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Share of Renewable Energy as Factors Affecting Economic Growth and Foreign Trade Balance

Ekonomik Büyüme ve Dış Ticaret Dengesini Etkileyen Faktörlerden Olan Yenilenebilir Enerjinin Payı

Duygu ÇELİK[1]

öz

Enerji tüketimi ülkelerin çeşitli makroekonomik göstergelerini etkileyen önemli konulardan biridir. Dünya üzerindeki çoğu ülke ihtiyacı olan enerjiyi yenilenemeyen enerji kaynaklarından elde etmektedir. Fakat bu kaynakların tükenebilir olma özelliği ve doğal kaynakların tüm dünya ülkelerine eşit dağılmaması nedeni ile son dönemlerde ülkeler yenilenebilir enerji kaynaklarından enerji elde etmek için bu alana yatırım yapmakta ve yatırımlarını arttırmaktadır. Bu çalışmada yenilenebilir enerji tüketiminin, ekonomik büyüme ve dış ticaret dengesi üzerine olan etkisi incelenmiştir. Çalışmaya dünyada en fazla yenilenebilir enerji üreten ve tüketen ülkeler arasında yer alan on ülke dahil edilmiştir. Bu ülkelerin 1995-2020 yılları arasındaki verileri kullanılarak panel veri analizi gerçekleştirilmiştir. Çalışmanın sonucuna göre yenilenebilir enerji tüketimi ile dış ticaret dengesi arasında çift yönlü anlamlı bir ilişki olduğu tespit edilmiştir. Dış ticaretin yenilenebilir enerji tüketimi üzerine, pozitif yönlü bir etkisi bulunmaktadır. Dış ticaretteki 1 birimlik artış, yenilenebilir enerji tüketimini 0.088 arttırmaktadır. Yani dış ticarette cari açık azaldıkça, yenilenebilir enerji tüketimi de artmaktadır. Aynı şekilde, yenilenebilir enerji tüketiminin dış ticaret üzerine anlamlı ve pozitif bir etkisi bulunmaktadır. Yenilenebilir enerji tüketiminde 1 birimlik artış olduğunda dış ticaret 0.09 artmaktadır. Yani yenilenebilir enerji tüketimindeki artış, cari açığı azaltmaktadır. Yenilenebilir enerji tüketimi ile ekonomik büyüme arasındaki ise anlamlı herhangi bir ilişki tespit edilememiştir. Bunun nedeni incelendiğinde ise, yenilenebilir enerji tüketiminin çalışmaya konu olan ülkelerde hala çok kısıtlı düzeyde olduğu görülmüştür. Çalışmada yer alan on ülkeden sekizinde hala yenilenemeyen enerji kaynakları baskın konumdadır. Bu nedenle, yenilenebilir enerji tüketiminin ekonomik büyüme üzerinde henüz anlamlı bir etki yaratmaması anlaşılabilirdir. Fakat ülkelerin her geçen dönemde yenilenebilir enerji kaynaklarına yatırımlarını artırması ve yenilenemeyen enerji kaynaklarından yenilenebilir enerji kaynaklarına geçişlerini sürdürmesi beklenmektedir. Bu durumda, gelecekte yenilenebilir enerji tüketiminin ekonomik büyüme üzerinde de önemli bir belirleyici olacağı düşünülmektedir.

Anahtar Kelimeler: Yenilenebilir Enerji, Ekonomik Büyüme, Dış Ticaret.

ABSTRACT

Energy consumption is one of the important issues affecting various macroeconomic indicators of countries. Most countries in the world obtain the energy they need from non-renewable energy sources. However, due to the consumable nature of these resources and the fact that natural resources are not equally distributed to all countries of the world, countries have recently invested in this area and increased their investments in order to obtain energy from renewable energy sources. In this study, the effect of renewable energy consumption on economic growth and foreign trade balance was examined. Ten countries, which are among the countries that produce and consume the most renewable energy in the world, were included in the study. Panel data analysis was carried out using the data of these countries between 1995 and 2020. According to the results of the study, it has been determined that there is a two-way significant relationship between renewable energy consumption and foreign trade balance. A unit increase in foreign trade increases renewable energy consumption by 0.088. In other words, as the improve on the balance of trade in foreign trade decreases, renewable energy consumption also increases. Likewise,

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renewable energy consumption has a significant and positive effect on foreign trade. When there is a unit increase in renewable energy consumption, foreign trade increases by 0.09. In other words, the increase in renewable energy consumption reduces the improve on the balance of trade. No significant relationship was found between renewable energy consumption and economic growth. When the reason for this is examined, it is seen that the renewable energy consumption is still very limited in the countries that are the subject of the study. Non-renewable energy sources still dominate in eight of the ten countries included in the study. Therefore, it is understandable that renewable energy consumption has not yet had a significant impact on economic growth. However, it is expected that countries will increase their investments in renewable energy sources and continue their transition from non-renewable energy sources to renewable energy sources.

Keywords: Renewable Energy, Economic Growth, Foreign Trade.

INTRODUCTION

Societies need energy to survive. As the final consumption, energy is used to meet the needs of human beings such as heating and lighting in homes, as well as for production purposes in industry. Therefore, whether it is a developed country or a developing country, energy is of great importance. Today, energy needs are mostly obtained from non-renewable resources such as oil and natural gas. But these resources are not evenly distributed around the world. That is, while some countries have abundant non-renewable energy resources, some countries lack these resources. For this reason, while countries with non-renewable energy resources earn a significant income by selling these resources to other countries, other countries can become dependent on the country from which they import energy due to these resources. Being dependent on other countries for a strategically important good such as energy can be a problem for countries from time to time. In addition, payments made for energy cause a significant amount of foreign currency in the country to be transferred to foreign countries. This situation becomes important in terms of foreign trade balance. Of late, there has been a trend towards types of renewable energy. It is principal to acquire energy from different and environmentally compatible energy resources like the sun, wind, and streams.

All countries in the world need energy to sustain their economic activities. For this reason, energy consumption is an indispensable input that affects the macroeconomic indicators of the countries, especially in terms of the industry of the countries. Countries need energy to produce and convert this production into income. Since many countries do not have or do not have enough non-renewable energy resources such as oil, natural gas, coal, they have to import energy from foreign countries. This situation can sometimes become one of the main factors that create foreign trade deficits of countries. Although it causes an increase in foreign trade deficits of some countries in the world, energy is indispensable in terms of maintaining production and achieving economic growth (Bağcı & Akın, 2016). However, it is not sustainable as it tends to consume non-renewable energy resources such as oil, natural gas and coal. At this point, renewable energy sources gain importance. Recently, many countries are aware of this situation and they are investing in this field so that produce energy from environmentally friendly energy resources.

It is thought that countries that are not dependent on nonrenewable energy types and can generate their own energy from their own renewable energy types in the future will have an advantageous position. Although there are some studies on renewable energy, they are not yet sufficient and explanatory. For this reason, in this study, it was aimed to examine the 10 economies that use the most renewable energy. The share of renewable energy, which is one of the important factors affecting economic growth and foreign trade in these countries, has been examined. Russia, Japan, USA, China, Turkey, Germany, Canada, India, Brazil and Norway get involved in the study. The data of these economies from 1995 to 2020 were obtained and a panel data analysis was made based on this. Empirical analyzes preferred in the study were carried out using the STATA16 program. It is thought that the study will contribute significantly to the literature with both the selected country cases and the selected period range.

1. Literature Review

To summarize the literature in the table, all authors identified a correlation between the variables. However, Hassine and Harrathi could not detect a short-term relationship, while Örgün and Aynur found a short-term relationship between the variables. However, Hassine and Harrathi, Ibrahiem, Shahbaz et al., Alkhateeb and Mahmood, Apergis, Fotourehchi, Özşahin et al., Çandarlı and Unakıtan found a long-term relationship between the variables. However, Örgün and Aynur, in their study for 28 European countries, could not detect a long-term relationship between the variables. In general, short- and long-term causality relationships between reproducible energy utilization, economic rise and foreign trade balance have been determined in other studies and countries/country groups excluding the Gulf Cooperation Council countries, which Hassine and Harrathi have

examined, and 28 European Union countries, which have been examined by Örgün and Aynur. Variables affect each other in all countries.

In Table 1, there is a literature review examining renewable energy, which is one of the important energy sources, as well as economic growth and foreign trade indicators.

Table 1. Literature Review

Author/s	Publication year	Country/ies	Period Range	Conclusion
Ntanos et al.	2018	25 European countries	2007-2016	According to the results of the study, there is a correlation relationship between economic growth and renewable energy. The correlation between renewable energy consumption and economic growth is higher in high-income countries.
Hassine and Harrathi	2017	Gulf Cooperation Council countries	1980-2012	According to the results of the study, no causal relationship was found between economic growth, export and renewable energy consumption in the short run. However, there is a causal relationship between these variables in the long run. Renewable energy consumption and exports can increase economic growth.
Grabara et al.	2021	Kazakhstan and Uzbekistan	1992-2018	According to the results of the study, economic growth affects renewable energy consumption.
Amri	2017	72 countries	1990-2012	According to the results of the study, there is a feedback link between economic growth, renewable energy consumption and trade. These variables are dependent on each other.
Ibrahiem	2015	Egypt	1980-2011	There is a cointegration relationship between renewable energy consumption and economic growth in the long run. In addition, it was determined that there is a bidirectional causality relationship between the variables.
Shahbaz et al.	2020	38 countries consuming renewable energy	1990-2018	There is a long-term relationship between renewable energy consumption and economic growth. In addition, renewable energy has a positive effect on economic growth in 58% of the countries studied.
Jebli and Youssef	2013	69 countries	1980-2007	According to the results of the study, there is a one-way causality relationship from renewable energy to foreign trade. In addition, a bidirectional causality between renewable energy and imports, and a unidirectional causality from renewable energy to exports has been noticed. Renewable energy and trade

				have a positive effect on economic growth.
Alkhateeb and Mahmood	2019	Egypt	1971-2014	Economic growth and trade openness have an asymmetric effect on energy consumption in the short and long run. The increase in energy consumption increases economic growth and trade openness.
Bayar et al.	2020	European Union Transition Economies	1995-2015	According to the information obtained from the results of the tests, one-way causality relationship from trade to renewable energy was determined in some countries, while one-way causality relationship from renewable energy to trade was determined in some countries. In addition, there is a one-way causality relationship from economic growth to renewable energy.
Apergis	2014	80 countries	1990-2012	There is a long-term positive causality relationship from renewable energy to economic growth. Renewable energy consumption is important for economic growth. Economic growth also encourages the use of renewable energy sources..
Fotourehchi	2017	Developing countries	1990-2012	There is a long-term positive relationship from renewable energy to economic growth. Renewable energy consumption increases economic growth in the long run.
Bağcı	2019	Turkey	1996-2017	In the study, Turkey's renewable energy production and consumption, in addition to this, its renewable energy potential has been examined. According to the results of the study, it was concluded that Turkey does not benefit from renewable energy sources sufficiently. In addition, policy recommendations were made for energy imports.
Özşahin et al.	2016	BRICS-T	2000-2013	In their studies, the relationship between energy consumption and economic development was examined. According to the results of the study, a long-term positive relationship between the variables was determined.
Çınar and Öz	2017	Turkey	1965-2015	In their studies, the relationship between energy consumption and economic growth was examined. As a result of the study, they reached similar results with the literature studies that found that energy consumption was effective on economic growth.

Çandarlı and Unakıtan	2021	Turkey	1990-2019	In their study, they examined the relationship between energy consumption and economic growth in Turkey. According to the results of the study, in case of 10% increase in the share of renewable energy use in total energy consumption in the long term, it is estimated that there will be an increase of 1.8% in gross domestic product. It was understood from the results of the tests that there is a one-way causality relationship between renewable energy, which is the main variable, and economic growth, which is an important macroeconomic indicator.
Örgün and Aynur	2017	28 European Union Countries	1996-2013	In their studies, the relationship between energy consumption and economic growth was examined. According to the results of the study, there is a unilateral causality relationship from energy consumption to economic growth in the short run. A long-term causality relationship between the variables could not be determined.

2. Renewable Energy Production and Consumption of Countries

The shares of renewable energy in the total energy supply of countries are given in Figure 1. These data are based on the latest data from 2017 to 2020.

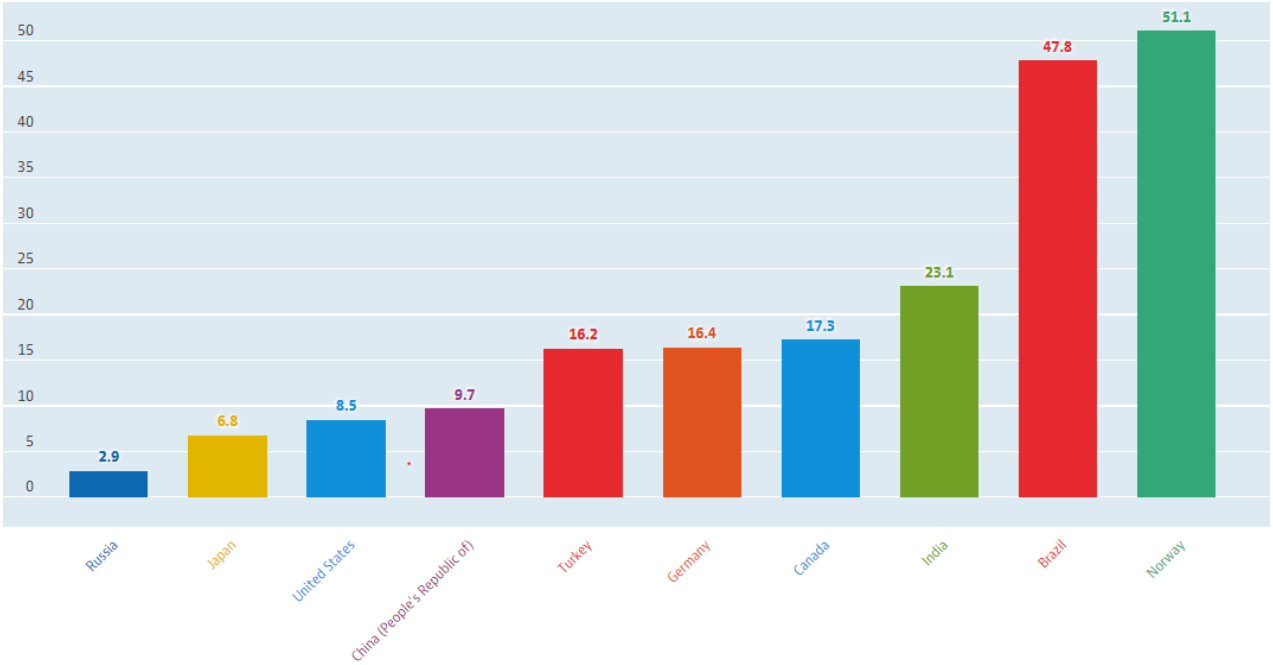

Figure 1: Share of renewable energy generation in total energy generation
Source: OECD Data, 2022, Access Link: https://data.oecd.org/energy/renewable-energy.htm#indicator-chart

Figure 1 shows the indicators for the renewable energy supply of the 10 countries that are included in the review. As can be seen from Figure 1, renewable energy supply in countries other than Brazil and Norway is still quite low compared to non-renewable energy supply. According to the latest data obtained in this sense, the main energy source of the countries is still non-renewable energy sources.

When the individual energy consumption of the countries is analyzed in terms of energy resources, similar indicators are encountered. Figure 2-a shows the distribution of Russia's final energy consumption by resources. As can be seen in Figure 2-a, Russia's main energy resources are oil, coal and gas. The share of renewable energy sources in final energy consumption is quite low. Figure 2-b shows the distribution of Japan's final energy consumption and resources. As can be seen in Figure 2-b, the main energy source of Japan is oil, coal and gas. The share of renewable energy sources in total energy consumption is quite limited. Figure 2-c shows the final energy consumption of the USA. Figure 2-e shows Turkey's final energy consumption by resources. While non-renewable energy sources constitute the majority in Turkey's energy consumption, the share of renewable energy sources is relatively low. Figure 2-f shows the distribution of Germany's final energy consumption by resources.

Figure 2-f shows Germany's final energy consumption by source. While non-renewable energy sources such as oil and coal constitute the majority in Germany's energy consumption, the share of types of renewable energy like hydropower, wind, solar are relatively low. Figure 2-g shows Canada's final energy consumption by source. When Canada's final energy consumption is examined in Figure 2-g, it is seen that oil and gas, which are among the non-renewable energy sources, have a significant share. However, the share of hydropower, is also at a significant level. However, the share of non-renewable energy in general constitutes the majority in total energy consumption. Figure 2-h shows the final energy consumption data of India by source. Looking at table 2-h, it will be noticed that, oil and coal constitute the majority of India's final energy consumption. However, the share of renewable energy sources is quite low. Figure 2-i shows Brazil's final energy consumption by source.

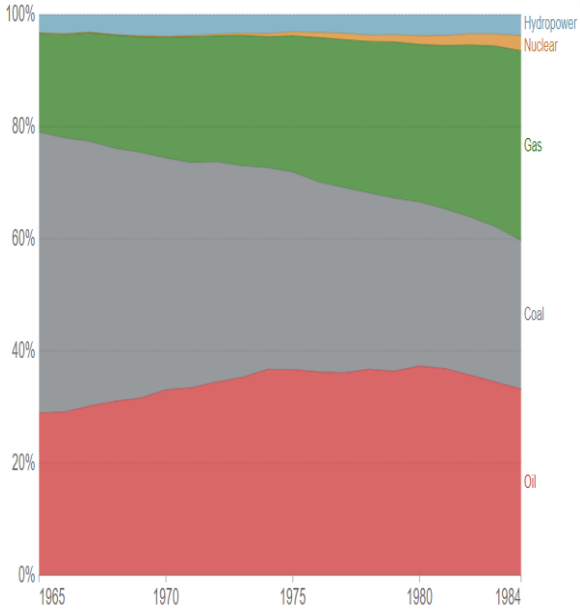

Figure 2-a: Russia's final energy consumption by source

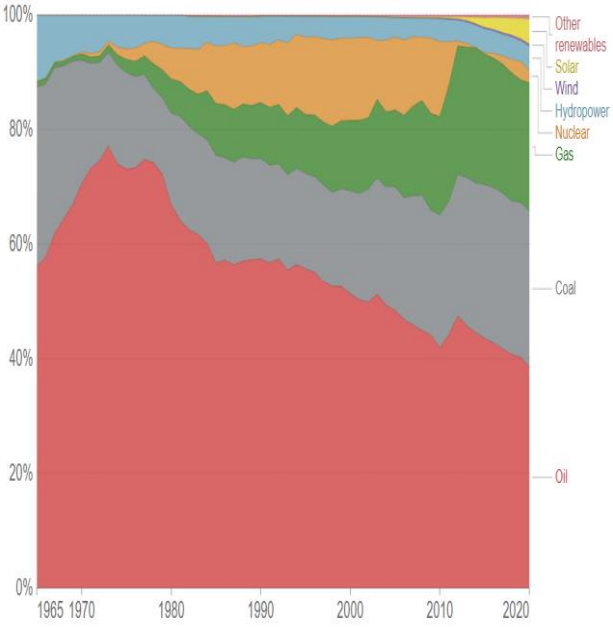

Figure 2-b: Japan's final energy consumption by source

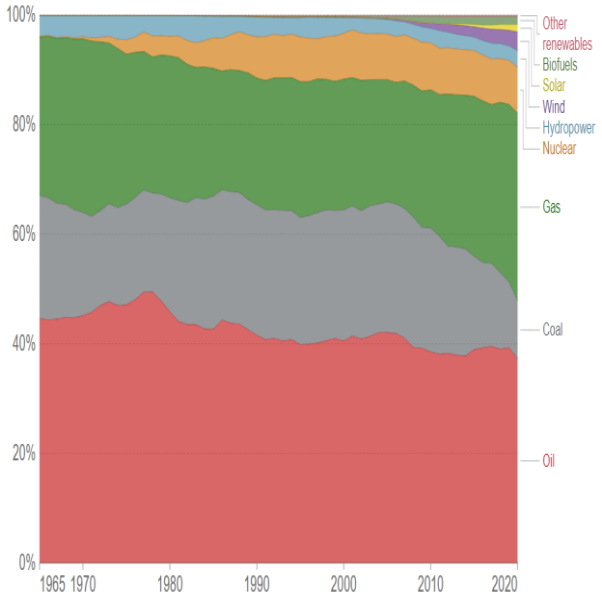

Figure 2-c: USA's final energy consumption by source

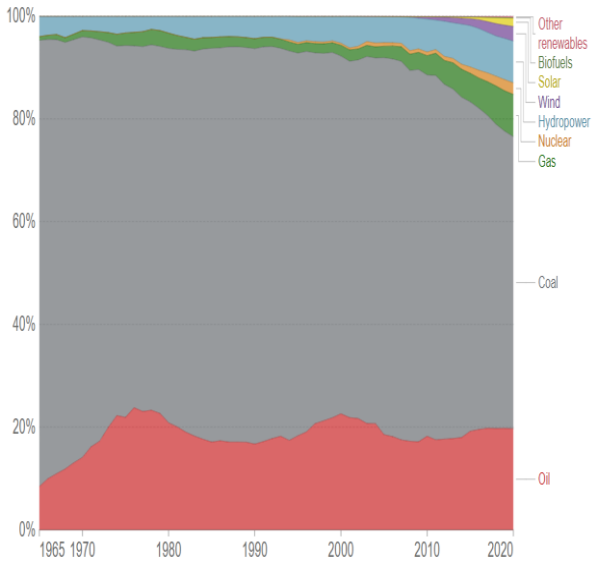

Figure 2-d: China's final energy consumption by source

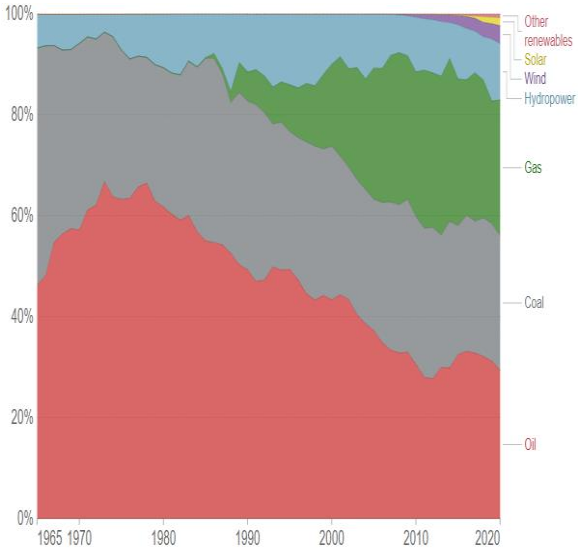

Figure 2-e: Turkey's final energy consumption by source

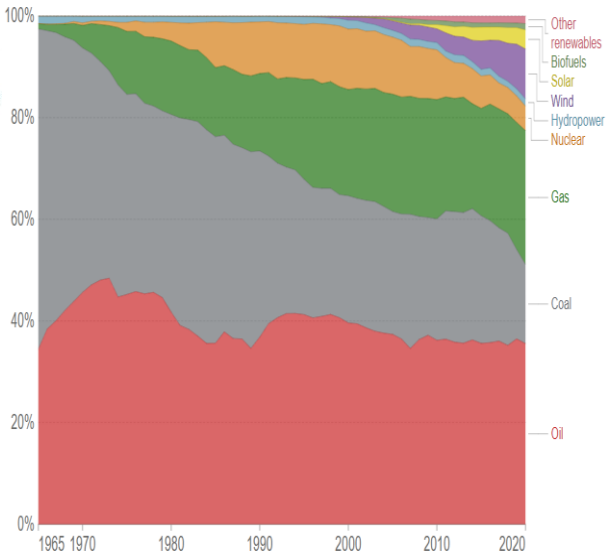

Figure 2-f: Germany's final energy consumption by source

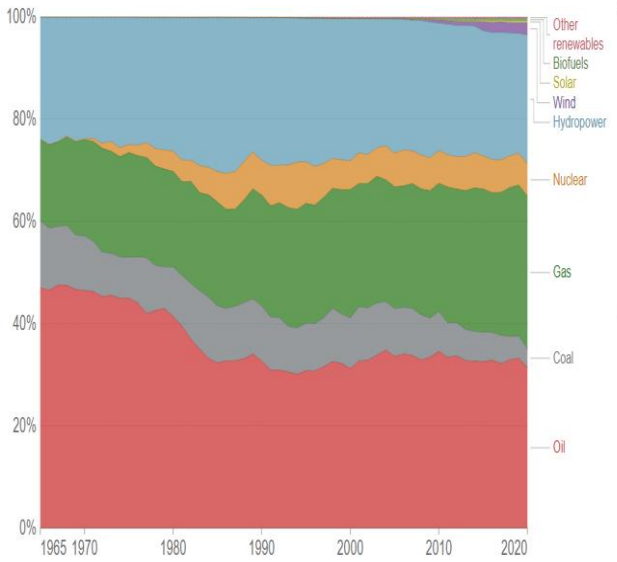

Figure 2-g: Canada's final energy consumption by source

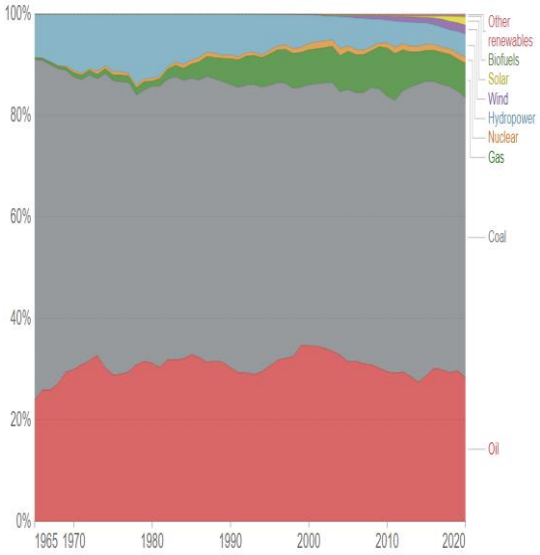

Figure 2-h: India's final energy consumption by source

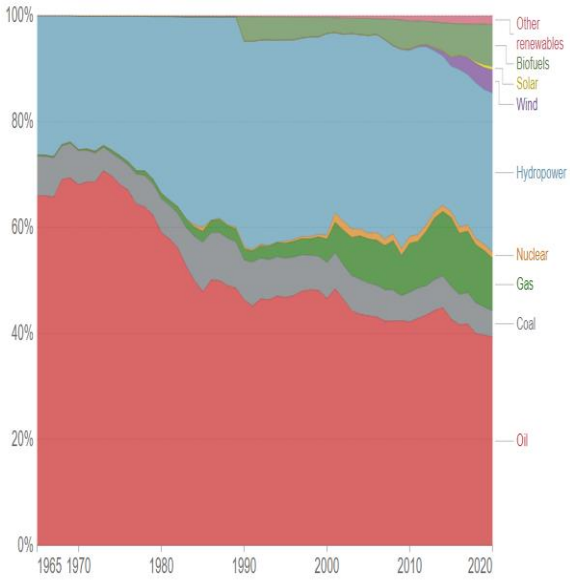

Figure 2-i: Brazil's final energy consumption by source

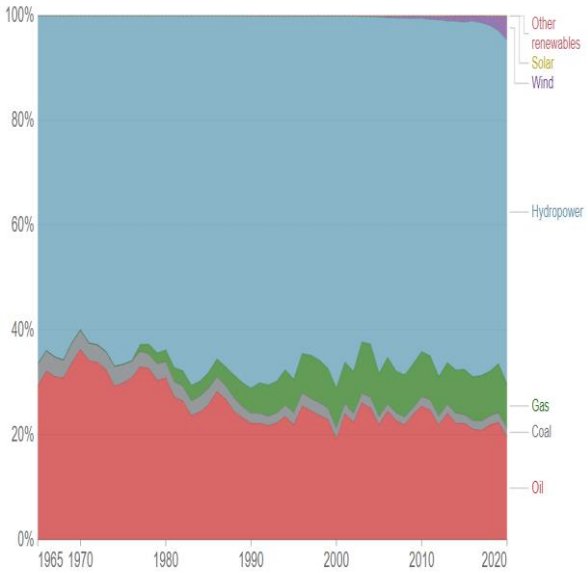

Figure 2-j: Norway's final energy consumption by source

Source: Our World in Data, 2022, Access Link: https://ourworldindata.org/grapher/energy-consumption-by-source-and-region?country

When the final energy consumption of Brazil is analyzed in Figure 2-i, it is seen that oil occupies an important place. However, besides this, the share of the total renewable energy resources, especially hydropower, is one of the issues that stands out, which is so important that it cannot be underestimated. Especially in recent years, the use of renewable energy sources and non-renewable energy sources has reached almost half. Figure 2-j shows Norway's final energy consumption by source. When the data of Norway in Figure 2-j is viewed, it will be noticed that one of the countries where renewable energy supply are used more than non-renewable energy supply is Norway. Hydropower is the main energy source and generally renewable energy consumption is higher than non-renewable energy supply.

3. Methodology

In this article, it has been tried to determine the interaction of renewable resources, which is one of the important energy resources, on economic growth, which is another important macroeconomic indicator, and also on the foreign trade balance. For this, in order to reach more reliable results, it was deemed appropriate to include the 10

countries that most preferred these sources in the analysis. In this part of the study, the variables, data and explanations of the panel data analysis on these 10 countries are given. The analysis of the study was carried out using the STATA16 program.

a. Countries Included in the Study

The list of countries included in the study was obtained from the International Renewable Energy Agency (IRENA). The data of variables were obtained from the World Bank. The economies in the study that generate the utmost reproducible energy in the globe are shown in figure 12.

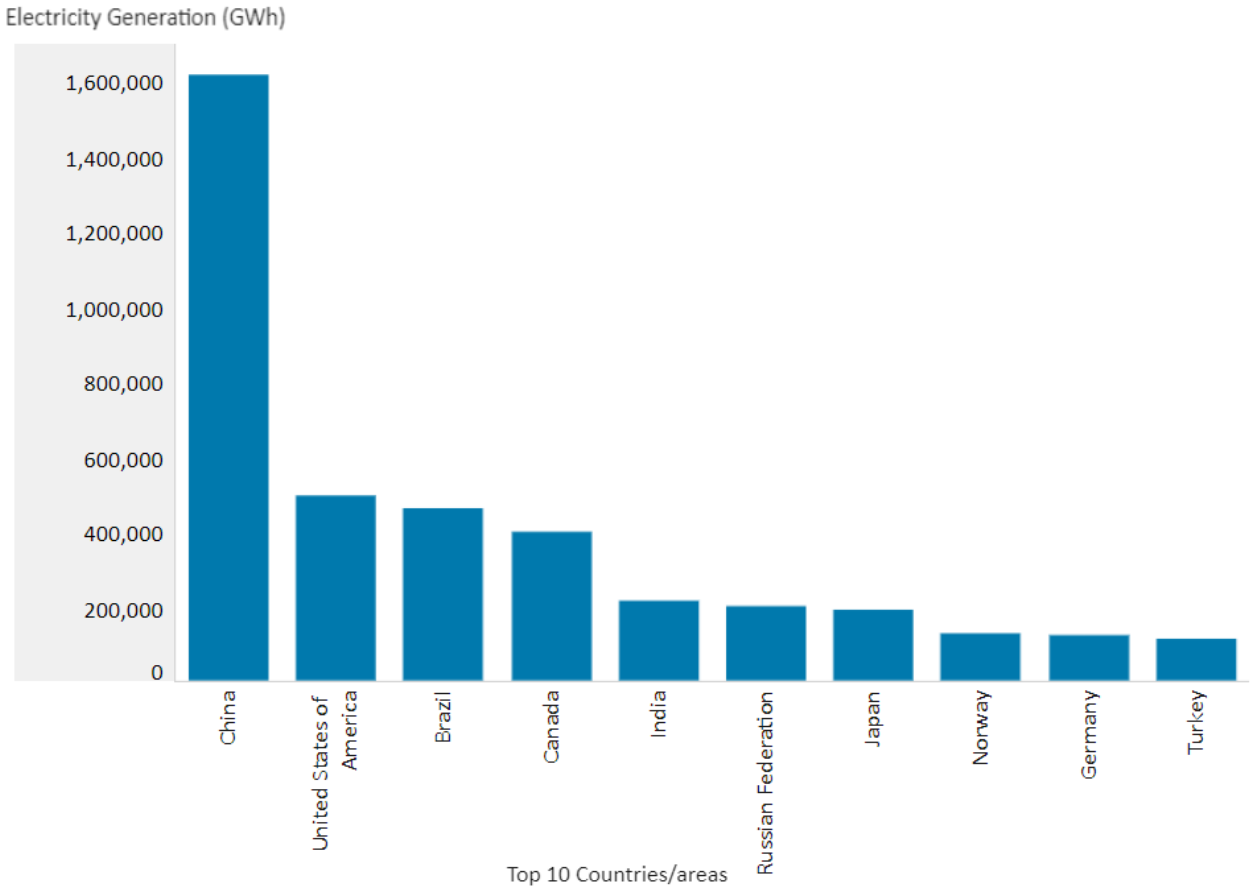

Figure 12. Top 10 countries producing the most renewable energy in the world (IRENA, 2022)

As can be seen in Figure 12, the countries producing the most renewable energy in the world are China, USA, Brazil, Canada, India, Russia, Japan, Norway, Germany and Turkey, respectively. Panel data tests are included in the empirical analysis part of the study. These tests were applied on 10 countries. The data of variables of these countries were obtained from the World Bank between 1995 and 2020.

b. Variables Used in the Model and Descriptions of Variables

The dependent and independent variables in the study, as well as the descriptions of these variables, are given in Table 2.

Table 2: Variables Used in the Model and Their Descriptions (World Bank Data, 2022, Date of Access: 16.03.2022)

Renewable Energy Consumption	REW	‘’Renewable energy consumption is the share of renewable energy in total final energy consumption.’’
Economic Growth	GDP	‘’Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars.’’

Foreign Trade Balance	TRD	‘’Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.’’

The descriptions in Table 2 were obtained from the data disclosures of the World Bank. This information more clearly expresses the content of dependent and independent variables.

4. Findings

In this article, it has been tried to determine the interaction of renewable resources, which is one of the important energy resources, on economic growth, which is another important macroeconomic indicator, and also on the foreign trade balance. For this, in order to reach more reliable results, it was deemed appropriate to include the 10 countries that most preferred these sources in the analysis. The data set progresses from 1995 to 2020.

a. Model

The model created for the country group included in the analysis is expressed in equations 1, 2 and 3.

$$REWit=\alpha0+\beta1GDPit+ \beta2TRDit+\mu i+\lambda t+\varepsilon it \quad (1)$$

$$GDPit=\alpha0+\beta1REWit+ \beta2TRDit+\mu i+\lambda t+\varepsilon it \quad (2)$$

$$TRDit=\alpha0+\beta1GDPit+ \beta2REWit+\mu i+\lambda t+\varepsilon it \quad (3)$$

$i= 1…10$

$t=1995-2020$

Among the variables included in the analysis, renewable energy consumption is shown in the model (REW), economic growth (GDP) and foreign trade balance (TRD). While the number of countries in the model is 10, the time dimension of the model is between 1995 and 2020.

The Driscoll - Kraay estimator preferred in the study is robust for all forms of spatial and periodic correlation. It also gives reliable results against fundamental deviations in the model. This estimator is consistent in the presence of heteroscedasticity even in the case of large T (years) and I (number of countries). It also produces robust standard errors. It can even be used in unbalanced panel data models (Yerdelen Tatoğlu, 2018). For this reason, it was preferred to estimate the data with this estimator in the study.

b. Cross-Section Dependency and Homogeneity Tests

The tests performed to test the correlation between the units for the variables and the homogeneity of the variables are given in Table 3. The cross-section dependency test was performed using the Pesaran CD test. The homogeneity of the variables was tested with the Swamy S test. In panel data analysis, if the unit root relationship cannot be determined according to the result of the cross-section dependency test, it is necessary to turn to the first generation panel unit root tests. If a unit root relationship is detected, it is more appropriate to use second generation panel unit root tests. Homogeneity tests, on the other hand, indicate which of the tests called the first and the second group within these generations would be more appropriate.

Table 3. Cross-Section Dependency and Homogeneity Test

Cross-Section Dependency	Pesaran CD Test	REW - p-value: 0.099 GDP - p-value: 0.000 TRD - p-value: 0.000
Homogeneity Test	Swamy S Test	Chi2:72268.63 (Prob=0.0000)

According to the results of the cross-section dependency test in Table 3, renewable energy consumption contains a unit root at the 90% confidence level. Economic growth and foreign trade balance, on the other hand, contain a

unit root at the 95% confidence level. In this case, it is more appropriate to use second generation panel data analysis tests. According to the result of the homogeneity test, the parameters are not homogeneous. It varies from unit to unit. So the parameters are heterogeneous. In this case, heterogeneous estimator tests should be preferred.

c. Appropriate Lag Length Selection Test

One of the important tests that should be done before moving on to the model estimation is the tests that determine the appropriate lag length. In order to determine the appropriate lag length in the study, the Hansen J appropriate lag length test was performed. Table 4 shows the Hansen J test results, which are frequently used to determine the appropriate lag length.

Table 4. Hansen J Test

Hansen J Test						
Lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	.4863982	39.0732	.3334206	-141.3097	-32.9268	-76.95931
2	-.3640436	26.55737	.4878601	-108.7298	-27.44263	-60.46701
3	-6.838353	10.73546	.9052433	-79.45597	-25.26454	-47.28079
4	-346.6925	2.393638	.9836084	-42.70208	-15.60636	-26.61449

Table 4 contains the Hanjen J test results for the four lags. The results also include Bayesian Information Criteria (MBIC), Akaike Information Criteria (MAIC), and Hannan Quinn Information Criteria (MMQIC) based on Hansen J statistics (Yerdelen Tatoğlu, 2018). Since these indicators are minimum at 1 lag, the appropriate lag length has been determined as 1.

d. Stationarity (Unit Root) Tests

Since the correlation between units was determined in the previous cross-section dependency test in the study, Multivariate Augmented Dickey Fuller (MADF) panel unit root test was preferred in unit root analysis. The reason for this is that the MADF test is a test that pays attention to the correlation between residuals. Table 5 shows the results of the MADF test.

Table 5. Multivariate Augmented Dickey Fuller (MADF) Test

Variables	Lags	MADF	Approx 5% CV
REW	1	52.531	30.715
GDP		143.107	
TRD		34.465	

According to the results of the MADF test in Table 5, the MADF value is greater than the Approx 5% CV value for all variables. Accordingly, the series are stationary at the 95% confidence level and are stationary in level.

F, LM and LR Tests

F, LM and LR tests are among the tests that help to select an estimator in panel data analysis. These tests indicate whether the model contains unit and time effects. In other words, it is tested whether the data differ from unit to unit and/or whether the data differ from time to time. (Yerdelen Tatoğlu, 2020).

Table 6. F, LM ve LR Tests

	Unit Effect	Time Effect

F test statistic	558.12 (Prob=0.0000)	0.07 (Prob=1.000)
LM test statistic	2894.70 (Prob=0.0000)	0.00 (Prob=1.0000)
LR test statistic	722.01 (Prob=0.0000)	0.00 (Prob=1.000)

According to the results of the tests that help to choose an estimator in Table 6, it is seen that the model includes unit effects but not time effects in all of the F, LM and LR tests.

e. Robust Hausman Test

Model selection is important when model estimation is made in panel data analysis. In other words, Hausman tests are required in order to choose between the random effects model and the fixed effects model. Table 7 shows the Robust Hausman Test and its results.

Table 7. Robust Hausman Test

	Robust Hausman Test
rH test statistic	0.03 (Prob=0.9835)

According to the result of the Robust Hausman test in Table 7, it seems more appropriate to use a random effects model in model estimation.

f. Multicollinearity and Normal Distribution Tests

In the study, it was first tried to determine whether there was a multicollinearity problem with a priori indicators, and then the variance was checked with a variance inflation factor (VIF) to reach a reliable result. First of all, it was tried to determine whether it is a predictor of multicollinearity with the least squares estimator. Afterwards, the results were supported with the variance inflation factor (VIF). In addition, the Jarque Bera test was applied to test the normal distribution.

Table 8. Multicollinearity ve Normal Distribution Tests

Multicollinearity	
Least squares estimator	R2=0.0176, Prob: 0.1115
Variance inflation factor (VIF)	Mean VIF=1.00
Normal Distribution	
Jarque Bera	Chi2=5.9e-08

According to the results in Table 8, it is seen that there is a multicollinearity problem in the least squares estimator according to the a priori indicators. However, when the VIF value is between 0 and 5, it is stated that there is no multicollinearity. Since this result is listed as 1 in Table 7, it can be said that there is no multicollinearity. According to the Jarque Bera test, the error terms are normally distributed.

g. Autocorrelation and Heteroscedasticity Tests

Before proceeding with the model estimation, autocorrelation, heteroscedasticity and cross-section dependency tests are performed to check whether there are deviations from the basic assumptions. Table 9 includes autocorrelation and heteroscedasticity tests. cross-section dependency test has been done before.

Table 9. Autocorrelation and Heteroscedasticity Tests

Basic Assumption Tests		
Autocorrelation	Durbin- Watson	0.0574
	Baltagi-Wu, LBI	0.1881
Heteroscedasticity	Levene, Brown ve Forsythe Test	W0: 50.111825, (Prob=0.0000)
		W50: 22.278506, (Prob=0.0000)
		W10: 46.532982,(Prob=0.0000)

According to the results in Table 9, there are deviations from all three basic assumptions. That is, there is both autocorrelation, heteroscedasticity and cross-section dependency. The results of the cross-section dependency test are given in Table 2. There is also a correlation between units. In this case, the Driscoll-Kraay estimator, which is one of the model estimators that is suitable to be used in the presence of these three deviations, will be used.

h. Driscoll-Kraay Model Forecast Results

In the study, the model estimation was made according to the Driscoll-Kraay standard error, random effects estimator using the data between 1995 and 2020 for the top 10 countries that direct their production towards renewable energy, which is their new choice to meet the world's energy needs. Table 10 contains the estimation results.

Table 10. Driscoll-Kraay Model Forecast Results

REW	Coefficients	Drisc/KraayStd.Err.	t statistic	p > |t|
GDP	0.4593683	0.2991338	1.54	0.137
TRD	0.0889812	0.0156219	5.70	0.000
Constant	17.10855	0 .8578619	19.94	0.000
Coefficients				
F statistic			29.80	
			(Prob>F: 0.0000)	
R^2			0.0164	
Number of Observations			260	

TRD	Coefficients	Drisc/KraayStd.Err.	t statistic	p > |t|
REW	0.0927243	0.0153755	6.03	0.000

GDP	-0.0344573	0.2031778	-0.17	0.867
Constant	45.43779	0.7353384	61.79	0.000
Coefficients				
F statistic			19.67 (Prob>F: 0.0000)	
R^2			0.0083	
Number of Observations			260	

GDP	Coefficients	Drisc/KraayStd.Err.	t statistic	p > |t|
REW	0.0179737	0.0114514	1.57	0.129
TRD	- 0.0012938	0.0075785	-0.17	0.866
Constant	2.927512	0.3654466	8.01	0.000
Coefficients				
F statistic			1.55 (Prob> F : 0.2319)	
R^2			0.0083	
Number of Observations			260	

In the study, renewable energy sources are represented symbolically (REW), while foreign trade balance (TRD) is represented as economic growth (GDP). According to the estimation results in Table 10, it is noticed that there is a significant relationship between REW, which is the new choice to meet the world's energy needs, and TRD, which is an important macroeconomic indicator. TRD has a positive effect on REW. A unit enhancement in TRD scale ups REW by 0.088. Scilicet, as the improve on the TRD diminishes, REW also scale ups. Alike, REW has a remarkable and not negative influence on TRD. While there is a unit enhancement in REW, TRD scale ups by 0.09. In other words, the enhancement in REW lessens the improve on the TRD. No significant relationship was found between REW and GDP. When GDP is the dependent variable, there is no significant effect of REW and TRD on GDP.

CONCLUSION:

Energy is one of the substantial matter of all countries in the world, and also one of the basic inputs of their production. In order to maintain their macroeconomic performance, the energy issue has a strategic importance for the countries. Most of the countries in the world meet their energy needs from non-REW resources such as oil, natural gas and coal. However, these resources are not sustainable as they are heading towards depletion. For this reason, countries have recently started to turn to REW and have invested in this area. Although most countries in the world still use non-REW, it is foreseen that these rates will change in the future. For this reason, in this study, empirical analysis was conducted on Russia, Japan, USA, China, Turkey, Germany, Canada, India, Brazil and Norway, which are the countries that use up the lion's share REW in the globe and the effect of REW consumption

in these countries on GDP and TRD was investigated. In the study, the data of the countries between 1995 and 2020 were used.

As a result of the model estimation, it is noticed that there is a significant relationship between REW, which is the new choice to meet the world's energy needs, and TRD, which is an important macroeconomic indicator. TRD has a positive effect on REW. A unit enhancement in TRD scale ups REW by 0.088. Scilicet, as the improve on the TRD diminishes, REW also scale ups. Alike, REW has a remarkable and not negative influence on TRD. While there is a unit enhancement in REW, TRD scale ups by 0.09. In other words, the enhancement in REW lessens the improve on the TRD. No significant relationship was found between REW and GDP. When GDP is the dependent variable, there is no significant effect of REW and TRD on GDP. The results obtained from the study are similar to the following studies in the literature in terms of foreign trade variable: Jebli and Youssef (2013), Alkhateeb and Mahmood (2019), Bayar et al. (2020). The results obtained from the study are similar to the following studies in the literature preferring the economic enlargement variable: Hassine and Harrathi (2017), Shahbaz et al. (2020), Bağcı (2019), Form and Aynur (2017).

As stated earlier in the study, REW is till now extremely narrow in the economies that are the object of the article. Non-REW resources till now predominate in eight of the ten economies got involved in the article. Although the energy utilization from REW scale ups with each passing period, it is still relatively knee-high today. That's why, it is comprehensible that REW utilization hasn't yet had a notable influence on GDP. Nevertheless, it is anticipated that economies will scale up their hedges in REW resources and proceed their readjustment from non-REW resources to REW resources.

Since the use of renewable energy reduces foreign trade deficits, which is one of the main macroeconomic problems of countries, it is recommended that policy makers increase their investments in this field. In addition, renewable energy has a strategic importance as it will reduce the foreign dependency of countries that do not have sufficient non-renewable energy resources and have to import energy. Because today, countries that have to import energy can become foreign-dependent politically and strategically. This can prevent countries from producing free policies. For this reason, it is thought that countries that invest more in renewable energy may be the first to become free in energy.

Countries should increase their investments in renewable energy sources in order to increase foreign dependency in energy. These investments will also help in maintaining the foreign trade balance. Investments in renewable energy sources take a long time. For this reason, countries should make long-term plans and arrange their budgets in the long-term. In fact, policy makers should reduce their investments in unsustainable areas and direct these funds to energy infrastructures to be obtained from renewable energy sources. In addition, renewable energy will contribute to economic and environmental sustainability. Countries that specialize in renewable energy production will be able to export this energy and make positive contributions to their foreign trade. Considering all these processes, it is recommended that policy makers complete the transition to renewable energy before non-renewable energy resources are exhausted.

Compliance with the Ethical Standard

Conflict of Interest: The authors declare that there is no conflict of interest.

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