluations.

2. LITERATURE REVIEW

The relationship between energy consumption and economic growth in the literature is examined with four main hypotheses. These are the Growth Hypothesis, Conservation Hypothesis, Feedback Hypothesis and Neutrality Hypothesis. An increase in energy consumption accelerates economic growth in the Growth Hypothesis. According to this hypothesis, energy conservation affects growth negatively. However, increased income level causes energy consumption to increase in the Conservation Hypothesis. There must be a one-directional causality from economic growth to energy consumption in support of this hypothesis. According to this hypothesis, energy conservation measures do not affect economic growth. The Feedback Hypothesis predicts that economic growth will decrease with energy conservation measures. Energy consumption has no effect on economic growth in the Neutrality Hypothesis; therefore, energy conservation policies do not affect economic growth negatively in this hypothesis (Tuna and Tuna, 2019).

The relationship between electricity consumption and economic growth may vary according to the analyzed economy, used data or method (Ahmed and Azam, 2016; Mutascu, 2016; Streimikiene and Kasperowicz, 2016). In literature the relationship

between electricity consumption and economic growth is generally analyzed using panel data analysis (Doğan, Seker, and Bulbul, 2017; Kahia,Ben Aïssa, and Lanouar, 2017; Narayan and Doytch, 2017; Saidi and Mbarak, 2017; Antonakakis,Chatziantoniou, and Filis, 2017; Hasanov, Bulut and Süleymanov, 2017; Osman,Gachino, and Hoque,2016; Long et al., 2015; Selahuddin and Gow, 2014; Omri, 2013; Özcan, 2013; Acaravci and Özturk, 2010; Pao and Tsai, 2010; Mehrara, 2007; Al-Iriani, 2006). Studies have also used time series, but theyare more limited in number (Nyasha, Gwenhure and Odhiambo, 2018; Amri, 2017; Ohlan, 2016; Tang, Tan and Öztürk, 2016; Alshehry and Belloumi, 2015; Long et al.,2015; Mohammadi and Amin, 2015; Shahateet, 2014; Tuğcu, Ozturk, and Aslan, 2012; Soytaş, Sarı and Ewing, 2007). However, it is not always possible to find a stable result in causality analysis in which the relationship between electricity consumption and economic growth is analyzed. In empirical studies the causality relationship not only may vary from country to country, but it also differs according to the data set, energy sources and socio-economic policies or the method used as well (Kao and Wan, 2017).

The studies analyzing the relationship between electricity consumption and economic growth separately in the countries examined within this study are very limited in number (Mukhtarov et al., 2020; Aydın and Esen, 2017). While in the analyzed literature, Hasanov et al. (2017), Narayan (2016), Sentürk and Sataf (2015), Tang and Abosedra (2014), Bildirici and Kayıkçı (2013), Bildirici and Kayıkçı (2012), Apergis and Payne (2010a), Apergis and Payne (2010b), Apergis and Payne (2009), studied these countries as a group through panel causality analyses while Mukhtarov et al. (2020), Acaravci and Erdoğan (2017), Kalyoncu Gürsoy, and Göcen, (2013), studied these countries separately.

A few studies analyzing the energy consumption and economic growth of Azerbaijan, Kazakhstan and Kyrgyzstan separately could be found in the literature reviewed (Mukhtarov et al., 2017, 2020; Aydın and Esen, 2017). The countries analyzed within these studies was very small parts ofthe sample in different academic studies. The separate analysis of Azerbaijan, Kazakhstan and Kyrgyzstan in this current study will provide detailed information for the energy policy practitioners of each country. At the same time, traditional methods used in previous studies arepanel data analysis (Mukhtarov et al., 2020; Mukhtarov et al., 2017). However, applying the asymmetric causality analysis for each

country separately in this current study is important to obtain detailed results and it distinguishes this study from those in the literature.

Reynolds and Kolodziej (2008) analyzed the transition process of the former Soviet Union in the 1987-1996 period. Energy resource consumption such as oil, coal and gas and economic growth data from 1960 to 2007 were used in the study. According to the study results, there is a one-directional causality from economic growth to coal and gas consumption and from oil consumption to economic growth.

Apergis and Payne (2009) analyzed the energy consumption and economic growth nexus in 1991-2005 period for the Commonwealth of Independent States using panel cointegration and ECM (Error Correction Model). According to the study , there is a bi-directional causality between energy consumption and economic growth in the long run; however, there is a one-directional causality from energy consumption to economic growth in the long run. Apergis and Payne (2010a) analyzed the 1992-2004 period for Commonwealth of Independent States. According to results of this study, there is a bi-directional causality from energy consumption to economic growth. In their study, Apergis and Payne (2010b) analyzed OECD countries (inluding Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Lithuania, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan) for 1992-2007 period using panel VECM (Vector error correction model). The results showed there is a bi-directional causality for renewable energy consumption and economic growth in the long and short runs.

Bildirici and Kayıkçı (2012) were the first researchers analyzing the relationship between electricity consumption and economic growth through static panel data approach for the 1990-2009 period in CIS countries. They found that there is a unidirectional causality from electricity consumption to economic growth. While Kalyoncu et al. (2013) in their study of Georgia, Azerbaijan and Armenia for the 1995-2009 period stated that there is a unidirectional relationship from economic growth to electricity consumption for Armenia, no such relationship exists for Azerbaijan and Georgia. However, when Bildirici and Kayıkçı (2013) analyzed the relationship between oil production and economic growth for Azerbaijan, Kazakhstan, Russian Federation and Turkmenistan for the 1993-2010 period using Pedroni panel cointegration analysis, the results showed a bi-directional causality between energy consumption and economic growth.

Tang and Abosedra (2014) in their study for 24 MENA countries including Azerbaijan analyzed the energy consumption and economic growth nexus for the 2001-2009 period using panel OLS (Least Squares) method. The results reveal a one-directional causality from energy consumption to economic growth.

Şentürk and Sataf (2015) analyzed the energy consumption and economic growth nexus of Turkic Republics (including Azerbaijan and Kazakhstan for the 1992-2012 period using panel FMOLS, DOLS and VECM models. The study found there is no causality in the short run, but there is a bi-directional causality in the long run.

Using panel regression model, Narayan (2016) analyzed 135 countries with high, medium and low income levels in which Commonwealth of Independent States are included forthe 1884-2010 period. According to the results of the study, causality exists from economic growth to energy consumption for the developing countries and a causality from energy comsumption to economic growth for the countries with low medium income level.

According to Acaravci and Erdoğan's (2017) study, for the 1992- 2012 period, there is a bi-directional causality from economic growth and electricity consumption for Kazakhstan and Uzbekistan, a unidirectional causality from economic growth to electricity consumption for Turkmenistan and no causality for Azerbaijan and Kyrgyzstan.

Hasanov et al. (2017), in their study on 10 oil-exporting countries including Azerbaijan, stated that causality exists from economic growth to electricity consumption. Mukhtarov et al. (2020) indicated a bi-directional causality between economic growth and electricity consumption for Kazakhstan in the 1993-2014 period.The results on the hypotheses obtained from past literaturesare displayed in Table 1.

Some studies in literature favor the growth hypothesis (Narayan, 2016; Tang and Abosedra, 2014; Bildirici and Kayıkçı, 2012; Apergis and Payne, 2009; Reynolds and Kolodziej, 2008), and conservation hypothesis (Acaravci and Erdoğan, 2017; Hasanov et al., 2017; Narayan, 2016; Kalyoncu et al., 2013; Reynolds and Kolodziej, 2008), feedback hypothesis (Mukhtarov et al., 2020; Acaravci and Erdoğan, 2017; Şentürk and Sataf, 2015; Bildirici and Kayıkçı, 2013; Apergis and Payne, 2009, 2010a, 2010b;) and neutrality hypothesis (Acaravci and Erdoğan, 2017; Kalyoncu et al., 2013).

TABLE 1
Literature for Azerbaijan, Kazakhstan or Kyrgyzstan

Author(s)	Country	Period	Methodology	Hypothesis			
				Growth	Conservation	Feedback	Neutrality
Reynolds and Kolodziej(2008)	The Soviet Union	1960-2007	Granger Causality Analysis	✓	✓		
Apergis and Payne (2009)	Commonwealth of Independent States	1991-2005	Panel cointegration and ECM	✓		✓	
Apergis and Payne (2010a)	Commonwealth of Independent States	1992-2004	Panel cointegration, panel causality, FMOLS			✓	
Apergis and Payne (2010b)	OECD Countries	1992-2007	Panel VECM			✓	
Bildirici and Kayıkçı (2012)	CIS countries, including Azerbaijan	1990-2009	Static panel data approach and GMM	✓			
Kalyoncu et al. (2013)	Georgia	1995-2009	The Engle-Granger cointegration, Granger Causality				✓
	Azerbaijan						✓
	Armenia				✓		
Tang and Abosedra(2014)	24 MENA Country with Azerbaijan	2001-2009	Panel OLS	✓			
Şentürk and Sataf (2015)	Turkish states including Azerbaijan and Kazakhstan	1992-2012	Panel FMOLS, DOLS and VECM			✓	
Narayan (2016)	135 countries with high middle low income including the Commonwealth of Independent States	1984-2010	Panel regression	✓	✓		
Acaravci and Erdoğan (2017)	Turkic Republics	1992-2012	Konya Panel Causality				
	Kazakhstan and Uzbekistan					✓	
	Turkmenistan				✓		
	Azerbaijan and Kyrgyzstan						✓
Hasanov et al. (2017)	10 oil-exporting countries, including Azerbaijan	1997-2014	Panel Granger-causality		✓		
Mukhtarov et al. (2020)	Kazakhstan	1993-2014	VECM, Toda-Yamamoto Causality			✓	

Source: Prepared by the author.

3. DATA AND METHODOLOGY

3.1. DATA

Electricity (energy) consumption and economic growth data of Azerbaijan, Kazakhstan and Kyrgyzstan between 1992 and 2015 are used in this study. Gross domestic product (GDP) is used for economic growth data, fixed with the dollar. However, electricity energy production was used for energy consumption data. Electricity (energy) consumption data is measured by billion kilowatt hours (kwh).

This study is important as it presents new evidence on causality of the consumption and economic growth of Azerbaijan, Kazakhstan and Kyrgyzstan. The electricity (energy) consumption and economic growth nexus is analyzed in this study separately for its reaction to positive and negative shocks. Positive or negative shocks in one variable may have different effect on the other economic variables (Shahbaz et al, 2017). So, it is important to know the asymmetric relationship between the variables.

3.2. METHODOLOGY

The causality between economic growth and electricity consumption for Azerbaijan, Kazakhstan and Kyrgyzstan is analyzed in this study. For this purpose, the model developed by Aqeel and Butt (2001) and Wolde-Rufael (2006) was used.

(1) $$Y_t = f(E_t)$$

where

Y = Economic growth
E = Total electricity consumption.

This model can be expressed as:

(2) $$LY_t = \beta_0 + \beta_1 LE_t + \varepsilon_t$$

where

LY = Log of GDP (Atif and Siddiqi, 2010)
LE = Log of electricity consumption (Atif and Siddiqi, 2010)

This study uses the Hacker-Hatemi-J(2006) and Hatemi-J(2012) Causality Test. In the Hacker-Hatemi-J (2006) test the causality is tested by the following (VAR) model:

(3) $y_t = \alpha + A_1 y_{t-1} + \cdots + A_p y_{p-1} + u_t$

where

y_t = Variable vector in 2-1 dimension
A = Parameter vector

Here, the main hypothesis indicates that there is no Granger causality between series. In order to test this hypothesis, Wald statistics were used. In order to obtain the Wald statistics, the VAR model indicated in this equation is expressed as the following:

(4) $Y = DZ + \delta$

The statements in this model can be expressed as the following:

$$Y = (y_1^+, y_2^+, y_3^+, \ldots\ldots\ldots y_T^+)$$
$$D = (\alpha,\ A_1, A_2, \ldots\ldots\ldots\ldots A_p)$$
$$Z = (Z_0,\ Z_1, Z_2, \ldots\ldots\ldots\ldots Z_{T-1})$$
$$Z_t = \begin{bmatrix} 1 \\ y_t^+ \\ y_{t-1}^+ \\ \cdot \\ \vdots \\ \cdot \\ y_{t-p+1}^+ \end{bmatrix}$$

$$\delta = (u_1^t, u_2^t, u_3^t, \ldots . u_T^t)$$

Wald test statistics:

(5) $W = (C\beta)'[C((Z'Z)^{-1} \otimes S_U)C']^{-1}(C\beta)^{-1}$

where

$\otimes$ = Kronecker multiplication
C = The indicator function including the limitations

β = *vec (D)* that *vec* means the column-accumulation operator

q Number of lag in VAR equilibrium, it indicates the variance-covariance matrix calculated for unlimited VAR model as S_U

$$\hat{\delta}_u' \hat{\delta}_u \Big/ (T-q)$$

According to Hatemi-J (2012), it is asymmetric in the sense that positive and negative shocks may have different impacts. It is defined as the following random walk processes:

$$(6) \qquad y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1t}$$

$$(7) y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2t}$$

where t=1,2,... T, the constants are the initial values and the variables signify white noise disturbance terms. Positive and negative shocks are defined as follows:

$$\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0), \varepsilon_{1i}^{-} = \max(\varepsilon_{1i}, 0), \varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0), \varepsilon_{2i}^{-} = \max(\varepsilon_{2i}, 0),$$

respectively. Therefore, it can be suggested :

$\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}, \varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$

and equation can be rewritten as the following:

$$(8) \qquad y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-}$$

$$(9) \qquad y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-}$$

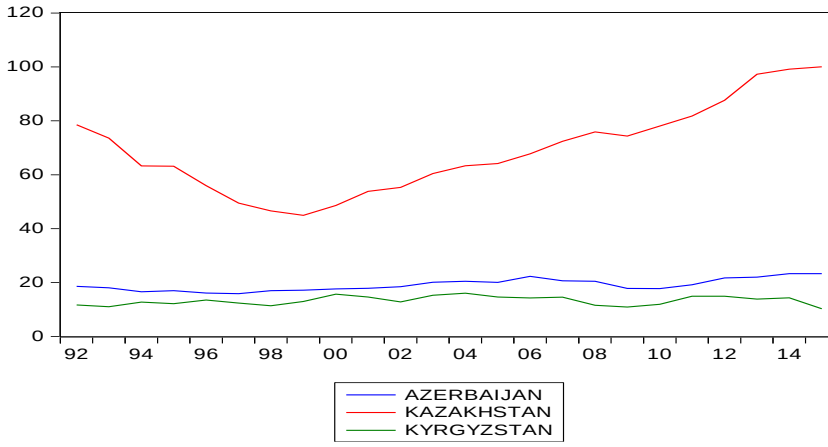
In Hatemi-J (2012), it is asymmetric in the sense thatpositive and negative shocks may have different causal impacts. The positive and negative shocks of each variable can be defined in a cumulative form as

$$(10) y_{1i}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}, y_{1i}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}, y_{2i}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}, y_{2i}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-},$$

4. EMPIRICAL RESULTS

Electricity (energy) consumption of Azerbaijan, Kazakhstan and Kyrgyzstan analyzed in the study is displayed in Figure 1.

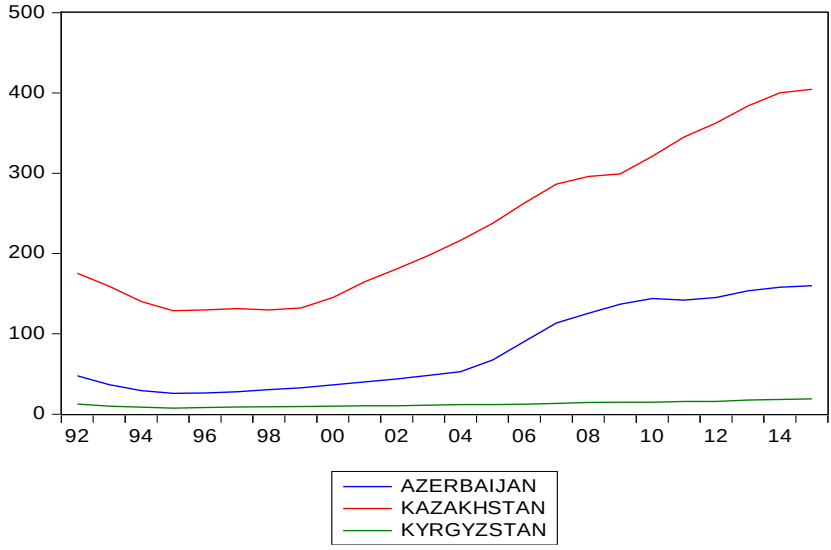
FIGURE 1
Electricity (Energy) Consumption for
Azerbaijan, Kazakhstan and Kyrgyzstan



. Electricity (energy) consumption in Azerbaijan and Kazakhstan generally tends to increase positively.

Accordingly, Kyrgyzstan experienced a significant decrease in electricity consumption especially following independence. Electricity consumption has been decreasing ever since 1995. The share of electricity consumption which was 43.8 % in the transition period decreased to 29.3 % in the 2007-2012 period. The share of electricity consumption has rapidly decreased due to the non-renewal of the hydro infrastructure from the Soviet Russian period, meeting the need for rapid growth from oil, the increase in electricity exports was substantial (from $31 million in 1995 to $142 million in 2011) (Bostan and Ravanoğlu; 2018). In Azerbaijan electricity consumption was not similar to that in Kyrgyzstan. Electricity consumption in Azerbaijan and Kyrgyzstan does not change greatly over the years. However, in Kazakhstan, the change in electricity consumption which has decreased especially until 2000 and has begun to increase since then is remarkable. This decrease can be attributed to different reasons such as recession in the sector after the collapse of the Soviet Union. However, there was a significant increase in electricity consumption in the 2000-2015 period. The most important reason for this increase in electricity consumption is related to the implemented energy policies (Mukhtarov et al., 2020).

FIGURE 2
Economic Growth for Azerbaijan, Kazakhstan and Kyrgyzstan



When we look at the changes in economic growth, as in Figure 2, the growth rate of Azerbaijan, Kazakhstan and Kyrgyzstan economies decreases until 1996.

This decrease may be due to the collapse of the Soviet Union. However, after 1996, economic growth in all three countries was positive and in particular, in the period of 2000-2007, Azerbaijan and Kazakhstan reached their highest economic growth. Oil prices increasing especially in the 2000s affected the export value in oil and gas sectors positively. However, despite the export in oil and gasbyAzerbaijan and Kazakhstan ,the global crisis of 2008 decreased the rate of economic growth (Mukhtarov et al., 2020). After 2013, the economic growth rate decreased for Azerbaijan. The Kyrgyzstan economy also tends to be stable in general.

The descriptive statistics ofelectricity (energy) consumption and economic growth data of Azerbaijan, Kazakhstan and Kyrgyzstan are displayed in Table 2. According to Table 2, while Kazakhstan has the highest electricity (energy) consumption with 65.23577 billion kilowatt hourson average, Kyrgyzstan has the lowest consumption with 12.91525 billion kilowatt hours. The largest deviation in electricity (energy) consumption data is in Kazakhstan, while the smallest deviation is in Azerbaijan. Skewness

coefficients for Kazakhstan and Kyrgyzstan are significantly negative, indicating that the distributions of electricity consumption are skewed to the left. The distribution of electricity consumption for Azerbaijan is skewed to the right. Kurtosis coefficients for Azerbaijan, Kazakhstan and Kyrgyzstan are significantly positive, while the distributions of electricity consumption are leptokurtic.

TABLE 2
Descriptive Statistical Values for Variables

	Electricity (Energy) Consumption			Economic Growth		
	Azerbaijan	Kazakhstan	Kyrgyzstan	Azerbaijan	Kazakhstan	Kyrgyzstan
Mean	19.159	65.235	12.915	79.826	234.678	12.391
Median	18.525	63.749	13.260	50.587	207.120	11.996
Maximum	23.320	99.177	16.037	160.085	404.547	19.019
Minimum	15.912	10.055	1.280	25.963	128.855	7.577
Std. Dev.	2.241	18.994	2.917	51.922	96.865	3.328
Skewness	0.417	-0.644	-2.671	0.426	0.444	0.458
Kurtosis	2.025	4.366	11.667	1.433	1.753	2.126
Num. of Observation	24	24	24	24	24	24

Kazakhstan, with the largest gross domestic product value of 234.678 billion dollars, is the country with the highest economic growth out of the three countries in study. However, Kyrgyzstan has the smallest economic growth value with 12.391 billion dollars of gross domestic product. While Kazakhstan has the biggest variation in economic growth values, Azerbaijan and Kyrgyzstan follow it. Skewness coefficients for all of them are significantly positive, indicating that the distributions of economic growth are skewed to the right. Kurtosis coefficients for Azerbaijan, Kazakhstan and Kyrgyzstan are significantly positive, while the distributions of electricity consumption are leptokurtic.

Unit root analysis is primarily conducted on the variables. All variables in the study have unit root at level. All the series were taken at their first differences. So, all variables were made stable.

Results of the non-asymmetric and asymmetric causality tests are presented in order to appreciate the reflections of the electricity (energy) consumption and economic growth nexus of these countries separately.. Energy consumption and economic growth commonly used following this part indicate electricity (energy) consumption and economic growth values.

TABLE 3
The Non-Asymmetric and Asymmetric Causality Analysis (EG-EC)

Country	Hypothesis	Wald Test Statistic	Bootstrap Critical Values		
			1%	5%	10%
Azerbaijan	EG≠>EC	0,221	13,220	7,484	5,521
	EG^{+}≠>EC^{+}	1,123	9,223	4,715	2,995
	EG^{-}≠>EC^{-}	0,006	9,773	4,491	3,011
Kazakhstan	EG≠>EC	0,292	11,543	7,391	5,248
	EG^{+}≠>EC^{+}	0,001	8,631	4,549	2,911
	EG^{-}≠>EC^{-}	0,002	8,709	4,568	3,221
Kyrgyzstan	EG≠>EC	17,816***	11,954	6,962	5,409
	EG^{+}≠>EC^{+}	10,439	25,152	13,798	10,575
	EG^{-}≠>EC^{-}	22,240**	32,538	18,290	13,842

Note: *, **, *** indicate level of significance at 1%, 5% and 10%, respectively.

According to the results of non-asymmetric causality analysis from Table 3, only Kyrgyzstan has a causal relationship from economic growth to electricity (energy) consumption. For Azerbaijan and Kyrgyzstan, such a relationship does not exist for non-asymmetric causality analyses. Likewise, this result obtained for Azerbaijan and Kyrgyzstan is supported by asymmetric causality analysis. Asymmetric causality test was used to evaluate whether the causal nexus for Kyrgyzstan held true for positive or negative shocks. According to the results of the asymmetric causality test, this is supported only in negative shocks.

Results of the causality analysis from electricity (energy) consumption to economic growth are presented in Table 4. According to the non-asymmetric causality test, there is no causality for any country. However, according to the asymmetric causality test, there is causality relationship only in Kazakhstan for positive

shocks. Finally, there is no causality,neither positive nor negative, shocks for all other countries except for Kazakhstan.

TABLE 4
The Non-Asymmetric and Asymmetric Causality Analysis (EC-EG)

Country	Hypothesis	Wald Test Statistic	Bootstrap Critical Values		
			1%	5%	10%
Azerbaijan	EC≠>EG	0,949	12,915	7,300	5,353
	EC^{+}≠>EG^{+}	0,869	9,006	4,655	2,815
	EC^{-}≠>EG^{-}	0,778	8,937	4,971	3,191
Kazakhstan	EC ≠> EG	0,331	14,993	7,613	5,488
	EC^{+}≠>EG^{+}	4,342*	10,457	4,602	3,213
	EC^{-}≠>EG^{-}	0,257	11,437	5,452	3,498
Kyrgyzstan	EC ≠> EG	0,765	15,030	7,137	5,246
	EC^{+}≠>EG^{+}	11,624	34,702	22,269	15,348
	EC^{-}≠>EG^{-}	3,152	29,601	17,163	12,235

Note: *, **, *** indicate level of significance at 1%, 5% and 10%, respectively.

The results of causality analysis evaluated for the four main hypotheses are shownin Table 5.

TABLE 5.
Results of Hypotheses for Non-asymmetric Causality Analysis

Electricity (energy) Consumption and Economic Growth Nexus				
Country	Growth	Conservation	Feedback	Neutrality
Azerbaijan	-	-	-	✓
Kazakhstan	-	-	-	✓
Kyrgyzstan	-	✓	-	-

While non-asymmetric causality analysis results favor the Neutrality Hypothesis for Azerbaijan and Kazakhstan, it favors the Conservation Hypothesis for Kyrgyzstan.

This result obtained for Azerbaijan is similar to Kalyoncu et al. (2013) and Acaravci-Erdoğan's (2017) study results. However, this result obtained for Kazakhstan is not similar to the current literature. Acaravciand Erdoğan(2017) and Mukhtarov et al. (2020) concluded that the Feedback Hypothesis was valid for Kazakhstan. However, this resultis different from the current literature for

Kyrgyzstan. Accordingly, energy conservation policies implemented in Azerbaijan and Kazakhstan do notaffect economic growth. The result for Kyrgyzstan favors that electricity consumption will increase with an increase in income level. Also, energy conservation policies implemented for Kyrgyzstan do not influence economic growth. In general, non-asymmetric causality analysis results favor that energy policies implemented in Azerbaijan, Kazakhstan and in Kyrgyzstan they have no or little effect on economic growth.

According to Table 6, for asymmetric causality analysis, the Neutrality Hypothesis is confirmed for Azerbaijan in positive and negative shocks. So, Neutrality Hypothesis is supported for positive shocks in Kyrgyzstan and this hypothesis is supported in negative shocks for Kazakhstan. According to this hypothesis, electricity consumption has either a few or no effects on economic growth. The Growth Hypothesis is supported in positive shocks for Kazakhstan. This indicates that electricity consumption is a crucial component for economic growth. According to the analysis results for Kyrgyzstan, the Conservation Hypothesis is supported only for negative shocks. This shows that electricity consumption is not a crucial component in economic growth. This result obtained for Kyrgyzstan is similar to that of Acaravciand Erdoğan's (2017). Energy (electricity) conservation policies are suitable because they have no unfavorable effect on economic growth in which the Conservation and Neutrality hypotheses are valid.

TABLE 6
Electricity (energy) Consumption and Economic Growth Nexus for Asymmetric Causality Analysis

Electricity (energy) Consumption and Economic Growth Nexus								
Country	Growth		Conservation		Feedback		Neutrality	
	Positive Shocks	Negative Shocks	Positive Shocks	Negative Shocks	Positive Shocks	Negative Shocks	Positive Shocks	Negative Shocks
Azerbaijan	-	-	-		-	-	✓	✓
Kazakhstan	✓	-	-		-	-	-	✓
Kyrgyzstan	-	-	-	✓	-	-	✓	-

5. CONCLUSION AND POLICY IMPLICATIONS

This study examines the causality in the electricity (energy) consumption and economic growth nexus for Azerbaijan, Kazakhstan and Kyrgyzstan. Electricity (energy) consumption data includes the electricity used in production. GDP is used for the economic growth data. The data set between 1992 and 2015 are used in this study. As the research model, Hacker-Hatemi-J (2006) and Hatemi-J(2012) causality tests are used. According to the non-asymmetric causality analysis results in the study, the Neutrality Hypothesis is supported for Azerbaijan and Kazakhstan and Conservation Hypothesis is supported for Kyrgyzstan. Through the results of asymmetric causality analysis conducted for a more detailed analysis of this situation,the Neutrality Hypothesis, which is supported for Azerbaijan, is supported for positive and negative shocks. Neutrality Hypothesis is supported for Kazakhstan in negative shocks and Growth Hypothesis is supported in positive shocks. However, Conservation Hypothesis, which is supported according to non-asymmetric causality analysis results, is supported in Kyrgyzstan for negative shocks and Neutrality Hypothesis is supported for positive shocks.

According to the study, there is no causality between electricity (energy) consumption and economic growth for Azerbaijan. This suggests that energy conservation policies have no effect on economic growth in Azerbaijan. Neutrality Hypothesis which suggests there is no energy consumption-economic growth nexus is supported only in negative shocks in Kyrgyzstan. However, the Growth Hypothesis is supported for Kazakhstan in positive shocks. Accordingly, an increase in energy consumption in Kazakhstan increases economic growth. However, a decrease in energy consumption is not a factor affecting the economic growth negatively. This favors the result that energy conservation policies in Kazakhstan have no negative effect. In addition, this is supported only in negative shocks and the Neutrality Hypothesis is supported in positive shocks according to asymmetric causality results in Kyrgyzstan in which the Conservation Hypothesis is supported according to non-asymmetric causality analysis results. In other words, there is no causality between the increase in income level and energy consumption in Kygyzstan. However, the decrease in income level decreases energy consumption. In this case, energy

conservation policies have no effect on economic growth in Kyrgyzstan.

The obtained results show that analyzing the results in positive and negative shocks in electricity (energy) consumption separately while determining energy policies will help countries to determine more accurate energy conservation strategies. Exploring the relationship between electricity consumption and economic growth is very important for policymakers in order to be able to implement appropriate energy policies. Therefore, having the necessary energy resources is of critical importance for a country to ensure sustainable economic growth (Aydın and Esen; 2017). In order to realize effective economic development and growth, Azerbaijan, Kazakhstan and Kyrgyzstan should determine their energy policies by considering the existing conditions.

What is noteworthy here is that the positive or negative changes in energy consumption have different effects on economic growth. This is the most important point to consider in determining new energy policies. An energy-based growth policy may not always be supported in Azerbaijan, Kazakhstan and Kyrgyzstan. The increase in energy consumption is not a factor that increases the economic growth in all cases. The decrease in energy consumption also does not affect economic growth. Knowing this fact is highly important for countries to ensure sustainable economic development.

The increase or decrease in electricity consumption does not have any effect on economic growth in Azerbaijan. For that reason, policy makers should focus on other factors affecting economic growth in policies to be implemented in order to foster economic growth and also take into account that the effect of electricity consumption is not so great.

Any increase in electricity consumption leads to economic growth in Kazakhstan. However, the decrease in electricity consumption has no effect on economic growth. Therefore, it can be said that increase in electricity in Kazakhstan plays an important role for economic growth. For that reason, policy makers in Kazakhstan should consider the practices that encourage investments in the energy infrastructure and the regulations that can ensure energy supply continuity while organizing energy policies. In addition, negative effects of energy saving policies on economic growth should be considered.

A decrease in economic growth also decreases the electricity consumption in Kyrgyzstan. However, the increase in economic growth has no significant effect on the increase in electricity

consumption. At that point, while organizing energy policies, policy makers should consider that in Kyrgyzstan there is an economic growth independent from electricity consumption.Different dynamics of economic growth should be focused on.

The fact that the concept of sustainable development in the world rapidly increases theirattractiveness makes it necessary to turn to the consumption of renewable energy resources. At this point, it is a must for Azerbaijan and Kazakhstan to concentrate on efficient use of alternative sources such as renewable energy resources. Kyrgyzstan has the potential to reach an important point in the world energy market by using the existing hydroelectric energy resources more effectively and productively.

Electricity (energy) consumption and economic growth were analyzed in this study for only non-renewable energy resources for Azerbaijan, Kazakhstan and Kyrgyzstan. However, while Azerbaijan and Kazakhstan have potential for non-renewable energy resources, Kyrgyzstan is very rich in renewable energy resources. Hence, in order to determine the role of renewable energy sources consumption in economic development, it is important to study this in detail in the future to obtain significant results for economic development and energy sector.

REFERENCES

Aqeel, A., and M.S. Butt. “The Relationship Between Energy Consumption and Economic Growth in Pakistan.” *Asia-Pacific Development Journal* 8, no. 2 (2001): 101-10.

Acaravci, A., and I. Ozturk. “Electricity Consumption-Growth Nexus: Evidence from Panel Data for Transition Countries.” *Energy Economics* 32, no. 3 (2010): 604-8.

_____, and S. Erdoğan. “Türki Cumhuriyetlerde Elektrik Tüketimi, Reel Gelir ve Dışa Açıklık İlişkisi: Bootstrap-Granger Nedensellik Yaklaşımı.” *Uluslararası Ekonomi ve Yenilik Dergisi* 3, no. 2 (2017): 73-84.

Ahmed, M., and M. Azam. “Causal Nexus between Energy Consumption and Economic Growth for High, Middle and Low İncome Countries Using Frequency Domain Analysis.” *Renewable and Sustainable Energy Reviews* 60 (2016): 653-78.

Al-Iriani, M.A. "Energy-GDP Relationship Revisited: An Example From GCC Countries Using Panel Causality." *Energy Policy* 34, no. 17 (2006): 3342-50.

Alshami, M.A., and A. Sabah. "The Strategic Importance of Energy Consumption to Economic Growth: Evidence from the UAE." *International Journal of Energy Economics and Policy* 10, no.1 (2020): 114-9.

Alshehry, A.S., and M. Belloumi. "Energy Consumption, Carbon Dioxide Emissions and Economic Growth: The Case of Saudi Arabia." *Renewable and Sustainable Energy Reviews* 41 (2015): 237-47.

Amri, F. "The Relationship Amongst Energy Consumption (Renewable and Non-Renewable), and GDP in Algeria." *Renewable and Sustainable Energy Reviews* 76 (2017): 62-71.

Antonakakis, N., I. Chatziantoniou, and G. Filis. "Energy Consumption, CO2 emissions, and Economic Growth: An Ethical Dilemma." *Renewable and Sustainable Energy Reviews* 68 (2017): 808-24.

Apergis, N., and J.E. Payne. "Energy Consumption and Economic Growth: Evidence from the Commonwealth of Independent States." *Energy Economics* 31, no. 5 (2009): 641-7.

_____. "The Emissions, Energy Consumption, and Growth Nexus: Evidence from the Commonwealth of Independent States." *Energy Policy* 38, no.1 (2010a): 650-5.

_____. "Renewable Energy Consumption and Economic Growth: Evidence from A Panel of OECD Countries." *Energy Policy* 38, no. 1 (2010b): 656-60.

Atif, S.M., and M.W. Siddiqi. "The Electricity Consumption and Economic Growth Nexus in Pakistan: A New Evidence." (2010).https://www.econstor.eu/handle/10419/65688.

Aydın, C., and Ö. Esen. "Does Too Much Energy Consumption Harm Economic Growth for Turkish Republics in the Transition Process? New Evidence on Threshold Effects." *International Journal of Energy Economics and Policy* 7, no. 2 (2017): 34-43.

Bildirici, M.E., and F. Kayıkçı. "Economic Growth and Electricity Consumption in Former Soviet Republics." *Energy Economics* 34, no. 3 (2012): 747-53.

_____. "Effects of Oil Production on Economic Growth in Eurasian Countries: Panel ARDL Approach." *Energy* 49 (2013): 156-61.

Bostan, A., and A. Ravanoğlu. "Kırgızistan Ekonomisinde Ekonomik Büyüme Ve Enerji Tüketimi İlişkisi Açısından Sürdürebilir Büyüme Analizi." *Ekonomi, Politika & Finans Araştırmaları Derqisi* 3, no. 2 (2018): 181-94.

Costantini, V., and C. Martini. "The Causality Between Energy Consumption and Economic Growth: A Multi-Sectoral Analysis Using Non-Stationary Cointegrated Panel Data." *Energy Economics* 32, no. 3 (2010): 591-603.

Doğan, E., F. Seker, and S. Bulbul. "Investigating the İmpacts of Energy Consumption, Real GDP, Tourism and Trade on CO2 Emissions by Accounting for Cross-Sectional Dependence: A Panel Study of OECD Countries." *Current Issues in Tourism* 20, no. 16 (2017): 1701-19.

Esso, L.J."Threshold Cointegration and Causality Relationship Between Energy Use and Growth in Seven African Countries." *Energy Economics* 32, no. 6 (2010): 1383-91.

Ghali, K.H., and M.I. El-Sakka. "Energy Use and Output Growth in Canada: A Multivariate Cointegration Analysis." *Energy Economics* 26, no. 2 (2004): 225-38.

Hacker, R.S., and A. Hatemi-J. "Tests for Causality Between İntegrated Variables Using Asymptotic and Bootstrap Distributions: Theory and Application."*Applied Economics* 38, no. 13 (2006): 1489-500.

Hatemi-J, A. "Asymmetric Causality Tests with an Application."*Empirical Economics* 43, no. 1 (2012): 447-56.

Hasanov, F.J., C. Bulut, and E. Suleymanov. "Review of Energy-Growth Nexus: A Panel Analysis for Ten Eurasian Oil Exporting Countries." *Renewable and Sustainable Energy Reviews* 73 (2017): 369-86.

_____, J.I. Mikayilov, S. Mukhtarov, andE. Suleymanov."Does CO 2 Emissions-Economic Growth Relationship Reveal EKC in Developing Countries?Evidence from Kazakhstan." *Environmental Science and Pollution Research* 26, no. 29 (2019): 30229-41.

Kahia, M., M.S. Ben Aïssa, and C. Lanouar. "Renewable and Non-Renewable Energy Use-Economic Growth Nexus: The Case of MENA Net Oil Importing Countries." *Renewable and Sustainable Energy Reviews* 71 (2017): 127-40.

Kalyoncu, H., F. Gürsoy, and H. Göcen. "Causality Relationship between GDP and Energy Consumption in Georgia, Azerbaijan and Armenia." *International Journal of Energy Economics and Policy* 3, no. 1 (2013): 111-7.

Kao, C.-W., and J.-Y. Wan. "Energy Consumption And Economic Growth: Further Evidence from Taiwan." *International Journal of Economics and Finance* 9, no. 7 (2017): 165-78.

Long, X., E.Y. Naminse, J. Du, and J. Zhuang. "Nonrenewable Energy, Renewable Energy, Carbon Dioxide Emissions and Economic Growth in China from 1952 to 2012." *Renewable and Sustainable Energy Reviews* 52 (2015): 680-8.

Mehdiyev, A. "Azerbaycan'ın Dünya İqtisadiyyatına İntegrasiyasının Reallıqları." *Ekspert İqtisad Jurnalı* 7-8 (2001): 24-6.

Mehrara, M. "Energy Consumption and Economic Growth: The Case of Oil Exporting Countries." *Energy Policy* 35, no. 5 (2007): 2939-45.

Mohammadi, H., and M.D. Amin. "Long-run Relation and Short-Run Dynamics in Energy Consumption-Output Relationship: International Evidence from Country Panels with Different Growth Rates." *Energy Economics* 52 (2015): 118-126.

Mukhtarov, S., J.I. Mikayilov, and V. İsmayılov. "The Relationship between Energy Consumption and Economic Growth: Evidence from Azerbaijan." *International Journal of Energy Economies and Policy* 7, no. 6 (2017): 32-8.

_____, S. Humbatova, I. Seyfullayev, and Y. Kalbiyev. "The Effect of Financial Development on Energy Consumption in the Case of Kazakhstan." *Journal of Applied Economics* 23, no. 1 (2020): 75-88.

Mutascu, M."A Bootstrap Panel Granger Causality Analysis of Energy Consumption And Economic Growth in the G7 Countries." *Renewable and Sustainable Energy Reviews* 63 (2016): 166-71.

Narayan, S., and N. Doytch. "An İnvestigation of Renewable and Non-Renewable Energy Consumption and Economic Growth NexusuUsing İndustrial and Residential Energy Consumption." *Energy Economics* 68 (2017): 160-76.

_____. "Predictability within the Energy Consumption-Economic Growth Nexus: Some Evidence from Income and Regional Groups." *Economic Modelling* 54 (2016): 515-21.

Nyasha, S., Y.Gwenhure, and N.M. Odhiambo. "Energy Consumption and Economic Growth in Ethiopia: A Dynamic

Causal Linkage." *Energy & Environment* 29, no. 8 (2018): 1393-412.

Ohlan, R."Renewable and Nonrenewable Energy Consumption and Economic Growth in India." *Energy Sources, Part B: Economics, Planning, and Policy* 11, no. 11 (2016): 1050-4.

Omri, A."CO2 Emissions, Energy Consumption And Economic Growth Nexus in MENA Countries: Evidence from Simultaneous Equations Models." *Energy Economics* 40 (2013): 657-64.

Osman, M., G. Gachino, and A. Hoque. "Electricity Consumption And Economic Growth in the GCC Countries: Panel Data Analysis." *Energy Policy* 98 (2016): 318-27.

Ozcan, B."The Nexus between Carbon Emissions, Energy Consumption and Economic Growth in Middle East Countries: A Panel Data Analysis." *Energy Policy* 62 (2013): 1138-47.

Ozturk, I., and U. Al-Mulali. "Natural Gas Consumption and Economic Growth Nexus: Panel Data Analysis for GCC Countries." *Renewable and Sustainable Energy Reviews* 51 (2015): 998-1003.

Pao, H.-T., and C.-M. Tsai. "CO2 Emissions, Energy Consumption and Economic Growth in BRIC Countries." *Energy Policy* 38, no. 12 (2010): 7850-60.

Paul, S., and R.N. Bhattacharya. "Causality between Energy Consumption and Economic Growth in India: A Note on Conflicting Results." *Energy Economics* 26, no. 6 (2004): 977-83.

Reynolds, D.B., and M. Kolodziej. "Former Soviet Union Oil Production and GDP Decline: Granger Causality and the Multi-Cycle Hubbert Curve." *Energy Economics* 30, no. 2 (2008): 271-89.

Saidi, K., and M.B. Mbarek. "The Impact of Income, Trade, Urbanization, and Financial Development on CO 2 Emissions in 19 Emerging Economies." *Environmental Science and Pollution Research* 24, no. 14 (2017): 12748-57.

Salahuddin, M., and J. Gow. "Economic Growth, Energy Consumption and CO2 Emissions in Gulf Cooperation Council Countries." *Energy* 73 (2014): 44-58.

Sentürk, C., and C. Sataf. "The Determination of Panel Causality Analysis on the Relationship between Economic Growth and Primary Energy Resources Consumption of Turkey and

Central Asian Turkish Republics." *Procedia-Social and Behavioral Sciences* 195 (2015): 393-402.

Shahateet, M.I. "Modeling Economic Growth and Energy Consumption in Arab Countries: Cointegration and Causality Analysis." *International Journal of Energy Economics and Policy* 4.3 (2014): 349-59.

Shahbaz, M., S. Sarwar, W. Chen, and M.N. Malik. "Dynamics of Electricity Consumption, Oil Price and Economic Growth: Global Perspective." *Energy Policy* 108 (2017): 256-70.

Soytas, U., R. Sari, and B.T. Ewing. "Energy Consumption, Income, and Carbon Emissions in the United States."*Ecological Economics* 62, no. 3-4 (2007): 482-9.

Streimikiene, D., and R. Kasperowicz. "Review of Economic Growth and Energy Consumption: A Panel Cointegration Analysis for EU Countries." *Renewable and Sustainable Energy Reviews* 59 (2016): 1545-9.

Tang, C.F., and S. Abosedra. "The Impacts of Tourism, Energy Consumption and Political Instability on Economic Growth in the MENA Countries." *Energy Policy* 68 (2014): 458-64.

_____, B.W. Tan, and I. Ozturk. "Energy Consumption and Economic Growth in Vietnam." *Renewable and Sustainable Energy Reviews* 54 (2016): 1506-14.

Tuğcu, C.T., I. Ozturk, and A. Aslan. "Renewable and Non-Renewable Energy Consumption and Economic Growth Relationship Revisited: Evidence from G7 Countries."*Energy Economics* 34, no. 6 (2012): 1942-50.

Tuna, G., and V.E. Tuna. "The Asymmetric Causal Relationship between Renewable and Non-Renewable Energy Consumption and Economic Growth in the ASEAN-5 Countries."*Resources Policy* 62 (2019): 114-24.

Wolde-Rufael, Y. "Electricity Consumption And Economic Growth: A Time Series Experience for 17 African Countries."*Energy policy* 34, no. 10 (2006): 1106-14.

World Bank (WB). (2018). World Development. İndicators. https:// da Rahman,2010;ta.worldbank.org/indicator/