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Tourism revenues and energy consumption in e-7 countries: Examining the dynamic effects on economic growth

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ABSTRACT

The study tests the tourism and energy-related growth hypothesis with an analysis of E-7 countries. The main purpose of the study is to understand the dynamics between economic growth, energy consumption and tourism revenues in these countries and to evaluate the interactions between these factors. The analysis period consists of annual data for the period 2005-2020. Fixed Effects and GMM estimators were used in the analysis. The findings showed that there is no significant relationship between renewable energy consumption and economic growth. It has been observed that tourism revenues and primary energy consumption have an impact on growth. The findings revealed the relationship between tourism and energy consumption, and necessary economic policy recommendations were made for the sustainability of destinations.

1. Introduction

Today tourism is accepted as an important element of economic growth as other factors like finance, industrial production, exports, income, etc. Tourism represents an evolving industry that is constantly growing and at the same time more destinations are emerging around the world. In this context, it is an industry that has high growth potential, grows rapidly and makes a significant contribution to economic growth and development in many regions and countries around the world (Lee & Chang, 2008). The impact of tourism on economic growth is generally accepted as positive. It creates employment opportunities, expands consumer markets, promotes export trade and generates foreign exchange earnings (Saleh et al., 2015). It is an accepted fact that the tourism industry plays an important role in the economic development of many countries by creating additional employment, income and taxes (Choi & Sirakaya, 2005; Hefner et al., 2014; Smeral, 2015; López-Rodríguez et al., 2022). In 2019, the number of international tourists increased by 3.8 percent and reached 1462 million. However, the coronavirus (COVID-19) crisis has changed the continuous growth scenario of international tourism. The pandemic has caused a total loss of 2.6 billion international entries in 2020, 2021 and 2022. Export revenues from international tourism decreased by 62% in 2020 and 59% in 2021 compared to 2019 and then rebounded in 2022. The total loss in export revenues from tourism in this three-year period reached 2.6 trillion dollars. However, the negative effects of the pandemic on tourism are gradually decreasing. International tourist arrivals reached 87% of pre-pandemic levels in January-September 2023 (World Tourism Organization, 2024). This recovery shows that the effects of tourism on growth will continue. Chart 1 shows the trend of tourism revenues of E-7 countries.

Although it is among the E-7 countries, due to data restrictions on China's tourism revenues, this country has been excluded from the analysis and is among the six countries subject to analysis. The graph shows that tourism revenues are increasing regularly in most of these countries. It is noteworthy that there is no regular trend in Russia's tourism revenues, and there was a significant decrease in 2009 and 2016. Additionally, there was a decrease in Indonesia's tourism revenues in 2009. In Turkey, a decrease was observed in 2016. Another noteworthy point is that there was a significant sharp decline in tourism revenues in 2020 due to the impact of the pandemic.

Energy consumption has also a great effect and importance in the process of economic growth and development. Energy constitutes an indispensable input at every stage of

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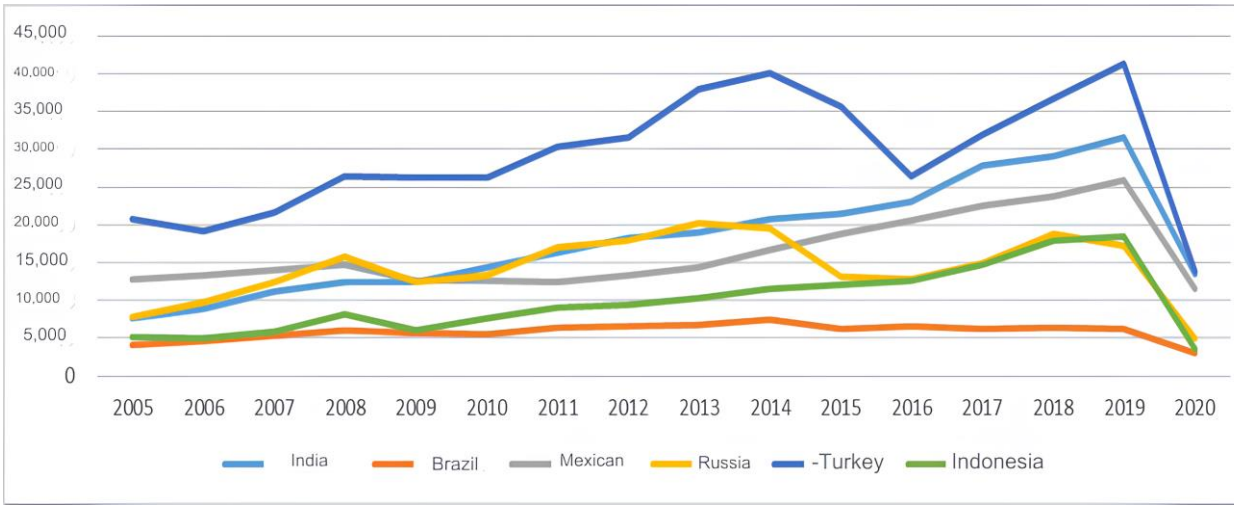

Chart 1: E-7 Countries Tourism Revenue Trend (Million $)

Source: World Bank (World development indicators)

production processes and also in every sector of the economy. Like labor and capital, energy is a vital factor of production in the growth process. Energy plays a fundamental role in the economic and social development of a country, increasing its economic growth and therefore living standards (Soares et al., 2014). The increase in production with industrialization increases energy demand, and this is also reflected in the growth rate (Medlock & Soligo, 2001). The energy and growth relationship has a wide place in the literature, both theoretically and empirically (Mezghani & Haddad, 2017; Yazdi & Shakouri, 2107; Wang & Wang, 2020; Shahbaz et al., 2020; Mutumba et al., 2021; Magazzino et al., 2021)., 2021). In the context of the growth hypothesis, Belke et al. (2011) states that energy consumption is a very important component of growth, directly or indirectly, as a complement to the capital and labor factor. The decrease in energy consumption leads to a decrease in real GDP. Therefore, sustainable energy supply is a necessary factor for society to achieve economic growth and development.

Chart 2 shows primary energy consumption in E-7 countries. Primary energy comprises commercially traded fuels, including modern renewables used to generate electricity. As seen in the graph, primary energy consumption remains at the same levels in all countries, and this indicates the dependence of countries on primary energy. However, it is noteworthy that there has been a steady increase in India's energy consumption over the years. Apart from this, Chart 2 shows that Russia has the highest primary energy consumption among these countries.

The main purpose of this study is to understand the relationship between international tourism revenues and energy consumption with economic growth and to evaluate the interactions between these factors. These relationships were investigated in the sample of E-7 countries, which

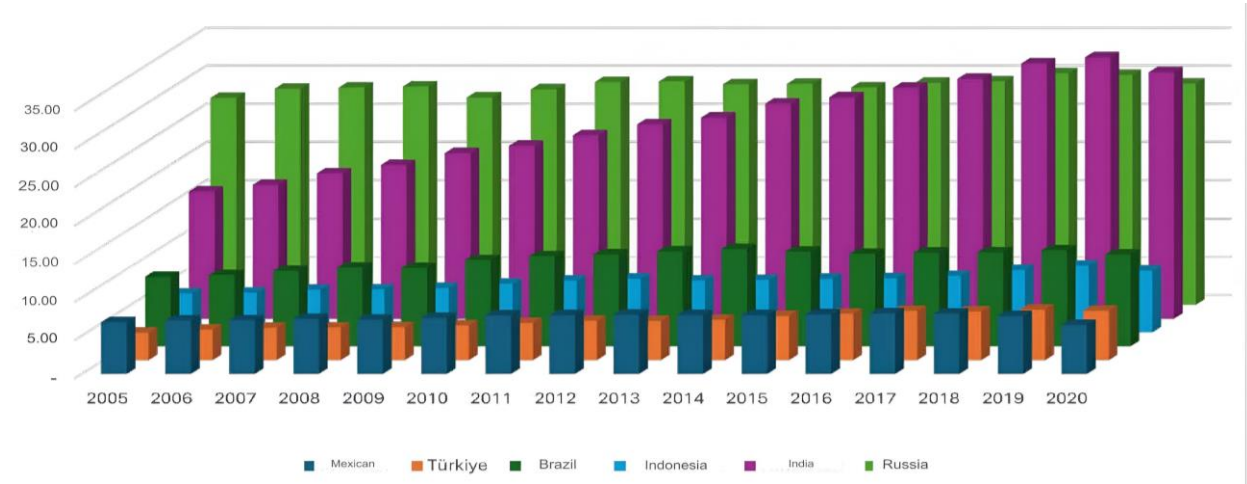

Chart 2: Primary Energy Consumption of E-7 Countries (%)

Source: Energy Institute, Statistical Review of World Energy

represent large and developing economies that have an important role in the world economy. Based on the findings, the study offers policy recommendations that support the tourism sector and encourage sustainable energy use. This contributes to applicable policy recommendations in literature.

The study is divided into four parts, and in the first part, the theoretical framework is drawn, and current information is included. The second section is devoted to the current summary of the relevant literature. In the third section, the data set, model and method used in the study are explained and empirical application results are also included. In the last section, an evaluation was made based on the econometric application results and policy recommendations were made.

2. Literature Review

Empirical studies on the determinants of economic growth is quite extensive. Since this study investigates the effects of energy consumption and tourism revenues on economic growth, an up-to-date summary of empirical studies investigating the effects of energy consumption and tourism on growth processes is included. Table 1 presents the major studies in literature in chronological order.

The studies included in the literature summary reveal that energy and tourism have a positive effect on economic growth. The tourism and energy growth literature is quite extensive with different country examples and analysis periods. This study contributes by differing from the literature, especially in terms of its sample group.

Table 1: Summary of Literature

Author(s)	Analysis Period and Sample	Estimator	Findings
Tang and Abosedra (2014)	2001-2009 MENA	GMM	Tourism and energy consumption have a positive impact on growth
León et al. (2014)	1998–2006 14 Developed, 31 Developing countries	generalized method of moments, GLS	Tourism has a positive impact on 14 developed and 31 underdeveloped countries
Omri et al. (2015)	1995–2011 18 MENA Countries	POLS, GMM	The energy-driven growth and tourism-driven growth hypotheses are supported.
Rezitis and Ahammad (2015)	1990–2012 South Asian Countries	FOLLS, DOLS	Energy positively affects growth
Rezitis and Ahammad (2015)	1990–2012 South Asian Countries	Panel Vector autoregression	Energy-based growth hypothesis is supported
Šimundić et al. (2016)	2000-2014 Latin America and the Caribbean	Panel Data Analysis	Tourism has a positive impact on growth
Machete (2016)	1995-2013 OECD Countries	VECM	The energy-based growth hypothesis is valid
Leitao and Shahbaz (2016)	1990–2009 European Economy	OLS-FE- GMM	Tourism and energy consumption have a positive impact on growth
Kahia et al. (2017)	1980-2012 MENA	FMOLS	The impact of both renewable and non-renewable energy consumption on growth is positive.
Muslija et al. (2017)	1995-2015 113 Countries	GMM	Tourism has a positive impact on growth
Jebli et al. (2019)	1995–2010 22 Central and South American Countries	FMOLS-DOLS	Renewable energy and tourism are effective in increasing growth
Mazzola et al. (2019)	2000-2015 European and Mediterranean Countries (13 Countries)	GMM	Tourism-led growth hypothesis is supported
Balsalobre-Lorente and Leitão (2020)	1995-2014 EU Union	FMOLS-DOLS-FE	Renewable energy consumption and tourism spur growth
Sarpong et al. (2020)	1995-2017 South Africa	ARDL	While tourism revenues and tourism arrivals affect growth positively, renewable energy affects growth negatively.
Kasperowicz et al. (2020)	1995-2016 29 European Countries	OLS-DOLS	Energy consumption positively affects growth
Adedoyin and Bekun (2020)	1995–2014 7 Countries	YES	Tourism boosts growth
Garidzirai and Pasara (2020)	1996-2018 Southern Africa Region	FMOLS-DOLS	Tourism positively affects growth
Acheampong et al. (2021)	1970-2015 23 Developing Countries	GMM	A strong relationship has been found between energy consumption and growth and this relationship is positive.
Rasool et al. (2021)	1995-2015 BRICS Countries	ARDL	Tourism has a positive impact on growth
Titalessy (2021)	2000-2015 Asia Pacific	GLS	Renewable energy negatively affects growth.
López-Rodríguez et al. (2022)	1995-2019 14 European Union Countries	DOLLS	Tourism-led growth hypothesis (TLGH) is valid for the entire sample
Azam and Abdullah (2022)	1995-2018 South Asian Countries	FMOLS	It positively affects tourism and economic growth

Source: Elaborated by Authors

3. Model, Data Set, Method and Econometric Findings

Model and Dataset

In this study, which focuses on economic growth based on international tourism revenues and energy consumption, the relationships between economic growth, energy consumption and tourism revenues of E-7 (China, India, Brazil, Russia, Mexico, Indonesia and Turkey) countries were investigated. However, due to the limitation of tourism revenue data, China was excluded from the analysis. 2005-2020 annual data were used in the study. Due to limited data on international tourism revenues, the beginning of the analysis period was determined as 2005. In this regard, Table 2 shows detailed information about the variables used in the model to be tested in the study.

Table 2. Variables Used in the Model and Their Explanations

Variables and Symbols	Definitions and Measurement	database
Economic Growth (Log-kbGDP)	GDP per capita (constant 2015 $)	World Bank
Tourism Revenues (Log -Tourism)	International Tourism Revenues (Current $)	World Bank
Primary Energy Consumption (log -bet)	Primary energy, commercially traded fuels including modern renewable sources used to generate electricity	BP Stats 2021
Renewable Energy Consumption (log -yet)	renewable energy (excluding hydropower, which is reported separately) and biofuels (input equivalent)	BP Stats 2021

Source: Elaborated by Authors

The model to be tested in the study was developed by Tiwari, Ozturk, and Aruna (2013), Brida et al. (2016), Tang et al. (2016) and Shaheen et al. (2019) was created based on their work.

KBGDPIH=f(International Tourism Revenues, Primary Energy Consumption, Renewable Energy Consumption)

$$Log - kbGSY\dot{I}H_{i,t} = \beta_0 + \beta_1 Log - Turizm_{i,t} + \beta_2 Log - bet_{i,t} + \beta_3 Log - yet_{i,t} + u_{i,t} \qquad (1)$$

In the equation, β represents the slope coefficients. While *i* represents the horizontal section, *t* represents time, and *u* represents the error term. Natural logarithmic transformations of the variables used in the model were used. The reason for using logarithmic transformations is that they can bring some variables closer to a normal distribution. Normally distributed data are preferred in statistical analysis because they produce more reliable results. Logarithmic data is also preferred because it can alleviate the problem of heteroskedasticity (variability of variance). Working with logarithmically transformed data enables direct measurement of percentage changes. This advantage provides convenience especially when working with variables whose sizes are quite different from each other (Greene, 2012; Baltagi, 2005; Gujarati & Porter, 2012). The table below, which expresses the empirical findings, shows a summary of the statistics of the variables.

Table 3: Summary of Statistics

Variables	Number of Observations	Average	std. Deflection	min	max
Log-kbGDP	96	3.747106	0.3336571	2.9767	4.085635
Log -tourism	96	10.11624	0.2654041	9.491222	10.61716
Log -bet	96	1.05177	0.2941374	0.5548895	1.533369
Log -yet	96	1.223447	0.3967976	0.5024271	1.699404

Note: *All statistics obtained in the study were obtained from Stata15 Package Program.*
Source: Elaborated by Authors

It can be seen that the number of observations is 96. It is accepted that this number of observations is a suitable number for short panel data analysis. The minimum value belongs to renewable energy consumption (Log -yet). It was observed that the maximum value belongs to the primary energy consumption (Log -bet).

The correlation relationships between variables, are seen in the correlation matrix table below.

Table 4: Correlation Matrix

	Log-kbGDP	Log -Tourism	Log -bet	Log -yet
Log-kbGDP	1			
Log -Tourism	0.106	1		
Log -bet	-0.288	-0.035	1	
Log -yet	-0.557	-0.406	-0.226	1

Source: Elaborated by Authors

No relationship confirming multicollinearity between the variables was found in the correlation matrix table. Therefore, it was decided that the variables were suitable for econometric analysis. Table 5 shows the results of the preliminary tests necessary to decide on the appropriate model for coefficient estimation in the study.

Table 5 includes the findings from the F-Test, Hausman and BP LM Tests. Here, the F test was used to investigate whether the model included a unit effect. The results of the

Table 5. Model Selection

	F-Test		Hausman Test		BP LM Test		Decided Model
	Statistics	p -value	Statistics	p -value	Statistics	p -value	
(Dependent variable Log-kb GDP)	2387.45	0.000***	8.42	0.038**	435.87	0.000	Fixed Effects Model

Note: *** and *** indicate significance at 1% and 5% significance level, respectively.*
Source: Elaborated by Authors

F test confirm that the model has a unit effect. The Hausman test is used to decide which of the Fixed Effects Model and Random Effects Model should be used. Additionally, the Hausman (1978) test searchs the relationship between the error term resulting from the unit effect and explanatory variables (Wooldridge, 2000, pp. 288). The null hypothesis of the Hausman test is as follows; H0: Random Effect Model is Suitable (Baltagi, 2005). Accordingly, according to the results of the Hausman test statistics in the table, it was decided that the model that should be used was the Fixed Effects Model. Another test shown in the table is the Breusch -Pagan Lagrange Multiplier Test. This test examines whether this model is significant when the random effects model should be used (Breusch & Pagan, 1980).

Table 6 shows the coefficients obtained from the Fixed Effects Model.

Table 6. Fixed Effects Model

Variables	Coefficient	Standard Error	P-value
Log -Tourism	0.031	0.017	0.081*
Log -bet	0.816	0.046	0.000***
Log -yet	-1.147	0.052	0.010**
Still	2,751	0.206	0.000***
*F-Statistic: 277.46 F (p-value.): 0.000****			

Note: **, ** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.*
Source: Elaborated by Authors

According to the results in the table, it was decided that all variables had a statistically significant relationship with the dependent variable. In this context, 1% increase in international tourism revenues creates a 0.031% increase in economic growth. 1% increase in primary energy consumption creates a 0.81% increase in economic growth. Finally, 1% increase in renewable energy consumption reduces economic growth by 1.14%.

In the study, the control estimator was used as a dynamic method developed by (Arellano & Bond, 1991, pp. 282-283), which is a suitable estimator for short panels. y_it= 〖αy〗 _(i,t-1)+x_it β+ε_it) The widely accepted GMM estimator was used (Anderson & Hsiao, 1981). This model is a dynamic model. It is known as a model in which the lagged value of the dependent variable is added to the right side of the model like the independent variable. Later, the Arellano -Bond estimator developed additional assumptions in order to differentiate the first difference of the instrumental variables from the fixed effects. In this new method, it has been observed that the effectiveness of the findings of the Arellano-Bond estimator increases due to the use of more instrumental variables. This new method, developed by combining the original equation and the transformed equation in a system, is considered "System GMM". It has been determined that this developed method produces more effective and unbiased results in general compared to the GMM estimator (Baltagi, 2005, pp. 147-148).

It is important to first test the consistency of the results of the System GMM estimator. In this context, there are basically three conditions (Roodman, 2006, pp. 33-42): The first of these conditions is whether the error term of the GMM estimator contains second-order autocorrelation. In this context, the null hypothesis in AR(1) that there is no first-order and second-order autocorrelation should be rejected or accepted. Additionally, in AR(2), the null hypothesis must be definitely accepted. Secondly, the p value of the Wald chi2 test statistic must be greater than 5% or 10%. This situation shows that the model as a whole is meaningful. The Sargan test examines the validity of the instrumental variables included in the model. The last condition is that the lagged value of the dependent variable must be less than one in order to compare the accuracy of System GMM in the model (Roodman, 2006).

Table 7 shows the results of GMM, which is a robust estimator.

Table 7. GMM Results

Dependent Variable (lnGDP)	Coefficient	p -value
$log - kbGSY\|H_{t-1}$	0.579	0.000***
Log -Tourism	0.0301	0.000***
Log -bet	0.330	0.000***
Log -yet	-0.017	0.558
$Wald\ Chi_2$	2843.30	0.000***
$Sargan\ testi$	183.7523	0.000***
Arellano -Bond Test for AR (1)	-2.2766	0.0228**
Arellano -Bond Test for AR(2)	-1.3326	0.1826

Note: **, ** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.*
Source: Elaborated by Authors

Among the statistics in the table, first of all, the statistics made to search the consistency of system GMM (Arellano -Bond Dynamic GMM) estimators were evaluated. Accordingly; The Wald test searches the significance of the variables included in the model. The Sargan test examines whether the instrumental variables in the model are valid. The last test is the Arellano -Bond (AB) test, which investigates the autocorrelation of the model. Wald Chi2 shows that the model as a whole is significant. The Sargan test confirms that the validity of the instrumental variables used in GMM is accepted. Arellano -Bond test results show that there is no AR(2) type autocorrelation.

Looking at the coefficient results, no statistically significant relationship was found between the renewable energy consumption variable and economic growth. A 1% increase in the lagged value of economic growth increases the dependent variable by approximately 0.58%. A 1% increase in international tourism revenues creates an increasing effect of 0.0301% on growth. This finding obtained in the study is consistent with Garidzırai and Pasara, 2020, Rasool et al., 2021; López-Rodríguez et al. (2022) is parallel to the results of their study. It has been observed that a 1% increase in primary energy consumption has a 0.330% increasing effect on growth. This result supports the findings the studies of Pala, 2016; Rezitis and Ahammad, 2015; Kasperowicz et al., 2020; Acheampong et al., 2021.

4. Conclusion

Economic growth processes are one of the most important goals of countries. In this context, countries focus on factors that encourage and make economic growth sustainable and try to achieve their growth goals. This study researched the effects of tourism income, which is an important sector in growth processes, and energy consumption, which is vital for economies, on economic growth, specifically for E-7 countries. However, due to data limitations, China was excluded from the analysis. The period covering the years 2005-2020 was determined as the analysis period. Relationships between variables were searched with Fixed Effects and Generalized Moments (GMM) Estimator. In examining the findings obtained from empirical analysis it has been concluded that renewable energy consumption is not statistically significant with economic growth and that the increase in international tourism revenues has an increasing effect on economic growth. It has also been observed that primary energy consumption has a positive effect on growth. The results obtained in the study support the literature.

Findings from empirical application have shown that there is no significant relationship between renewable energy consumption and economic growth. This result is unexpected. The effects of applications and projects for renewable energy may be seen later than other factors. Therefore, analysis made for a certain period may be insufficient to evaluate these effects as a whole. The endogeneity problem between the variables may also have caused this result to emerge. That is, economic growth can be an effective factor in determining renewable energy consumption, which can complicate statistical analysis. In addition, this may be since the investments and consumption of renewable energy of the countries in the sample group are quite different from each other. It has been concluded that the increase in the lagged value of economic growth increases growth. This result shows that past growth positively affects future growth.

Necessary measures should be taken to ensure the continuity of the enhancing effect of primary energy consumption on growth. In addition to the economic growth-enhancing effect of the increase in primary energy consumption, it is also important to evaluate energy efficiency and sustainability policies. In order to draw attention to the importance of the energy factor, which is of critical importance for economic growth, it is important to develop the country's energy infrastructure and subsidize energy consumption. Additionally, investments should be made in alternative energy sources to reduce energy dependency, to increase energy supply security and to ensure sustainable growth. Energy efficiency is as important an issue as energy supply security. Therefore, investments in technology that will increase energy efficiency should be encouraged. Additionally, positive contributions to economic growth can be made by optimizing energy consumption. Incentive policies such as tax advantages and selectively applied low-interest loans should be developed to stimulate investments in the primary energy sector. These incentives can enable the private sector to invest more in the energy sector. E-7 countries generally attract attention with their dynamic economies and rapid population growth. They need a strong energy infrastructure to meet the increasing energy demands with their rapid economic growth. In this context, prioritizing investments in energy infrastructure can increase economic growth by supporting energy consumption. They may also pay special attention to international cooperation and diplomacy in the field of energy. Cooperation on issues such as trade in energy resources, joint projects and technology transfer can support energy security and economic growth.

According to the analysis results, it would be correct to recommend the same policies in terms of further encouragement of the tourism sector, which has been found to have a significant impact on economic growth.

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Tourism revenues and energy consumption in e-7 countries: Examining the dynamic effects on economic growth

Abstract

The study tests the tourism and energy-related growth hypothesis. A study was conducted on E-7 countries. The main objective of the study is to understand the dynamics between economic growth, energy consumption and tourism revenues in these countries and to evaluate the interactions between these factors. The analysis period consists of 2005-2020 annual data. Fixed Effects and GMM estimators are utilized. The findings show that there is no significant relationship between renewable energy consumption and economic growth. On the other hand, it is observed that tourism revenues and primary energy consumption have an impact on growth. The findings revealed the relationship between tourism and energy consumption, and necessary economic policy recommendations were made for the sustainability of destinations.

Keywords: *International Tourism, Energy Consumption, Economic Growth, .*

Authors

Full Name	Author contribution roles	Contribution rate
Şeyma Bozkaya:	*Methodology, Software, Formal Analysis, Data Curation, Visualization*	*40%*
Aysun Özen:	*Conceptualism, Writing - Original Draft, Writing - Review & Editing, Supervision*	*40%*
Sinan Göç:	*Investigation, Resources*	*20%*

Author statement: *Author(s) declare(s) that All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.* ***Declaration of Conflicting Interests:*** *The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article*

This paper does not required ethics committee report

Justification: The methodology of this study does not require an ethics committee report.