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THE RELATIONSHIP BETWEEN HEALTH EXPENDITURES AND RENEWABLE ENERGY CONSUMPTION IN THE TURKISH ECONOMY

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Abstract: Sustainable economic growth without harming nature is one of the top issues on the agenda of all countries recently. In this regard, renewable energy consumption is important for both sustainable economic growth and public health. Along with the environmental pollution caused by non-renewable energy sources, the consumption of renewable energy sources has become very popular in the global economy. In this direction, the relationship between renewable energy consumption and health expenditures for Türkiye was investigated using the 1990-2020 period data using the Toda Yamamato Causality analysis method. The findings show that there is a one-way causality relationship from renewable energy consumption to health expenditures. In addition, the findings revealed the existence of a one-way causality relationship from economic growth to health expenditures.

Keywords: Health expenditure, Renewable energy consumption, Economic growth

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1. Introduction

Energy is one of the resources necessary to meet our basic needs. Energy, which has become a controversial issue today, has reached significant levels of consumption thanks to the increasing population and developing technology. With the process of globalization and industrialization, the intensity of interaction between countries is increasing. One of the main commodities subject to trade between countries is the consumption of fossil energy resources. The dependence on fossil fuel consumption has increased the tendency towards alternative energy sources due to the negative impact on environmental conditions and ecological balance, together with the consideration of the extinction of these resources at the end of a certain period of time. Renewable energy sources are one of them.

Renewable energy has become increasingly popular in recent years. It is defined as energy derived from naturally replenished sources. These include solar energy, wind, wave, geothermal, biomass, and hydroelectric power. Renewable energy sources are considered self-sustaining, as they do not deplete with use. The key characteristic of renewable energy is its renewability (Kızılkan, 2023). The consumption of fossil fuels has been rising due to widespread industrialization and rapid population growth. This increase depletes fossil reserves, exacerbates global climate change, and negatively impacts public health (Farhad et al., 2008). Consequently, societies are being driven to adopt renewable energy sources like solar and wind power, which have a lower environmental impact. Health expenditures are a significant indicator of economic growth.

These expenditures vary according to a country's level of development, and the recent rise in resources allocated to health has increased both the amount and the importance of efficient and effective use of health expenditures (Mutlu and Işık, 2012; Akar, 2014). Globally, health expenditures are crucial for enhancing welfare and improving the quality of life in societies (Yavuz et al., 2013).

Health expenditures are generally shaped by the economic structure of countries, the form of government, the policies they implement, and the social and cultural values of the country. As can be understood from the analysis, economic, social, demographic and environmental factors have an impact on health expenditures (Hansen and King, 1996). With the globalization process, societies are in a constant change and development. Depending on factors such as urbanization, population growth rate, increase in environmental pollution, increase in chronic diseases, increase in epidemics, technological developments in the field of medicine, factors affecting health expenditures also change (Khanolkar et al., 2016).

The quality of the environment in which people live is also seen as an important factor affecting individual and public health. The increase in carbon emissions in nature is seen as the main cause of environmental pollution and one of the most important factors that increase health expenditures. The environmental effects of carbon dioxide, which has the highest share among greenhouse gases that cause climate change and global warming, are of great importance (BÇM, 2015). Increasing carbon emission in the atmosphere increases environmental pollution and negatively affects individual and public health. Living in places where environmental pollution is high harms both individual and public health, reduces the quality of health and leads to an increase in health expenditures. In addition, the increase in diseases in the society decreases labor force participation and decreases labor productivity, which may negatively affect economic growth (Narayan and Narayan, 2008).

Renewable energy consumption is important in preventing global climate change. The use of renewable energy consumption sources helps increase energy efficiency in countries, reduces the use of carbon emissions and provides environmentally friendly energy consumption (Çobur and Başel, 2023). As a matter of fact, renewable energy resources are important in terms of ensuring economic and social development, creating a cleaner environment, and minimizing negative externalities on human health (Owusu and Asumadu, 2016). Therefore, the consumption of renewable energy resources positively affects individual and public health by reducing the use of greenhouse gases and helps to reduce the cost of health expenditures (Khan et al., 2020). In this respect, it is important to examine the social-economic-environmental impacts in depth in order to better understand and manage health expenditure policies more accurately.

For this purpose, the relationship between renewable energy consumption, economic growth, and health expenditures in Türkiye is analyzed for the period 1990-2020 using the Toda-Yamamoto Causality Analysis. The study begins with a brief introduction and theoretical framework, followed by a literature review in the second section. The third section discusses the methodology, the variables used, and the empirical findings. The conclusion section offers evaluations and policy recommendations based on the findings.

1.1. Literature Review on the Subject

One of the world's biggest problems is the rapid increase in environmental pollution causing climate change and the need to tackle the problems caused by this change. The health services market is one of the sectors that is affected by this process. There are many factors affecting health expenditures. As determinants of health expenditures, issues such as health expenditures - growth (Altunöz, 2020; Emirkadı, 2022) health expenditures - carbon emissions (Abdullah et al., 2016; Yazdi and Khanalizadeh, 2017; Zaidi and Saidi, 2018) are at the forefront. This study tests the relationship between renewable energy consumption-economic growth and health expenditures. Since understanding the relationship between renewable energy consumption-health expenditures and economic growth is very important in recent times, the scarcity of studies and information on this issue reveals the main purpose of this study. It is seen that the studies on this subject for Türkiye are scarce in the literature. It is thought that the study will contribute to the literature in this respect. The literature review on the subject is summarized in Table 1.

Table 1. Literature review

Author(s)-Year	Country(s)/Period	Method	Finding
Apergis et. al. (2018)	42 Sub-Saharan African Countries/1995-2011	Panel Data Analysis	A one-way causality relationship was found from renewable energy consumption to health expenditures.
Çetin (2018)	BRICS-T /2000-2015	Panel ARDL analysis	Renewable energy consumption reduces health expenditures.
Öndeş (2019)	28 EU countries/2000-2014	Panel Data Analysis	A unidirectional causality relationship was found from renewable energy consumption to health expenditures.
Ullah et. al. (2019)	Pakistan/1998-2017	Time Series Analysis	A negative relationship was found between renewable energy consumption, health expenditures and CO2.
Caruso rt al. (2020)	1990-2015/12 EU countries	Panel Autoregression Analysis	It was found that there is a causal relationship between renewable energy consumption and health expenditures.
Khan(2019)	ASEAN /2007-2017	Panel Data Analysis	There is a negative relationship between health expenditures and the environment.
Shahzad et. al. (2020)	Pakistan/1995-2017	ARDL Analizi-Causality Analysis	While economic growth and CO2 emissions increase health expenditures, renewable energy consumption and information communication technologies decrease health expenditures. In addition, while a bidirectional relationship was found between health expenditures-economic growth-carbon emissions and information communication technology, a unidirectional causality relationship was found from renewable energy consumption to these variables.
Nawab et. al. (2021)	ASEAN /2000-2018	GMM	Renewable energy consumption reduces health expenditures and carbon emissions.

Table 1. Literature review (continuing)

Author(s)-Year	Country(s)/Period	Method	Finding
Pata (2021)	1982-2016/Japan and USA	ARDL Analysis	Renewable energy consumption and health spending improve environmental quality.
Ecevit et. al. (2022)	Türkiye/1985-2018	ARDL, FMOLS, DOLS, VECM Analysis	Renewable energy consumption and financial development have a negative effect on health expenditures, while economic growth has a positive effect on health expenditures.
Ecevit et. al. (2022)	Türkiye/1988-2018	VECM Analysis	Renewable energy consumption in health economic growth, financial development and unemployment have a negative impact on health.
Mehmood et al. (2022)	South African Countries/1990-2018	VECM Analysis	Renewable energy consumption reduces healthcare expenditures
Akar et. al. (2023)	13 EU countries /2001-2019	Panel Data Analysis	Renewable energy consumption reduces health expenditures.
Triki et. al. (2023)	Saudi Arabia/1980-2020	ARDL and NARDL analysis	The existence of a long-run relationship between the variables was found.
Dorbonova and Sugözü (2024)	Asian Countries/2000-2020	Dumitrecu Hurlin(2012) Causality Analysis	A causality relationship was found between renewable energy and health expenditures.

Table 2. Descriptive information on variables

Variables	Description	Source
Per Capita Health Expenditure (HE)	Per Capita Health Expenditure (US$)	OECD
Renewable Energy Consumption (REC)	Renewable energy consumption (share in total energy consumption)	World Bank
Gross Domestic Product (GDP)	Gross Domestic Product per capita (US$)	World Bank

Table 3. Descriptive statistics

	LHE	LGDP	LREC
Mean	1.398074	8.710979	2.781597
Median	1.474992	8.946385	2.690547
Maximum	1.703657	9.439719	3.194583
Minimum	0.894454	7.714503	2.433613
St.Deviation	0.251315	0.586629	0.257827
Jargue -Bera	4.972071	3.731352	3.074372
Jargue –Bera Probability	0.832345	0.154792	0.214985

2. Methodology and Econometric Estimation Results

2.1. Data Set

The explanations of the variables used for econometric analysis in the study are shown in Table 2. The data set for Türkiye for the 1990-2020 period is used in this study, where the health expenditure variable is obtained from the OECD database and the renewable energy consumption and GDP per capita variables are obtained from the World Bank database.

$$LHE_t = \beta_0 + \beta_1 LREC_t + \beta_2 LGDP_t + \mu_t \qquad (1)$$

In the equation 1, “□” represents both the coefficient and the elasticity coefficients of the variables and “□□” represents the error term. In the model, health expenditures are considered as the dependent variable, while economic growth and renewable energy consumption are considered as independent variables. Since it is recommended to work with the logarithmic forms of the variables used in econometric analysis, the logarithms of all variables in the equation are taken. The descriptive statistics of the variables are presented in Table 3.

This dataset analyzes the variables of health expenditures, renewable energy consumption, and economic growth. The table presents the mean, median, maximum, minimum, standard error, and Jarque-Bera values for these variables. The Jarque-Bera probability values for all variables in the model exceed the 1% significance level, indicating that the variables are normally distributed.

2.2. Methodology and Findings

The econometric method of the study consists of two parts. In the first part, the stationarity levels of the variables are analyzed with the ADF unit root test. Then, the causality relationship between the variables is determined by Toda Yamamoto analysis.

2.2.1. Unit root test

The long-run characteristics of any series are revealed by examining how the value of the variable in the previous period affects the current period. To understand the process from which a series originates, it is necessary to regress the value of the series in each period with the values from the previous period. Therefore, the stationarity levels of the series should be determined using unit root tests, which are among the most common methods (Tarı, 2015).

Unit root tests can determine whether the variables are stationary. It is noted that analyses conducted with non-stationary variables may yield misleading results. Hence, the stationarity of the series should be confirmed before starting the analysis (Coşkun and Eygu, 2020).

To determine the unit root levels of the series in the model, the Augmented Dickey-Fuller (ADF) unit root test was employed. The null hypothesis (H0) of this test is that the series contains a unit root, while the alternative hypothesis (H1) is that the series is stationary. The unit root test results of the variables in the study are presented in Table 4.

Table 4. ADF unit root test results

	Level				First difference			
	Constant	Prob.	Constant and trend	Prob	Constant	Prob.	Constant and trend	Prob
LHE	-2.053	0.2638	-1.0526	0.9216	-3.7597	0.0007*	-3.9238	0.0022*
LREC	-1.6197	0.4600	-2.4341	0.3561	-6.4368	0.0000*	-6.7859	0.0000*
LGDP	1.1322	0.6901	1.3294	0.8614	5.7934	0.0000*	-5.8222	0.0002*

*= P<0.01.

$$Y_t = \beta_0 + \sum_{i=t}^{k} \beta_{i1} Y_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \beta_{2j} Y_{t-j} + \sum_{i=1}^{k} a_{1i} X_{t-1} + \sum_{j=k+1}^{k+d_{\max}} a_{2j} X_{t-j} + \varepsilon_{1t} \quad (2)$$

$$X_t = c_0 + \sum_{i=t}^{k} c_{i1} X_{t-1} + \sum_{j=k+1}^{k+d_{\max}} c_{2j} X_{t-j} + \sum_{i=1}^{k} d_{1i} Y_{t-1} + \sum_{j=k+1}^{k+d_{\max}} d_{2j} Y_{t-j} + \varepsilon_{2t} \quad (3)$$

Table 5. Determination of the appropriate lag length of the Var model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	20.06226	NA	6.43e-05	-1.137628	-0.997508	-1.092808
1	95.17480	130.1913	7.88e07	-5.544987	-4.984508*	-5.365685
2	106.3242	17.09567*	6.98e-07*	-5.688277*	4.707439	-5.374498*

LR= Likelihood Ratio FPE= Final Prediction Error AIC= Akaike Information Criteria SC= Schwarz İnformation Criteria HQ= Hannan Quinn.

Table 4 presents the results of the ADF unit root test. The stationarity analysis of the variables used in the study reveals that all series are not stationary at the level. To determine the maximum degree of integration (dmax), the first differences of the variables were taken to assess the stationarity levels. According to the ADF unit root test findings for these first-differenced series, all variables in the model are I(1), and the maximum degree of integration (dmax) is determined to be 1.

2.2.2. Toda Yamamoto causality analysis

In Toda Yamamoto Causality analysis, the level values of the series are used. The main difference between this test and other causality tests is that the series are not required to be stationary at the same level and no cointegration relationship is sought between the variables (Ak et al., 2016).

In order to determine the Toda Yamamoto causality analysis, it is first necessary to determine the extended VAR model with (k+dmax) lags. Where k is the lag length of the model and dmax is the highest degree of cointegration of the series. It is emphasized that the lag length of the WALD test is determined by summing these two values. Determination of these two values allows the model to be estimated accurately, preventing data loss and achieving more successful results at the level level (Toda and Yamamoto, 1995; Okur and Çiçek, 2023; Karakaya and Oktay, 2024). The model of the Toda and Yamamoto test is constructed as given in equation 2 and 3:

The hypotheses for equation 2 are as follows:

□₀: □ is not the grenger cause of □′ .

□₁: □ is the grenger cause of □′

The hypotheses of equation 3 are as follows:

□₀: □ is not the grenger cause of □′ .

□₁: □ is the grenger cause of □′ .

In this model, the test statistic value is tested with the Wald Test with X-squared distribution (Meçik and Koyuncu, 2020).

After the unit root test of the series, the VAR model should be created and the lag length (k value) should be determined. Table 5 shows the results of the appropriate lag lengths in the VAR model.

It is stated that determining the appropriate lag length while constructing the VAR model is very important in econometric analysis (Özkurt, 2024). According to Table 5, SC information criterion indicates the first lag, while

LR, FPE, AIC, HQ criteria indicate 2 lags. As a result, according to the findings in Table 4, the appropriate lag length k for the VAR model is determined as 2. In the study, it was previously determined by the unit root test that the maximum stationarity level of the series is I(1) at first difference and the dmax value was calculated as 1. The third order VAR model analysis was performed by adding the maximum degree of cointegration of the variables to the appropriate lag length of the VAR model (k+dmax= 1+2=3). In the Toda-Yamamoto Causality analysis, various diagnostic tests are first performed to determine whether the model is reliable. The results are shown in Table 6.

Table 6. Diagnostic tests

Tests	Statistical Value	Probability Value
Lagrange Multiplier (LM) Autocorrelation Test	9.244	0.4185
White Variance Test	107.66	0.4909

Table 6 shows that the null hypothesis of "no autocorrelation" in the VAR model at lag lengths is accepted and no autocorrelation problem is detected. In addition, according to the test for changing variance, it is summarized in the table that the VAR model has constant variance. It is seen that the diagnostic tests investigated in the VAR model are determined in accordance with the expectations. As a result of the findings, the study continued with Toda Yamamoto causality analysis.

Table 7. Toda Yamamoto causality analysis results

Dependent Variable LHE	Wald Ist.	Probability Value
LGDP	16.276	0.0001***
LREC	12.952	0.0047***
Dependent Variable LGDP		
LHE	1.877	0.5983
LREC	5.344	0.1482
Dependent Variable LREC		
LHE	10.371	0.1157
LGDP	5.285	0.1521

According to the results of the Toda-Yamamoto causality analysis in Table 7, for Model 1, health expenditures are considered the dependent variable, while renewable energy consumption and economic growth are the independent variables. The first model shows a unidirectional causality from GDP, representing economic growth, to health expenditures, as well as a unidirectional causality from renewable energy consumption to health expenditures. Thus, there is a causality relationship from economic growth and renewable energy consumption to health expenditures in Türkiye.

From the Toda-Yamamoto causality analysis results given in Table 7, economic growth is considered the dependent variable in the second model, with the other variables as independent variables. The analysis indicates no causality relationship from health expenditures and renewable energy consumption to economic growth in Türkiye.

In Model 3 in Table 7, renewable energy consumption is the dependent variable, while health expenditures and economic growth are the independent variables. The causality analysis for Model 3 found no causality link from economic growth and health expenditures to renewable energy consumption.

There are four main hypotheses to explain the relationship between energy consumption and economic growth. The first of these is the growth hypothesis. According to this hypothesis, there is a unidirectional relationship between economic growth and energy consumption. The direction of the relationship is from energy consumption to economic growth. In the growth hypothesis, energy consumption plays a role both directly and as a complement to capital and labour (Alper, 2018). Another hypothesis is the conservation hypothesis. According to this hypothesis, a unidirectional causality relationship from economic growth to energy consumption is considered. The third hypothesis argues that there is a bidirectional causality relationship between energy consumption and economic growth. According to this hypothesis, energy saving measures and energy supply shocks will have a negative impact on economic growth, which will naturally be reflected in energy demand. The last hypothesis is the neutrality hypothesis. According to this hypothesis, it is argued that it will be valid if no causality relationship is detected between economic growth and energy consumption (Alper, 2018; Ataş and Güler, 2020). In the period considered in this study, no causality relationship was found between economic growth and renewable energy consumption. It can be said that the null hypothesis is valid in the period in question.

The results of this study align with those of Apergis et al. (2018), Öndes (2019), and Caruso et al. (2020). It can be inferred that renewable energy consumption impacts efforts to improve health expenditures in Türkiye. This is because increasing the share of renewable energy consumption reduces environmental pollution, positively affecting public health and lowering health expenditure costs.

3. Conclusion

With the process of industrialization, the demand for energy is increasing day by day. Most developed countries meet a significant portion of their energy demands from fossil fuels. However, since fossil fuel resources are finite and harmful to the environment and public health, the necessity of using alternative energy sources has emerged. In this context, there has been a shift from fossil fuels to renewable energy sources to achieve sustainable economic growth and protect public health. The widespread use of renewable energy sources eliminates greenhouse gas emissions and reduces fossil fuel use, thereby minimizing negative effects on public health.

In this study, the relationship between renewable energy consumption, economic growth, and health expenditures in the Turkish economy for the period 1990-2020 is analyzed using the Toda-Yamamoto causality analysis. Firstly, the ADF unit root test is employed to assess the stationarity of the series. According to the results of the Toda-Yamamoto causality analysis, a unidirectional causality relationship is found from renewable energy consumption to health expenditures. Additionally, a unidirectional causality relationship is identified from economic growth to health expenditures, but no causality link is found between economic growth and renewable energy consumption.

Based on the results, it can be said that policies that can be followed on renewable energy consumption in Türkiye can have an impact on health expenditures. Since Türkiye is a country rich in renewable energy resources in terms of geographical location, it should be able to utilize renewable energy resources effectively and efficiently. In this case, air pollution caused by fossil fuel sources will be significantly reduced. This would lead to improvements in the quality of health of individuals and society. Furthermore, the use of clean technology should be encouraged for sustainable economic growth and a sustainable environment. The use of medical technologies should be encouraged, as the transfer of environmentally sound technologies contributes to sustainable economic growth and development, as well as reducing health costs in the long run.

Author Contributions

The percentage of the author contributions is presented below. The author reviewed and approved the final version of the manuscript.

	A.E.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declare that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because of there was no study on animals or humans.

References

Abdullah H, Azam M, Zakariya SK. 2016. The impact of environmental quality on public health expenditure in Malaysia. Asia Pacific J Adv Busin Soc Stud, 2(2): 365-379.

Ak MZ, Altıntaş N, Şimşek AS. 2016. Türkiye'de finansal gelişme ve ekonomik büyüme ilişkisinin nedensellik analizi. Doğuş Üniv Derg, 17(2): 151-160.

Akar S. 2014. Türkiye'de sağlık harcamaları, sağlık harcamalarının nisbi fiyatı ve ekonomik büyüme arasındaki ilişkinin incelenmesi. Celal Bayar Üniv İİBF Yönet Ekon Derg, 21(1): 311-322.

Akar T, Sarıtaş T, Akar G. 2023. Yenilenebilir enerji ve sağlık harcamaları ilişkisi: AB ülkelerinden kanıtlar. Balkan Sos Bil Derg, 12(23): 43-48.

Alper FÖ. 2018. Yenilenebilir enerji ve ekonomik büyüme arasındaki ilişki: 1990-2017 Türkiye Örneği. Çankırı Karatekin Üniv İİBF Derg, 8(2): 223-242.

Altunöz U. 2020. Sağlık harcamalarının ekonomik büyüme ile ilişkisinin oecd ülkeleri için analizi. Ekon Bil Derg, 12(1): 85-105.

Apergis N, Jebli MB, Youssef SB. 2018. Does renewable energy consumption and health expenditures decrease carbon dioxide emissions? Evidence for sub-Saharan Africa countries. Renew Ener, 127: 1011-1016.

Ataş H, Güler H. 2020. Türkiye'nin doğal gaz, petrol ve kömür tüketiminin büyümeye etkisi: Ekonometrik bir analiz. ÇÜ Sos Bil Enst Derg, 29(3): 524-539.

BÇM (Bölgesel Çevre Merkezi). 2015. A'dan Z'ye İklim değişikliği başucu rehberi. Bölgesel Çevre Merkezi, Ankara, Türkiye.

Caruso G, Colantonio E, Gattone SA. 2020. Relationships between renewable energy consumption, social factors, and health: A panel vector auto regression analysis of a cluster of 12 EU countries. Sustainability, 12(7): 2915. https://doi.org/10.3390/su12072915

Çetin MA. 2018. The long run relationship between health expenditure and renewable energy consumption in BRICS-T countries: Panel ARDL evidence. ICPESS 2018 Proc Econ Stud, 2: 359-370.

Çobur S, Başel S. 2023. Küresel iklim değişikliği ve yenilenebilir enerji farkındalığı arasındaki ilişkinin incelenmesi. J Soc Human Administ Sci, 9(66): 3171-3179. http://dx.doi.org/10.29228/JOSH AS.70743

Coşkun H, Eygü H. 2020. Ar–Ge harcamaları ve ihracat ilişkisinin incelenmesi: türkiye örneği. Anemon Muş Alparslan Üniv Sos Bil Derg, 8: 233-242.

Dorbonova I, Sugözü İH. 2024. Analyzing the relationships between health expenditure, renewable energy and life expectancy: Evidence from Asian countries. ESAM Ekon Sos Araş Derg, 5(1): 111-134.

Ecevit E, Çetin M, Yücel AG. 2022. Türkiye'de yenilenebilir enerji ve sağlık: Eşbütünleşme ve nedensellik analizi, Erciyes Akad, 36(1): 138-156. https://doi.org/10.48070/erciyesakademi.1039755

Emirkadı Ö. 2022. D8 ülkelerinde sağlık harcamaları- ekonomik büyüme ilişkisi: Panel nedensellik analizi. Finans Ekon Sos Araş Derg, 7(2): 241-252.

Farhad S, Saffar-Avval M, Younessi-Sinaki M. 2008. Efficient design of feedwater heaters network in steam power plants using pinch technology and exergy analysis. Int J Ener Res, 32(1): 1-11.

Hansen P, Kıng A. 1996. The determinants of health care expenditure: a cointegration approach. J Health Econ, 15(1): 127-137.

Karakaya M, Oktay S. 2024. Türkiye'de bankacılık sektörü ve sermaye piyasası değişkenleri arasındaki ilişkinin toda-yamamoto nedensellik analiziyle araştırılması. BDDK Bank Finan Piyasalar Derg, 18(1): 19-36. http://doi.org/10.46520/bddkdergisi.1525902

Khan SAR, Zhang Y, Kumar A, Zavadskas E, Streimikiene D. 2020. Measuring the impact of renewable energy, public health expenditure, logistics, and environmental performance on sustainable economic growth: Sustain Devel, 2020: 1-11.

Khan SAR. 2019. The role of renewable energy, public health expenditure, logistics and environmental performance in economic growth: an evidence from structural equation modelling. Urban Stud Plan (preprint). https://doi.org/10.20944/preprints201901.0102.v1

Khanolkar V, Khan SA, Gamba M. 2016. An insight on health care expenditure. URL: https://www.usi.edu/media/3654761/Insight-on-Health-Care-1.pdf (accessed date: May 12, 2024).

Kızılkan Ö. 2023. The impact of renewable energy consumption on unemloyment and CO_2 emmission: The case of OECD countries. MSC Thesis, Siirt Univerity, Institute of Social Sciences, Siirt, Türkiye, pp: 111.

Meçik O, Koyuncu T. 2020. Türkiye'de göç ve ekonomik büyüme ilişkisi: toda-yamamoto nedensellik testi. İnsan Toplum Bil Araş Derg, 9(3): 2618-2635.

Mehmood U, Agyekum EB, Kamel S, Shahinzadeh H, Moshayedi AJ. 2022. Exploring the rolesof renewable energy, educationspending, and CO_2 emissionstowards health spending in south Asian countries. Sustainability, 14: 3549. https://doi.org/10.3390/su14063549

Mutlu A, Işık A. 2012. Sağlık ekonomisine giriş. Ekin Basım Yayın Dağıtım, Bursa, Türkiye, pp: 372.

Narayan PK, Narayan S. 2008. Does environmental quality influence health expenditures? Empirical evidence from a panel of selected OECD countries. Ecol Econ, 65(2): 367-374.

Nawab T, Muneza C, Afghan M. 2021. Impact of renewable energy consumption and health expenditure on air pollutants: Implications for sustainable development in Asian countries. IRASD J Ener Environ, 2(2): 78-89. https://doi.org/10.52131/jee.2021.0202.0019

Okur MG, Çiçek A. 2023. Türkiye'de kırmızı et fiyatları ile besi yemi fiyatları arasındaki nedensellik ilişkisinin Toda-Yamamoto testi ile belirlenmesi. ÇOMÜ Zir Fak Derg, 11(2): 368-376.

Öndes H. 2019. Yenilenebilir enerji tüketimi ve sağlık harcamaları karbondioksit emisyonunu azaltır mı?. International Conference on Business and Organization Research Izmir. September 4-7, İzmir, Türkiye.

Owusu PA, Asumadu-Sarkodie S. 2016. A review of renewable energy sources, sustainability issues and climate change mitigation. Cogent Eng, 3(1): 1-14.

Özkurt İC. 2024. Türkiye'de inovasyon faaliyetleri ve ekonomik büyüme ilişkisi: nedensellik analizi, Afyon Kocatepe Üniv Sos Bil Derg, 26(1): 164-176.

Pata UK. 2021. Do renewable energy and health expenditures ımprove load capacity factor in the usa and japan? a new approach to environmental issues. Eur J Health Econ, 22: 1427-1439. https://doi.org/10.1007/s10198-021-01321-0

Zaidi S, Saidi K. 2018. Environmental pollution, health expenditure and economic growth and in the sub-saharan africa countries: panel ARDL approach. Sustain Cities Society, 41: 833-840.

Shahzad K, Jianqiu Z, Hashim M, Nazam M, Wang L. 2020. Impact of using information and communication technology and renewable energy on health expenditure: A case study from Pakistan. Energy, 204: 117956.

Tarı R. 2015. Ekonometri. Umuttepe Yayınları, Kocaeli, Türkiye, pp: 534.

Toda HY, Yamamoto T. 1995. Statistical ınference in vector autoregressions with possibly ıntegrated process. J Economet, 66(1- 2): 225-250.

Triki R, Kahouli B, Tissaoui K, Tlili H. 2023. Assessing the link between environmental quality, green finance, health expenditure, renewable energy, and technology innovation. Sustainability, 15(5): 4286.

Ullah I, Rehman A, Khan FU, Shah MH, Khan F. 2019. Nexus between trade, CO2 emissions, renewable energy, and health expenditure in Pakistan. Int J Health Plan Manag, 35(4): 818-831. https://doi.org/10.1002/hpm.2912

Yavuz NC, Yılancı V, Öztürk ZA. 2013. Is health care a luxury or a necessity or both? Evidence from Turkey. Eur J Health Econ, 14(1): 5-10. https://doi.org/10.1007/s10198-011-0339-6

Yazdi SK, Khanalizadeh B. 2017. Air pollution, economic growth and health care expenditure. Econ Res Istrazivanja, 30(1): 1181-1190.