

THE IMPACT OF RENEWABLE AND NON-RENEWABLE ENERGY CONSUMPTION ON FINANCIAL DEVELOPMENT: EVIDENCE FROM EMERGING COUNTRIES

Yenilenebilir ve Yenilenemez Enerjinin Finansal Geliřim Üzerindeki Etkisi:
Geliřmekte Olan Ülkelerden Kanıtlar

Feyyaz ZEREN* & Süleyman Serdar KARACA**

Abstract

Energy is an essential factor for countries to accomplish sustainable development and the importance of renewable energy has enhancing day by day. Over the last three decades the relationship between renewable energy consumption (RNW) and economic growth as well as energy consumption (EC) and financial development (FD) has intensely studied. In this paper the relationship between RNW, non-renewable energy consumption (non-RNW) and FD is investigated for top emerging countries of Bloomberg. The financial system deposits to GDP, deposit money bank assets to GDP and private credit to GDP have considered as FD indicators in the paper that investigates the period of 1980-2018. The long-term relationship between the variables was studied with Westerlund (2007) panel cointegration test and the direction of this relationship was examined with Pesaran (2006) CCE-MG panel cointegration estimator. The existence of causality among the variables was analyzed with Dumitrescu and Hurlin (2012) panel causality test. According to the cointegration test results, a positive long-run relationship was found between RNW and FD. Also, there is a bidirectional causality finding between RNW and FD, and there is a one-way causality finding from FD to non-RNW.

Keywords:

Financial Development, Renewable Energy Consumption, Non-Renewable Energy Consumption, Panel Cointegration Test, Panel Causality Test

JEL Codes:

C33, P43, Q20

Özet

Enerji, ülkelerin sürdürülebilir kalkınmayı başarması için önemli bir faktördür ve yenilenebilir enerjinin önemi her gee gün artmaktadır. Son otuz yılda yenilenebilir enerji tüketimi - ekonomik büyüme ve enerji tüketimi - finansal gelişim ilişkileri yoğun bir şekilde araştırılmıştır. Bu çalışmada Bloomberg'in en çok gelişmekte olan ülkeleri için yenilenebilir enerji tüketimi, yenilenemeyen enerji tüketimi ve finansal gelişim arasındaki ilişkiler araştırılmıştır. 1980-2018 dönemini ele alan çalışmada bankalardaki mevduatların GSYİH'ye oranı, finansal sistem mevduatının GSYİH'ye ve özel kredilerin GSYİH'ye oranı finansal gelişim göstergeleri olarak kullanılmıştır. Değişkenler arasındaki uzun vadeli ilişki Westerlund (2007) panel eşbütünlük testi ile incelenmiş ve bu ilişkinin yönü Pesaran'ın (2006) CCE-MG panel eşbütünlük tahmincisi ile belirlenmiştir. Dumitrescu ve Hurlin (2012) tarafından geliştirilen panel nedensellik testi vasıtasıyla ile değişkenler arasında nedenselliğin yönü araştırılmıştır. Elde edilen panel eşbütünlük testi sonuçlarına göre, yenilenebilir enerji tüketimi ve finansal gelişim arasında uzun dönemli pozitif yönlü bir ilişki bulunmuştur. Öte yandan, yenilenebilir enerji tüketimi ile finansal gelişim arasında çift yönlü nedensellik bulgusuna rastlanmış olup, finansal gelişimden yenilenemez enerji tüketimine doğru ise tek yönlü nedensellik bulgusu söz konusudur.

Anahtar Kelimeler:

Finansal Gelişim, Yenilenebilir Enerji Tüketimi, Yenilenemeyen Enerji Tüketimi, Finansal Gelişim, Panel Eşbütünlük, Panel Nedensellik

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* Corresponding Author, Assoc. Prof. Dr., Yalova University, Faculty of Economics and Administrative Sciences, Department of International Trade and Finance, feyyaz.zeren@yalova.edu.tr, ORCID: 0000-0003-0163-5916

** Prof. Dr., Malatya Turgut Özal University, Faculty of Business and Management Sciences, Department of Accounting and Finance, suleymanserdar.karaca@ozal.edu.tr, ORCID: 0000-0002-5424-5359

1. Introduction

Renewable energy has become an important factor for countries to achieve sustainable development. Both renewable energy sources and non-renewable sources are important energy sources that affect financial development and economic growth. The KYOTO Protocol United Nations Framework Convention on Climate Change, which came into force in 1994, encourages the countries to reduce greenhouse gas emissions, collaborate on research, technology and protect greenhouse gas sinks (e.g. forests, oceans, lakes). In this context, countries have sought renewable energy sources to reduce their greenhouse gas emissions. Accordingly, the exchange of RNWs between 1948-2015 is presented in Figure 1.

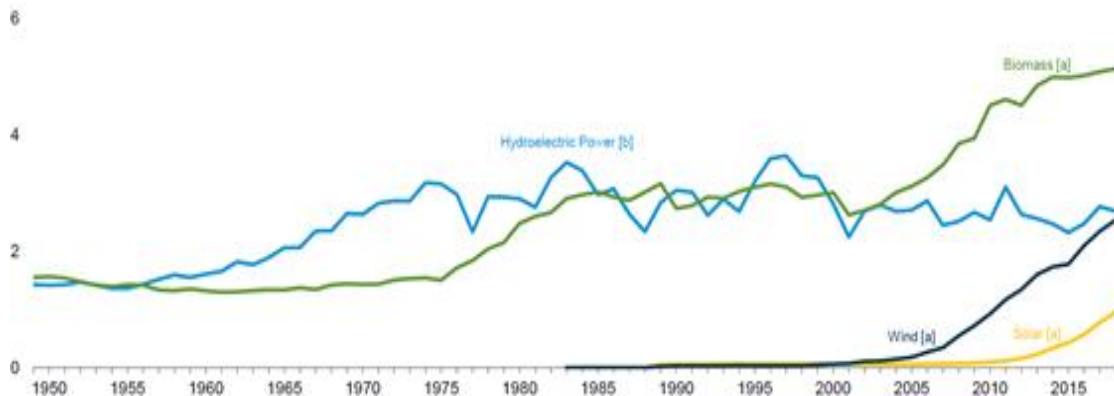


Figure 1. Renewable Energy Consumption (Quadrillion Btu)

Source: <https://www.eia.gov/totalenergy/data/29/10/2019>

When the graphic above is analysed, it is clear that Biomass EC has especially increased significantly in recent years. In addition, the view of energy sources from the 2050 perspective by the USA Energy Information Administration (EIA) is as in Figure 2.

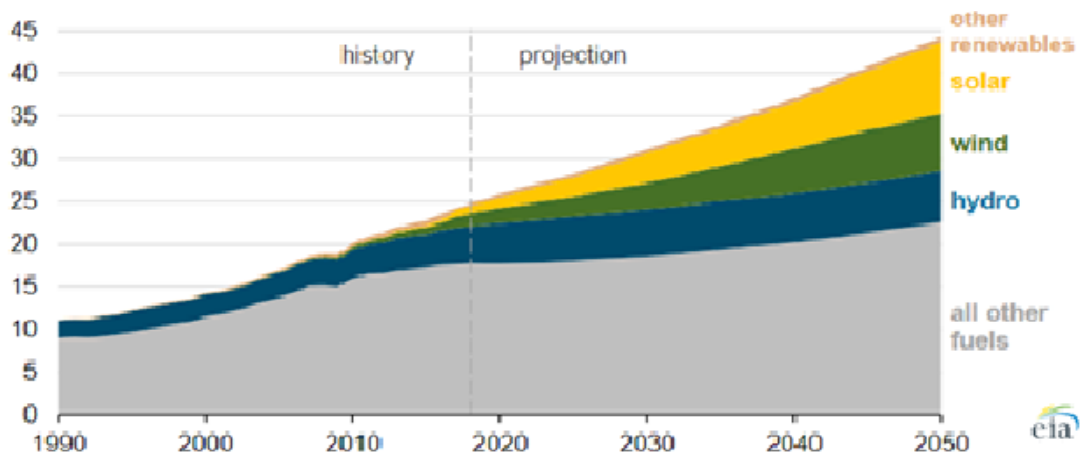


Figure 2. World Net Electricity Generation (Trillion kilowatt hours), (1990-2050)

Source: <https://www.eia.gov/todayinenergy/detail.php?id=41533/29/10/2019>

While renewable energy sources are about 30% of world electricity in 2018, this figure is expected to increase to 50% until 2050.

In the studies conducted in the last 10 years, it is especially seen that FD has started to take a role in explaining the factors that determine EC. The first examples of studies investigating the relationship between EC and FD coincide in 2009. The first studies to investigate the relationship belongs to Brunnschweiler (2009) and Dan and Lijun (2009). However, the first study to seriously discuss and explain the relationship between EC and FD was conducted by Sadorsky in 2011 and this study pioneered the literature.

Sadorsky (2011) stated that the relationship between these two variables may result from several possible reasons. The prices and consumption prices of vehicles that provide EC such as cars, houses, dishwashers and refrigerators can affect the money needs of people. In this context, how EC is priced can indirectly be reflected in FD indicators. In the opposite direction, FD can lead to more economical use of energy resources and, accordingly, to lower EC costs. Besides, the increase in economic prosperity due to the increasing FD may lead to the incentive to spend money comfortably and consequently an increase in EC.

In this study, it is aimed to reveal the possible effects of renewable and non-renewable energy consumption on financial development. The differences between renewable and non-renewable energy consumption are thought to have different effects on financial development. In this regard, the summary of the studies in the literature, the econometric method used, the findings obtained, and suggestions for future studies are tried to be presented.

2. Previous Literature Review

Many studies have made to investigate the relationship between EC and FD by methods such as Generalized Method of Moments (GMM), time series causality tests and some panel causality test in the literature. The focus of the study is to explain the renewable and non-renewable forms of energy and their impact on FD. However, in the literature, the number of studies investigating this situation is very limited. Studies investigating the relationship between EC and FD are briefly described below.

Sadorsky (2010) analyzed the relationship between EC and FD for 22 developing countries and determined a significant positive relationship between these two variables using the GMM model. In another study, Sadorsky (2011) found similar findings for 9 countries from Central and Eastern European Border Economies using the GMM model. Kakar, Khilji and Khan (2011) examined Pakistan and found that FD is a remarkable measurement tool for the effectuality of energy use. Xu (2012) determined a positive relationship between these two variables for China using the GMM model. In another study using GMM, oban and Topcu (2013) examined the European Union (EU) countries and found a significant nexus between these two variables for the former EU countries but did not find any relationship for other countries. Shahbaz and Lean (2012) found that EC was associated with FD and industrialization in their studies, which examined the Tunisian economy using the Granger causality test. Al-Mulali and Sab (2012a) examined Sub-Saharan African countries using the Pedroni panel cointegration and panel causality test. As a result, they found that EC plays a crucial role in financial and economic development. In another study of Al-Mulali and Sab (2012b), they analyzed 19 countries consisting of developed and developing countries and reached similar

findings. Al-Mulali and Lee (2013) examined the Gulf Cooperation Council and this time they found the opposite findings. According to the study, they found that FD positively increased EC.

Unlike other studies, Chtioui (2012) concluded that EC is the Granger cause of FD in his study dealing with Tunisia. Mehrara and Musai (2012), on the other hand, concluded that these two variables have an integrated structure in the long term for Iran with ARDL cointegration test. Islam, Shahbaz, Ahmed and Alam (2013) conducted a traditional Granger Causality test using the Vector Error Correction Model (VECM) in their paper in Malaysia and concluded that EC is affected by both financial and economic development. Zeren and Koç (2014) found that the relationship between EC and FD differs in the case of positive and negative shocks in their study of 7 New Industrialized countries. As a result of the study, they found that both positive and negative shocks exist for Malaysia and Mexico, while they found that there was a causality from EC to FD in negative shocks only for the Philippines. They also found bidirectional causality between India and Turkey. However, they could not achieve this result for South Africa. Salman and Atya (2014) studied three Northern African countries such as Algeria, Egypt and Tunisia. In their study, they dealt with the period of 1980-2010 with the granger causality test. As a result, there is a positive nexus between EC and FD for Algeria and Tunisia, whereas this relationship is negative for Egypt. Ali, Yusop and Hook (2015) discussed Nigeria for the period 1972Q1-2011Q4 using ARDL approach and quarterly data. As a result of the study, a negative relationship was found between EC and FD.

Chang (2015) used panel threshold regression for 1999-2008 and 58 countries in his study. According to the results obtained, when private and domestic loans are used as FD indicators, EC increases FD, while traded stocks and stock market transaction volume are used as FD indicators, and EC decreases FD. Paramati, Ummalla and Apergis (2016) used panel cointegration and panel causality tests in their studies of 20 developing countries. They concluded that stock markets positively affected EC for the period 1991-2012. In another study examining South Asian countries consisting of India, Pakistan, Bangladesh and Sri Lanka, Akhtar, Sheikh and Altaf (2016) used data from 1974-2013 and consequently found bidirectional causality between EC and FD. Mahalik, Babu, Loganathan and Shahbaz (2017) found a cointegration relationship between EC and FD for Saudi Arabia in their studies, which examined the period between 1971-2011. These findings were obtained with the help of Pesaran's (2001) ARDL test and the combined cointegration test developed by Bayer-Hanck (2013).

Destek (2017) examined 17 developing countries for the period 1991-2015. In his study, he used the Common Correlated Effect (CCE) cointegration estimator, which takes into account cross-section dependency. According to the findings obtained as a result of the study, developments in financial markets have been shown to reduce EC. Topcu and Altay (2017) viewed for Turkey in the 1989-2011 period. Looking at the findings, even with disaggregated data, there is a statistically significant nexus between EC and FD.

Topcu and Payne (2017) examined the relationship between the FD index and EC for the period of 1990-2014 in their study where they examined 32 high-income countries. The findings are that there is no relationship between these two variables but increases in stock market returns reduce EC. Çağlar and Kubar (2017) examined the 1969-2014 period by the Fourier Toda Yamamoto causality test for Turkey. As a result of the study, while no findings were

found between RNW and FD, it was determined that FD was the cause of fossil EC. Gngr, Korkmaz, Karaca and Keskin Benli (2017) 1985-2015 periods for Argentina, China, South Korea, Israel, Malaysia, Mexico and Turkey were examined. As a result of their work, they identified one-way causality from primary EC to FD.

In the literature, although many studies are examining the nexus between EC and FD, the number of studies examining the relationship between renewable energy and FD are very low. etin and Bakırtař (2018), one of the first studies conducted in this context, discussed the long-term relationship between RNW and FD, covering the years 1991-2011 for G-7 countries. As a result of the research, there is a long-term relation between RNW and real GDP, total EC, oil prices and FD.

In another study examining this relationship, Eren, Taspınar and Gokmenoglu, (2019) studied the Indian sample and examined the impact of FD and economic growth on the renewable energy source. In this paper, they concluded that FD has a significant and positive effect on renewable energy sources. They also found that renewable energy is based on FD in the long run.

The studies described up to this stage are presented in Table 1 as a summary. When the studies are examined, it is seen that System GMM, Granger causality, Panel Cointegration and Panel Causality tests are mainly used.

Table 1. Literature Review

Author	Country/Countries	Data	Method	Empirical Findings
Dan and Lijun (2009)	China	1985-2006	Granger causality	EC → FD
Sadorsky (2010)	22 emerging countries	1990-2006	System GMM	There is a positive relation between EC and FD
Sadorsky (2011)	9 Central and Eastern European frontier economies	1996-2006	System GMM	There is a positive relation between EC and FD
Kakar et al. (2011)	Pakistan	1980-2009	Granger causality	FD → EC
Xu (2012)	China	1999-2009	System GMM	There is a positive and significant relation between EC and FD
Chtioui (2012)	Tunisia	1972-2010	Granger causality	EC → FD
Mehrara and Musai (2012)	Iran	1970-2009	ARDL bound test	EC = FD
Shahbaz and Lean (2012)	Tunisia	1971-2008	Granger causality	EC ↔ FD
Al-Mulali and Sab (2012a)	Sub Saharan African countries	1980-2008	Pedroni panel cointegration and panel causality	EC = FD. EC has a positive impact on FD.
Al-Mulali and Sab (2012b)	19 selected countries	1980-2008	Pedroni panel cointegration and panel causality	EC = FD. EC has a positive impact on FD.
Al-Mulali and Lee (2013)	Gulf Cooperation Council (GCC) countries	1980-2009	Pedroni panel cointegration and panel causality	EC ↔ FD. EC = FD. FD increases EC positively.
Çoban and Topcu (2013)	New and Old European Union (EU) Countries	1990-2001	System GMM	While there is a positive relation between EC and FD for the old EU countries, there is no relationship for the new EU countries.
Islam et al. (2013)	Malaysia	1971-2009	Granger causality	FD → EC
Zeren and Koç (2014)	Newly industrialized countries	1971-2010	Hatemi-J (2012) asymmetric causality	EC ↔ FD for India, Turkey and Thailand. EC → FD for Malaysia Mexico and Philippines.
Salman and Atya (2014)	Egypt, Algeria and Tunisia	1980-2010	Granger causality test and error correction model	For Algeria and Tunisia, there is a positive relation between EC and FD, while for Egypt this relation is negative.
Ali et al. (2015)	Nigeria	1972Q1-2011Q4	ARDL bound test	There is a negative relation between EC and FD.
Chang (2015)	58 countries	1999-2008	Panel threshold regression	The direction of the effect of EC on FD depends on the variable used as the indicator of FD used.

Table 1. Literature Review (Cont'd)

Author	Country/Countries	Data	Method	Empirical Findings
Akhtar et al. (2016)	Pakistan, India, Sri-Lanka, Bangladesh	1974-2013	Dumitrescu Hurlin (2012) panel causality	EC ↔ FD
Paramati et al. (2016)	20 emerging market countries	1991-2012	Westerlund (2007) panel cointegration	EC = FD. Stock markets positively impact on EC.
Mahalik et al. (2017)	Saudi Arabia	1971-2011	Pesaran's (2001) ARDL and Bayer-Hanck (2013) combined cointegration test	EC = FD
Destek (2017)	17 developing countries	1991-2015	CCE cointegration estimator	Developments in financial markets have been shown to reduce EC.
Topcu and Altay (2017)	Turkey	1989-2011	Pedroni cointegration and Dumitrescu-Hurlin (2012) panel causality	EC = FD.
Topcu and Payne (2017)	32 High income countries	1990-2014	CCE cointegration estimator	FD ≠ EC. However, increase in stock market returns reduce EC.
Çağlar and Kubar (2017)	Turkey	1969-2014	Fourier Toda Yamamoto causality test	RNW = FD. FD → EC.
Güngör et al. (2017)	Argentina, China, South Korea, Israel, Malaysia, Mexico and Turkey	1985-2015	Westerlund (2007) panel cointegration, Holtz-Eakin, Newey and Rosen panel causality	EC = FD EC → FD
Çetin and Bakırtař (2018)	G7 Countries	1991-2011	PMG panel cointegration estimator	RNW = FD.
Eren et al. (2019)	India	1971-2015	Maki (2012) cointegration and Granger causality test	FD = RNW. FD → RNW

Note: “↔” indicates a bi-directional causality, “→” indicates one-way causality and “↔” indicates no causality. “=” indicates cointegration. “≠” sign indicates that there is no causality.

3. Econometric Methodology

Panel data analysis has some advantages instead of time series in econometric studies. Having a cross-section and a time dimension of the data is the major advantage of using panel data analysis. It is possible to indicate a few causality tests used in the literature on panel causality. These are GMM tests used when the dimension of the cross-section is larger than the time dimension, and Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose's (2011) Panel Fisher tests used when the time dimension is larger than the cross-section dimension. In the paper, it was decided that it would be appropriate to use one of the Dumitrescu and Hurlin (2012) or Panel Fisher (2011) tests since the time dimension was larger than the cross-section dimension. Dumitrescu and Hurlin (2012) test is used in the panel if all series are stationary at the same level, and Panel Fisher (2011) test is used if the series is stationary at different levels.

Dumitrescu and Hurlin (2012) panel causality test that regard the cross-sectional dependency was used in this study. The basic hypothesis in that test indicates the absence of a homogeneous causality nexus in the panel, while the alternative hypothesis indicates the presence of a heterogeneous causality relationship in at least one cross-section. The main hypothesis in this study is to research the existence of a homogeneous causality nexus, while the alternative hypothesis is to analyze causality the existence of a heterogeneous structure.

The test statistic used to test the basic hypothesis in this analysis is the simple average of individual Wald statistics (Bozoklu and Yilanci, 2013). So;

$$W_{N,T}^{Hnc} = \frac{1}{N} \sum_{i=1}^N W_{i,t} \quad (1)$$

Where $W_{i,t}$ shows Wald Test Statistic to test causality for the country. Individual Wald statistics are used for small values of T. Since T Statistics do not converge to the chi-square distribution, Dumitrescu and Hurlin (2012) suggested using the estimated standardized statistics for the mean and variance of this unknown distribution using the forecast values. This statistic is calculated as below.

$$Z_{N,T}^{HNC} = \frac{\sqrt{N} [W_{N,T}^{Hnc} - \sum_{i=1}^N E(W_{i,t})]}{\sqrt{\sum_{i=1}^N Var(W_{i,t})}} \quad (2)$$

In equation 2, i represents number of countries, W is Wald Statistics and T is the number of periods. More econometric information on this method can be found in studies by Dumitrescu and Hurlin (2012).

4. Data and Empirical Findings¹

The data were handled annually and countries were picked out from top emerging countries of Bloomberg as a recognized institution in the entire financial community. These countries consist of Brazil, Chile, Philippines, Hungary, India, Indonesia, Mexico, Morocco, Peru, Poland, South Africa, South Korea, Malaysia, Turkey and Thailand. The data set of the

¹ Ethics of research and publication were followed in this study, which does not require permission from the ethics committee and / or legal / special permission.

study covers the period of 1980-2018. The data of RNW and non-RNW is measured as in Million Kwh This data was taken from the official website of United State EIA. FD indicators were analyzed on three different variables. These are deposit money bank assets to GDP, private credit to GDP and financial system deposits to GDP (Çoban and Topcu, 2013; Sadorsky, 2010; Sadorsky, 2011). FD data was obtained from the official websites of Organization for Economic Co-operation and Development (OECD) and the World Bank. The models created in this context are as follows;

$$\ln RNW = \alpha + \ln FD1 + \ln FD2 + \ln FD3 + u \quad (3)$$

$$\ln Non-RNW = a + \ln FD1 + \ln FD2 + \ln FD3 + c \quad (4)$$

Findings obtained from cross-section dependency test are great importance in panel data analysis. Because the findings to be obtained from this pretest are the deciding factor in the selection of the unit root, cointegration and causality test to be used.

Much of the studies used conventional CDLM test of Breusch and Pagan (1980) up to 2008 to investigate the presence of cross-section dependence. However, this method is a test that gives reliable results if the group averages are zero, but the results are unreliable if the individual averages are different from zero. With the work of Pesaran and Yamagata (2008), this deficiency was eliminated by participating in the test statistics of variance and average. Therefore, the CDLM_{adj} test, which gives the new cross-section dependency test statistics, was used in the study. According to the findings in Table 2, Breusch and Pagan's (1980) CDLM test indicated that four of the panels had cross-sectional dependence, while Pesaran and Yamagata (2008) showed the presence of cross-sectional dependence on all panels used in the study.

Table 2. The Results of Cross Section Dependence Test

	CDLM	p-value	CDLM _{adj}	p-value
RNW	137,47	0.131	15.07	0.00
Non-RNW	163.06	0.005	27.65	0.00
FD1	541.88	0.00	7.49	0.00
FD2	599.30	0.00	3.98	0.00
FD3	819.37	0.00	9.51	0.00

According to Table 2, unit root, cointegration and causality tests that allow the cross-section dependency should be used. In such a situation, the panel unit root analysis is to do firstly. The cross-sectionally Augmented Dickey – Fuller (CIPS) test results point out that while all panels have a unit root at the level, they become stationary at the first difference.

Table 3. The Results of CIPS Unit Root Test

	CIPS	CIPS in 1 st dif.
RNW	-2.92	-4.85**
Non-RNW	-2.07	-4.36**
FD1	-2.43	-3.86*
FD2	-2.28	-3.87*
FD3	-2.51	-3.70*

Note: * 90% and ** 95% indicate significance level of reliability.

Table 3 indicates that panels are stationary in their first differences. So, the cointegration relationship between the panels will be analyzed. In this paper, Westerlund (2007) panel cointegration test which shows the results in cases with and without cross-section dependence will be used. While asymptotic probability value uses in the presence of cointegration relation in cases of the absence of cross-section dependence and bootstrap critical value uses in cases of cross-section dependency. Asymptotic probability value is used to conclude the presence of cointegration relations. Bootstrap critical values will be examined since both panels in the study have cross-section dependency.

Table 4. The Results of Westerlund Panel Cointegration Test

	LM Statistics	Asymptotic p-value	Bootstrap p-value
RNW vs FD1	54.15	0.00	0.49
RNW vs FD2	52.06	0.00	0.58
RNW vs FD3	16.95	0.00	0.88
Non-RNW vs FD1	23.86	0.00	0.84
Non-RNW vs FD2	61.35	0.00	0.46
Non-RNW vs FD3	49.39	0.00	0.67

According to the findings obtained, the zero hypothesis that there is cointegration between EC and FD for all matches is accepted. That's why, there is a long-term relationship between both RNW-FD and nonRNW-FD. Dumitrescu and Hurlin (2012) panel causality test results, which are the proper choice in each case where the panels are stationary at I (1) level and have a cross-section dependency, are shown in Table 5.

It is seen that there is a causality from both RNW and non-RNW to FD at the level of 0.01 significance. The findings are valid for all three indicators of FD. On the other hand, while it was seen that there was causality from FD to RNW, one of these findings was accepted with 0.01 significance, the other 0.05, and the last one with 0.10. However, causality is not observed from FD to non-RNW.

Table 5. The Results of Dumitrescu and Hurlin Panel Causality Test

	W-Stat.	Zbar-Stat.	p-value
RNW >> FD1	3.93	3.08	0.00
RNW >> FD2	3.91	3.04	0.00
RNW >> FD3	5.42	5.65	0.00
Non-RNW >> FD1	6.72	7.89	0.00
Non-RNW >> FD2	5.45	5.68	0.00
Non-RNW >> FD3	7.14	8.61	0.00
FD1 >> RNW	3.30	2.00	0.04
FD2 >> RNW	3.18	1.78	0.07
FD3 >> RNW	4.92	4.72	0.00
FD1 >> Non-RNW	3.09	1.63	0.10
FD2 >> Non-RNW	3.09	1.62	0.10
FD3 >> Non-RNW	3.11	1.65	0.10

The most appropriate analysis to be performed after the cointegration and causality test obtained is to decide the direction of cointegration. For this reason, CCE was used in this stage

of the study, which provides estimation of long-term regression coefficients. The findings are presented in Table 6.

Table 6. The Results of CCE-MG Estimation

Independent Variable	Dependent Variable	Coefficient	Standard Deviation	T Statistics
RNW	FD1	0.049	0.10	0.47
RNW	FD2	0.192	0.17	1.10
RNW	FD3	0.094	0.10	0.94
Non-RNW	FD1	0.155	0.19	0.83
Non-RNW	FD2	0.207	0.27	0.77
Non-RNW	FD3	-0.188	0.21	-0.87

According to the results obtained with the Pesaran's CCE-MG method (2006), the relationship between RNW and FD is positive. The relationship between non-RNW and FD appears contradictory results. While the relationship between Deposit Money Bank Assets to GDP and Private Credit by Deposit Money Banks to GDP variables and EC is positively determined, there is a negative relation between Financial System Deposits to GDP and EC. Accordingly, the certainty in the positive relationship between RNW and FD triggers use of RNW.

5. Conclusion and Discussion

In today's world, energy needs increased with economic and financial development. In this process, renewable energy sources, which can reduce the energy costs of the countries, have become important. In this context, the relationship between renewable energy sources and economic growth and financial development has reached very important dimension for developing countries.

In this study, it is aimed to reveal the possible effects of renewable and non-renewable energy consumption on financial development. The differences between renewable and non-renewable energy consumption are thought to have different effects on financial development.

The relationship between RNW and non-RNW and FD and the direction of this relationship are examined in this study. The long-term relationship between the variables was determined by Westerlund (2007) panel cointegration test and the direction of this relationship was determined by Pesaran (2006) CCE-MG coefficient estimator. The causality relationship between the variables examined was examined by Dumitrescu-Hurlin (2012) panel causality test.

As a result, a positive correlation was observed between RNW and FD. While causality was determined from RNW to FD, it could not be determined from FD to non-RNW. Here contradictory results have occurred. While a positive correlation was determined with the ratio of assets of deposit banks to GDP and the ratio of private loans of deposit banks to GDP, a negative relation was found with the ratio of financial system deposits to GDP. On the other hand, a causality was determined from FD to RNW. However, no causality has been found from FD to non-RNW. As a reason, it can be interpreted as increases in FD lead to the use of relatively expensive renewable energy sources. The usage of environmentally friendly

renewable energy sources will bring sustainable economic development along with it in the long term. Besides, since FD will result in more economical use of energy resources, this leads to lower EC costs. According to the findings, it is understood that the feedback hypothesis is valid for the relationship between RNW and FD, and the conservation hypothesis is valid for the relationship between non-RNW and FD.

Findings obtained from the study coincides with Dan and Luin (2009), Sadorsky (2011), Xu (2012), Mehrara and Musai (2012), Al-Mualali and Sab (2012b), Mahalk et al. (2017) Çetin and Bakırtaş (2018) and Eren et al. (2019) presents different results from Ali et al. (2015), Çağlar and Kubar (2017) studies.

This study has a unique structure in terms of being one of the first studies examining the relationship between EC as RNW and non-RNW and FD and in this respect, it provides valuable information to the reader. With the Kyoto protocol framework convention, countries have sought new energy sources to reduce their greenhouse gas emissions. To this end, different energy sources have been sought. Today, there has been a trend towards increasingly renewable energy sources. In this context, the impact of RNW on both economic growth and FD is supported by studies conducted. Therefore, with the result of this study, countries must develop their renewable energy resources in terms of both FD and economic growth.

For future studies, the relationship between the types of renewable energy sources and economic growth and financial development can be examined. In this context, the types of renewable energy sources which are biomass, hydroelectric power, wind and solar energy, can be analyzed and the relationship between different energy sources and economic growth and financial development can be examined.

Researchers' Contribution Rate Statement

The authors declare that they have contributed equally to the article.

Conflict of Interest Statement

There is no potential conflict of interest in this study.

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