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Investigation of the Asymmetric Causality Relationship of Global Risks and Uncertainties on Renewable and Non-Renewable Energy Prices

Küresel Riskler ve Belirsizliklerin, Yenilenebilir ve Yenilenemez Enerji Fiyatları Üzerindeki Asimetrik Nedensellik İlişkisinin İncelenmesi

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ABSTRACT

This study examines the relationship between VIX Volatility Index, Geopolitical Risk and Natural Gas, Brent Oil and Green Energy between December 2016 and October 2022 with Hatemi-J Asymmetric Causality analysis. Variables were tested based on monthly data and using the analysis model. The obtained findings were examined by applying binary tests with the independent variables GPR and VIX index and the dependent variables GAS, BRENT and GREEN. While GPR and VIX index and GAS showed significance at the level of 1%, no significant relationship was found with BRENT. While GREEN did not have a significant relationship with GPR, it was found to be significant at the 5% level with the VIX index. When there was a positive increase in the GPR and VIX index, it was seen that the increase in GAS prices was positive. However, the same is not true for BRENT oil prices.

Anahtar Kelimeler:
Jeopolitik Risk,
Brent Petrol,
VIX Endeksi,
Yeşil Enerji
Jel Kodları:
C01, C12, E00

ÖZET

Bu çalışma VIX Volatilite Endeksi, Jeopolitik Risk ile Doğalgaz, Brent Petrol ve Yeşil Enerji arasındaki ilişkiyi Hatemi-J Asimetrik Nedensellik analizi ile Aralık 2016 ile Ekim 2022 yılları arasında incelemektedir. Değişkenler aylık veri baz alınarak ve analiz modeli kullanılarak test edilmiştir. Elde edinilen bulgular, bağımsız değişkenler olan GPR ve VIX endeksi ile bağımlı değişkenler GAS, BRENT ve GREEN ile ikili testler uygulanılarak aradaki bağlantılar incelenmiştir. GPR ve VIX endeksi ile GAS %1 düzeyinde anlamlılık gösterirken, BRENT ile hiçbir anlamlı ilişkiye rastlanılmamıştır. GREEN ise GPR ile anlamlı bir ilişki yokken VIX endeksi ile %5 düzeyinde anlamlı olduğu görülmüştür. GPR ile VIX endeksinde pozitif bir artış olduğu zaman GAS fiyatlarındaki artışta pozitif olduğu görülmüştür. Ancak aynı durum BRENT petrol fiyatları için geçerli değildir.

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1. INTRODUCTION

Energy is generally defined as the potential to do work (Karakoç et al., 2011: 3). It is a basic need input for the continuity of the vital cycle of human life and is the most important factor of a mechanism that directly or indirectly affects daily life (Aydin, 2010: 318). The continuity of the economic development of the countries is directly proportional to the continuous and sufficient energy source. It is the first input in the production phase in the economy and is the most important item that closely concerns the goods and services sector (Konak, 2019: 198).

Non-renewable energy sources are fossil energy sources of animal and plant origin. These are coal, oil, natural gas and uranium. Ease of transportation and transmission, export impact, environmental impact, flexible end-use and potential for substitution, etc. have different characteristics from each other (Bilginoğlu, 1991: 123). Non-renewable energy sources have three basic features. These are the resources; it is limited, geographically unevenly distributed and it causes environmental pollution. These features cause problems for countries to meet sufficient energy to ensure economic sustainability.

Renewable energy sources, on the other hand, are clean energy compared to non-renewable energy sources and are less harmful to humans and nature, and are natural energy sources obtained from the sun, wind, geothermal, hydraulic, biomass and sea (Emeksiz & Fındık, 2021: 157). Renewable energy is an alternative, clean energy source that is sourced from nature and renews itself continuously. Each country and region can find a secondary energy source and integrate it into their economy according to its absolute superiority (Ramachandra & Shruthi, 2007: 1461-1463). Especially thanks to the cost reductions in solar and wind energy and subsidy policies, the sector has achieved rapid growth (IEA, 2022).

These three factors emerge as the main problem of all economies. Owning energy resources, being in a strategic position and having easy access to energy have always been the most important policy items of economies. Therefore, the word energy geopolitics and energy security have played an important role in the world energy supply-demand exchange (Demir, 2010: 4380). Energy security can generally be defined as the availability of sufficient energy resources. The Oil Crisis in 1973 showed that easy access to energy is the most important step for economic development (Sevim, 2012: 4384). When we look at the year 2017, it is known that 73.5% of the world's electricity production is obtained from non-renewable energy sources, namely fossil fuels (petroleum, natural gas, coal and nuclear energy) (Qazi et al., 2019: 63837), as well as 25% of the global electricity production obtained from natural gas (IEA, 2022). In addition, the share of renewable energy, which is a substitute for non-renewable energy sources, in global electricity production in 2020 is 29% (IEA, 2021).

With the Industrial Revolution that started towards the end of the 18th century, the need for energy increased and accessibility to (Frederick, 2016: 9) energy became much more important with the emergence of mechanized industry and global production. The main problem of the 20th century has been the energy supply. Economic growth after 1990 has been based on non-renewable energy. In fact, in the period when energy consumption increased by 40%, 80% of energy use was non-renewable energy (Devezas et al., 2008: 3).

When we come to the 20th century, oil has been the main energy source of economies. The majority of non-renewable energy resource reserves are located in the Middle East geography. The instability in this region has been a problem for countries (Durğun & Durğun, 2018: 2). Reserve distribution is as follows: Middle East Region: 48.1%, Central and South America Region: 18.7%, North America: 14%, Eurasia: 8.4%, Africa: 7.2%, Asia: 2.6%, and Europe: 0.8% (BP, 2021). As a matter of fact, economies suffered serious damage in the crisis that the Union of Arab Petroleum Exporting Countries (OAPEC) started in 1973. It has caused an economic crisis for energy-importing countries (Mut, 2010: 85-88).

Economic policy uncertainty (EPU) has always existed in human life. The Great Depression and II. Events such as World War II create uncertainty at a level that may hinder the development of the most appropriate policy and the progress of economic development. Consumption policies of renewable energy have a key role in the fight against climate change. Understanding how the EPU affects renewable energy markets will be important in designing the best policies in this area. Policies set by economies focus on subsidizing renewable energy and actively using it to regulate this sector. Without uncertainty, renewable energy producers make production decisions according to the policies determined by the government. Where the EPU is higher, incentives set by the government begin to deteriorate and the energy supply is disrupted. This situation negatively affects the amount of renewable energy consumed due to the deterioration of the supply chain (Ivanovski & Marinucci, 2021: 1-2).

Another uncertainty that economies should take into account when formulating energy policy is climate policy uncertainty. Policies or policy changes made by the government can create uncertainty in investment and

consumption decisions. Climate policy uncertainty may cause investments to be postponed, as it will increase the cost of production for investors in the event of a change in the given subsidy rates or a tax increase. This situation may adversely affect economic growth due to changes in energy consumption (Shang et al., 2022: 655).

The energy markets are considered to be at risk in the risky periods in global markets and the resulting uncertainty. In this direction, it is assumed that this study will have an impact on renewable energy and non-renewable energy prices in global risk and uncertainty environments. In reaching this conclusion, it is frequently mentioned in the academic literature by Blomberg et al., (2009); Jubinski & Lipton (2013); Bruckner et al., (2015); Ehin & Berg (2016); Mikulska (2020); Liu et al., (2021); Chen (2022) studies have been effective. In general, it has been determined that there is volatility in energy prices in the global risk environment. In this context, some studies on the importance of the subject (Gürsoy, 2021) only investigate the relationship between non-renewable energy and prices, while some studies focus on renewable energy. In this study, it focused on both renewable and non-renewable energy prices. In addition, it is hoped that the use of the VIX index will provide an opportunity to see its effect on the financial markets. With this aspect, it is expected that it will contribute to academic studies.

It is expected that a broad study of the effects of the VIX index and the GPR index, which affect renewable and non-renewable energy resources, will contribute positively to the academic literature. The most important feature of this study, which distinguishes it from other studies, is the joint investigation of the responses of renewable and non-renewable energy sources against global risk and uncertainty.

In the following parts of the study, the literature studies are given in the second part, and the methodology part is included in the third part. The data of the study, the econometric model used and the findings obtained from the study will be presented in tabular form. In Chapter 4, the findings will be interpreted comparatively with the literature. Finally, in light of the findings obtained, it will form a basis in terms of giving an idea for other studies to be done in this field.

2. LITERATURE REVIEW

There is a large literature on natural gas and oil. In this study, which is based on the VIX index and the GPR index, which affect natural gas and oil prices, it is aimed to investigate the energy markets. The effects of global risks and uncertainties on energy have been the subject of research in many studies. It has been seen in the literature that there may be different results as a result of the variables discussed. The fact that the natural gas market is regional and the oil market is global has greatly affected the results.

There are many publications in the literature to explain the energy relations between Russia and Europe. When we examine the literature, there are studies that reveal empirical results on Russian Natural Gas and European energy dependence. Europe's high dependence on natural gas and the use of Russian gas due to its geopolitical position make it important to explore this energy source. While the majority of the studies are based on empirical practice in European countries, it has been observed that panel analysis methods are also used, and when the results are examined, there are findings that Russian gas is effective on European markets.

Lloyd & Klare (2008); Casier (2011); Kropatcheva (2011); Stern et al., (2014); Henderson & Mitrova (2015); Laine (2015); Fischer (2016); Ehin & Berg (2016); Siddi (2016); Kuzemko et al., (2017); Mikulska (2020) examined the relationship between security of supply between Gazprom and Europe. The common point in these studies is Gazprom's desire and ability to use geopolitical superiority, as well as Europe's dependence on Russian Natural Gas. In addition, Stern et al., (2014) argue that the search for alternative energy will have a positive impact on Southeast Europe and the Baltic countries, while it is estimated to be more difficult for Eastern Europe. In the studies of Henderson & Mitrova (2015), it has been seen that Russia and Europe are mutually dependent and Russia's geopolitical weakness against China. In the study of Mikulska (2020), the policy difficulties in determining energy prices for Europe, the high vulnerability of Central and Eastern Europe, the monopoly of Gazprom in the market and the weak geopolitical situation of Russia against the Chinese market have also emerged.

Although the main factor determining oil price volatility, in the long run, is supply and demand, geopolitical risk, which is one of the important factors, has decisive importance. The relationship between GPR and BRENT oil price has been extensively studied in the literature. In the literature we have examined, studies showing how geopolitical risks and shocks in the oil market respond positively or negatively to the economies, as well as in the short, medium and long term, have been reached. It has been determined that both geopolitical risk and global economic policy uncertainty constitute a risk premium, especially in distressed market conditions. In addition, it

has been observed that the impact of geopolitical risk, global and economic policy uncertainty is much more important in adverse economic conditions.

Blomberg et al., (2009); Kang et al., (2017); Chen et al., (2020); Mamun et al., (2020); Zhang & Yang (2020) It has been determined that shocks in BRENT oil prices have an effect on economic uncertainty. In general, while a positive effect is seen in the short and long term, it is said that these shocks have a negative effect on uncertainty in the medium term. Bruckner et al., (2015); Chen et al., (2016); Kumar et al., (2021); Lee et al., (2021); Liu et al., (2021); Li et al., (2022); Aslam et al., (2022); Zhao (2022) conclude that the GPR has a significant positive effect on the BRENT oil price. Also, Lee et al., (2021) It has been argued that the GPR negatively affects BRENT oil returns.

Chicago Board Options Exchange Volatility (VIX Fear Index) has another variable feature that affects financial and commodity markets. In situations of uncertainty, economies tend to act more cautiously. The extent to which the economic development VIX index will be effective may vary. Many studies dealing with different results have been found in the literature.

Jubinski & Lipton (2013); Andreasson et al., (2016) argued that the VIX Fear Index significantly affected BRENT Oil Prices. Prasad et al., (2022) determined that the VIX Fear Index has a strong prediction in determining BRENT Oil Prices. At the same time, it has been included in the study of Chen (2022) that it has more impact on developing economies. On the other hand, Kang et al., (2020) argued that the VIX Fear Index affects BRENT Oil Prices in the short term.

3. DATA, MODEL, AND METHODOLOGY

3.1. The Aim of The Study and Method, Data

This study, it was investigated whether the data on energy renewable and non-renewable energy prices changed in the global risk and uncertainty environment. If a change is taking place, it is aimed to reveal in which direction it is trending. Accordingly, the econometric model for investigating the asymmetric effect was preferred in the empirical application part. In the application part of the study, the Geopolitical Risk Index (GPR) and VIX index data were taken as independent variables, and symmetric and asymmetric causality models were established in which each other variable took place as an independent variable. NASDAQ Clean Edge Green Energy Index (GREEN) representing renewable energy prices, Natural Gas Futures (GAS) and Brent Oil Futures (BRENT) index representing non-renewable energy prices were chosen as dependent variables. Thus, it has been tried to reach the findings in which direction the energy prices change in the global risk and uncertainty environment. In the application part of the study, the Lee-Strazicich unit root test was used, which allows the structural break of the data sets to the variables, and the Hatemi -J (2012) test was used in the analysis part.

The variables used in the study consist of GPR, VIX, GAS, BRENT, and GREEN. As of the period, Hatemi-J (2012) asymmetric causality test was run by using monthly data (190 observations) to cover the period from December 2006 to October 2022. While GPR (2022) address was used for the GPR variable used in the analysis, monthly data (Investing, 2022) were obtained for the other variables.

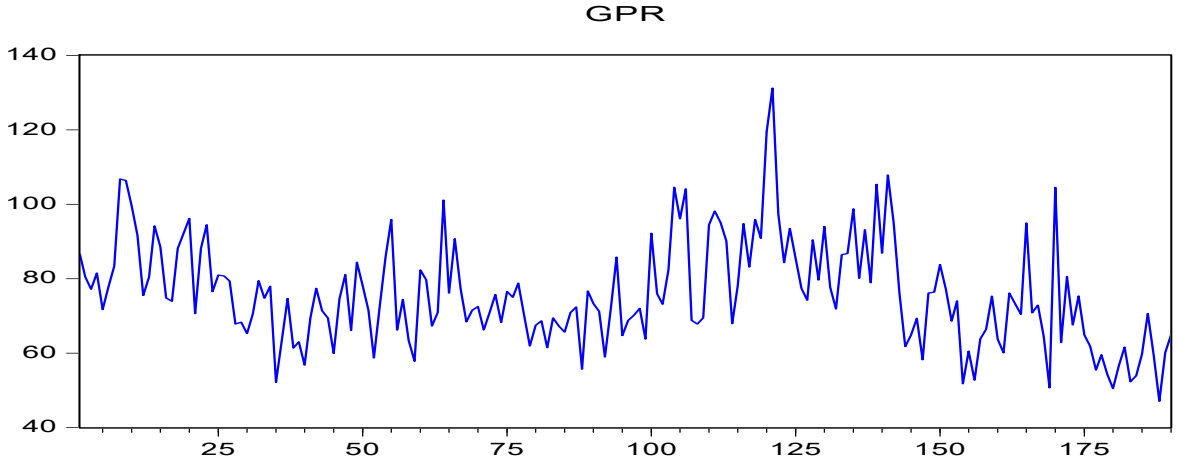

Figure 1. GPR Time Series Chart

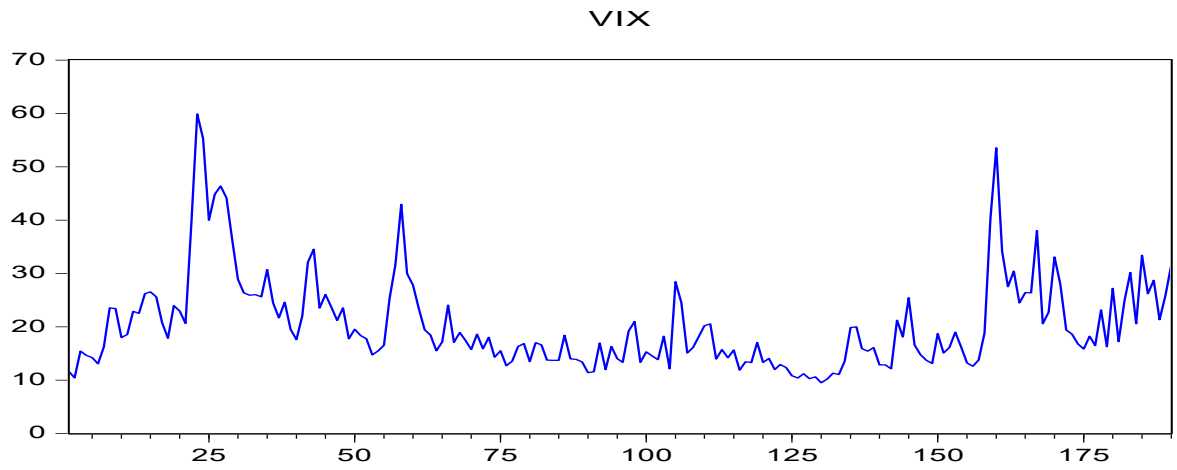

Figure 2. VIX Time Series Chart

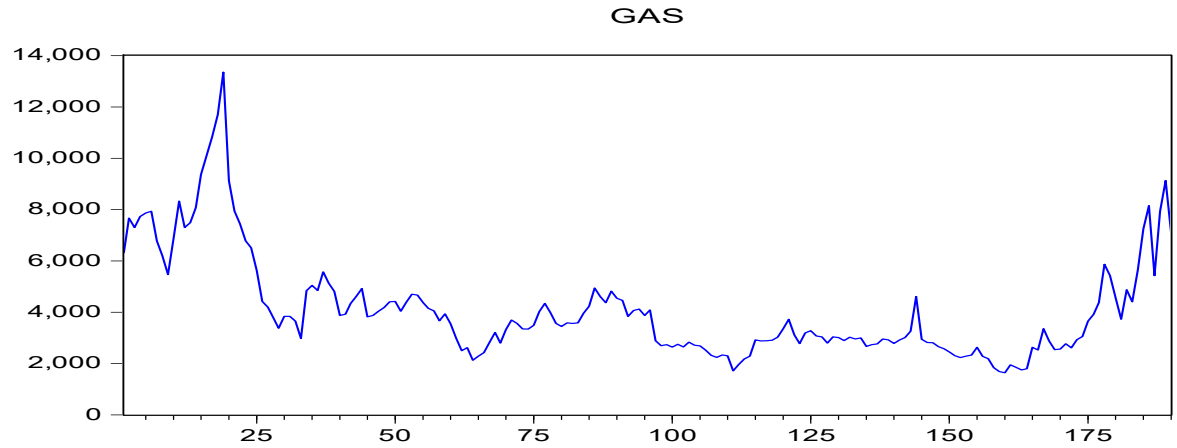

Figure 3. GAS Time Series Chart

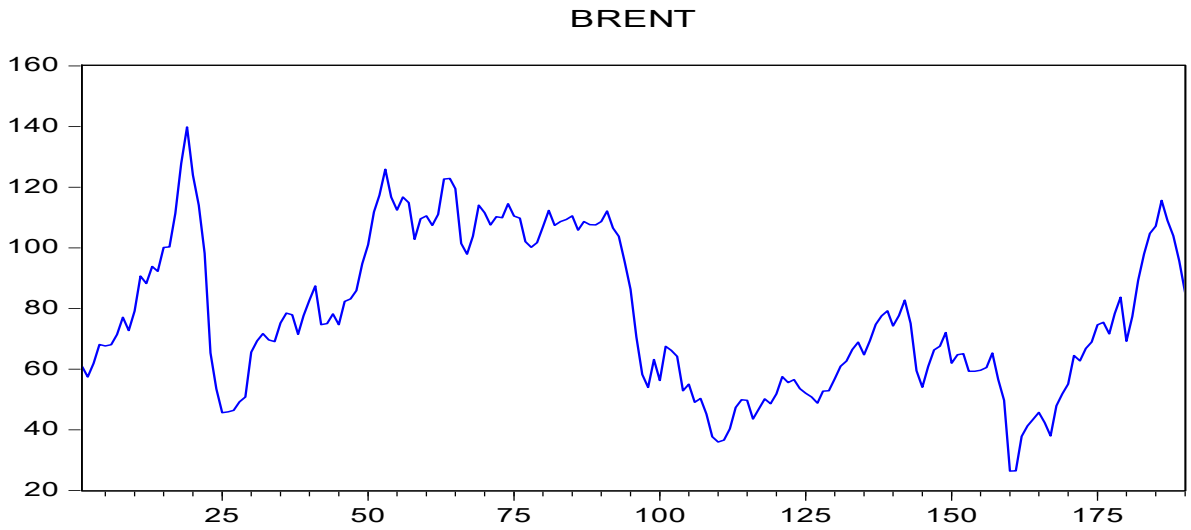

Figure 4. BRENT Time Series Chart

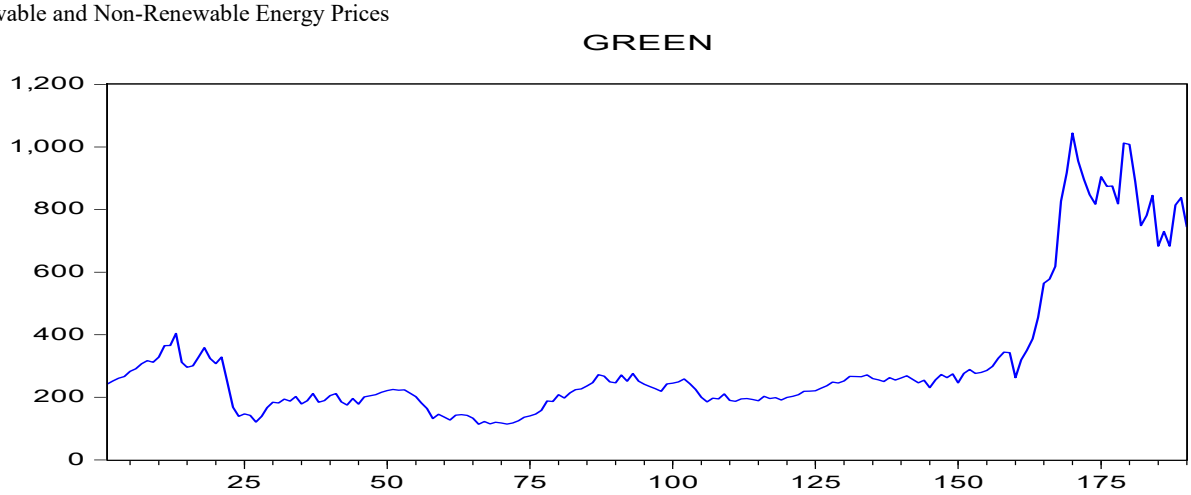

Figure 5. GREEN Time Series Chart

3.2. The Research Hypotheses

In the study, it was determined whether the data sets had a break and whether they contained a unit root (whether it was stationary or not). Whether the data sets are trending and whether there is a causal relationship between the data. The hypotheses related to the research are arranged as follows.

***H₀**: There is no causal relationship between GPR, VIX index and GAS, BRENT, GREEN.*

***H₁**: H₀: There is a causal relationship between GPR, VIX index and GAS, BRENT, GREEN.*

3.3. Lee-Strazicich Unit Root Test

Before running an application method on time series, the condition that the series of variables are stationary must be satisfied. Accordingly, Extended Dickey Fuller-ADF (1981); Phillips-Perron (1988); Ng Peron (2001) etc. It is used in unit root tests. In studies using only these tests, data breakouts cannot be obtained. On the other hand, other unit root tests that allow structural break have been developed in order to eliminate this deficiency Gürsoy, (2020: 404). The tests developed by Lee and Strazicich (2003, 2004) are the next-generation unit root tests.

3.4. Hatemi-J Asymmetric Causality Analysis

In the asymmetric causality analysis tests, it is argued that there may be a hidden relationship between two-time series that cannot be related and thought to be unrelated at first glance and that these hidden relationships can only be found if the asymmetry between the components is considered. Developed by Hatemi-J (2012), causality is examined by dividing the variables into positive and negative components. In this asymmetric causality analysis, it is aimed to find hidden relationships that will help to understand the dynamics of the series and allow to develop possible predictions for the future. Bayraktaroğlu et al., (2021: 10-11)

In this case, we want to test the causality relationship between two integrated variables y_{1t} and y_{2t} (Hatemi-J 2012:449–50);

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{10} + \sum_{i=1}^{t} \varepsilon_{1i}$$
$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{20} + \sum_{i=1}^{t} \varepsilon_{2i} \quad (1)$$

$t = 1, 2, \ldots T$, indicate the constant term, y_{1t} and y_{2t} denotes initial values, ε_{1i} and ε_{2i} error terms. Positive and negative shocks are expressed as in equation (2).

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

Therefore, it is implemented as $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$.

Then, according to it is possible to regulate equations (1) and (2), its expressed;

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad (3)$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (4)$$

Finally, negative shocks and the positive shocks in each variable are processed in cumulative form as

$$y_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}, \qquad y_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}, \qquad y_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}, \qquad y_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (5)$$

According to equations that are $y_t^{+} = y_{1t}^{+}, y_{2t}^{+}$, the causality relationship among the positive components is examined through the p delay vector autoregressive model (VAR). VAR (p) model is expressed as in equation (6);

$$y_t^{+} = v + A_1 y_{t-1}^{+} + \cdots + A_p y_{t-1}^{+} + u_t^{+} \quad (6)$$

3.5. The Results of the Lee-Strazicich Unit Root Test

The C model was taken into account in the unit root test analyzes of the research, and the results are presented in Table 1 below.

Table 1. Lee- Strazicich (C Model) Unit Root Test Results

Variables	I (0) (T) Statistic	Level Break Date	Critical Value	1.Difference (T) Statistic	1. Difference Date	Critical Value
GPR	-7.100750*	May 2015	-4.250632			
VIX	-3.885028	August 2019	-4.030284	-8.456327*	September 2014	-4.247772
GAS	-3.847094	May 2020	-4.066868	-7.111587*	September 2018	-4.171087
BRENT	-3.959475	September 2014	-4.249029	-6.990696*	December 2019	-4.088393
GREEN	-6.487416*	January 2020	-4.088572			

Note: *: %1 and **: %5 level are significant.

According to the Lee-Strazich Unit Root Test results, it was observed that the GPR and GREEN variables were stationary at the level. In addition, VIX, GAS and BRENT variables were found to be stationary at the 1st difference.

3.6. The Results of the Hatemi-J Asymmetric Causality Analysis

In this part of the study, GPR, VIX, GAS, BRENT, and GREEN variables were analyzed with the asymmetric causality test introduced to the literature by Hatemi-J (2012). The Hatemi-J asymmetric causality test was performed with the help of Gauss 10 econometric analysis package program. Table 3 presents the findings from the Hatemi-J Asymmetric Causality Test.

Table 2. Results of the Relationship Between Variables Analysis

Direction of the Causality	(T) Statistic	Bootstrap Critical Value		
		%1	%5	%10
GPR (+) > GAS (+)	13.119*	11.925	8.216	6.427
GPR (-) > GAS (-)	131.704*	13.948	9.941	8.025
VIX (+) > GAS (+)	27.788*	14.215	9.842	7.869
VIX (-) > GAS (-)	30.053*	11.745	8.056	6.431
GPR (+) > BRENT (+)	3.690	11.382	7.931	6.369
GPR(-) > BRENT (-)	4.840	11.306	7.966	6.344

VIX (+) > BRENT (+)	2.144	11.986	8.006	6.339
VIX (-) > BRENT (-)	3.212	11.348	7.906	6.346
GPR (+) > GREEN (+)	8.240	21.047	9.489	6.658
GPR (-) > GREEN (-)	6.915	13.917	8.702	6.791
VIX (+) > GREEN (+)	14.053**	17.536	9.507	6.706
VIX (-) > GREEN (-)	11.574**	14.598	8.983	6.852

Note: *: %1 and **: %5 level are significant.

As can be seen in Table 2, 12 different equations were established between the variables. While GPR and VIX index were included as independent variables for all variables, BRENT, GAS and GREEN were analyzed as dependent variables. All variables were interpreted by analyzing in the form of dual tests.

According to the results of the equation in which the GPR is included as an independent variable, it was found that the positive increase in the GPR had an effect on the GAS at the 1% significance level. These results were obtained because the T statistical values (13.119) were greater than the bootstrap critical value (8.636). The H0 hypothesis was rejected, H1 hypothesis was accepted. In addition, the results of the equation in which the negative relationship established between GPR and GAS were tested, resulted in the same direction. The T statistical value (131.704) was higher than the bootstrap value (9.941) and was found to be significant.

According to the results of the equation in which the VIX index is included as an independent variable, it has been found that the positive increase in the VIX index has an effect on the VIX index at the 1% significance level. These results were obtained because the T statistical values (27.788) were greater than the bootstrap critical value (9.842). The H0 hypothesis was rejected, H1 hypothesis was accepted. In addition, the results of the equation in which the negative relationship established between the VIX index and GAS were tested, resulted in the same direction. The T statistical value (30.053) was greater than the bootstrap value (8.056) and was found to be significant. However, it is understood from the coefficients (131.704), (27.788) that the common side of the equations in which GPR and VIX index are included as dependent variables is that a negative change is more dominant on non-renewable energy prices than positive changes.

According to the results of the equation in which GPR and VIX index were included as independent variables, it was seen that there was no statistically significant effect on BRENT. The H1 hypothesis was rejected and the H0 hypothesis was accepted. In addition, there were findings that a change in the VIX index had an effect on GREEN at the 5% significance level. To reach these results, it is based on the fact that the T statistical values (14.053), in which the positive relationship is tested, are greater than the bootstrap critical value (9.507). It is based on the fact that the T statistical values (11.574) in which the negative relationship is tested are greater than the bootstrap critical value (8.983). However, it was observed that neither a positive nor a negative change in the GPR index had a statistically significant effect on GREEN. In this case, the H0 hypothesis was accepted and the H1 hypothesis was rejected.

4. CONCLUSION

Energy is the most basic need for the continuation of life. Its source can be renewable or non-renewable energy. Here, the most correct energy policies should be chosen for the continuity of the economies. There are many variables that affect energy resources. These variables should be given due importance in order to be affected by negativities at a minimum level.

Global risks and uncertainties experienced in economies have significant effects on social development. Making economies more resilient to these risks and uncertainties means having a minimal impact from negativities. Since energy is the beginning of the universe's existence and the most important input item for the continuation of human beings, investments should be arranged accordingly in order for the determined policies to be implemented effectively. The development period in economies is a process that covers a long period and also negatively affects the environment. While economic growth affects the environment negatively at the beginning, it tends to decrease after reaching the per capita income threshold. Since the demand for energy for production will be more intense at the beginning of economic growth, the damage to the environment tends to increase. However, in the period when economic growth passes into the stage of economic development, it brings with it the demand for efficient use of energy, changes in energy production and consumption, and the demand for a clean environment. As a result, it is argued that economic growth will have a positive effect on the clean environment in the long run (Pala and Barut, 2021: 349).

In this direction, the GPR index and VIX index variables were used to represent global risk and uncertainty in the application part of the study. Hatemi – J (2012) asymmetric causality model was run by using monthly data as of December 2006-October 2022. In the study, in which GPR and VIX index was determined as independent variables, GAS, BRENT and GREEN variables were modeled as dependent variables in binary tests. In general, the findings suggest that global risks and uncertainties are effective on non-renewable energy (GAS-BRENT) and renewable energy GREEN.

In the study, the findings obtained as a result of the dual tests of the relationship between GPR and GREEN were determined by Yang et al., (2021); Wang et al., (2022) support the results with their studies. However, Flouros et al., (2022), the opposite results were obtained. At the same time, the findings obtained as a result of the dual tests of the relationship between the VIX index and GREEN support the results with the studies of Liu & Hamori (2020); Özdurak (2021). On the other hand, the findings obtained as a result of the bilateral tests of the relationship between GPR and BRENT were found by Wang et al., (2021); Gong et al., (2022) and reached opposite results in their studies. It has been observed that the price of BRENT oil is highly affected by the GPR variable. As soon as geopolitical risk arises, oil prices react to this negativity. In addition, the findings obtained as a result of the bilateral tests of the relationship between GPR and GAS were reported by Wang et al., (2022) support the results of this study.

In this study, we came to the following conclusion. It was concluded that econometric models, which include energy policy-related variables, should be consulted for future studies. Because it is thought that not only risk and uncertainty factors but also energy policies can be effective on energy prices. Since energy security always has a dynamic structure, various policy implications can be put forward. Considering the findings obtained from the analysis, GAS prices from non-renewable energies reacted in the same direction when the risk in global financial markets increased and decreased, while Brent oil prices were not affected by this activity. This situation has been interpreted as having a discriminatory structure for crude oil markets and GAS obtained from these markets. However, while only the VIX index has an effect on renewable energy prices, it has been concluded that the geopolitical risk index GPR is not effective. This situation can be interpreted as renewable energy prices are more related to financial markets in which different sectors are located in international markets, rather than factors such as war and threat. Considering the advantages of renewable energy resources, which are the substitutes for non-renewable resources, policies can be developed and the goal of economic development can be achieved. The energy supply problem is minimized and continuity in the economy is ensured.

In order to ensure continuity in the economies of the new century, energy policies must be made in the most accurate and applicable way. Considering the risk of depletion of oil and natural gas energy resources in the near future, shifting investments towards renewable energy resources can be seen as the most important step in energy policies. Although the cost of investments in renewable energy sources is high in the short term, it is seen as very beneficial in the long term. At the same time, the fact that renewable energy sources are not affected by any geopolitical risks in the global arena minimizes energy disruptions. In addition, since renewable energy sources are clean energy, there will be no negative environmental effects.

AUTHORS' DECLARATION
This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS' CONTRIBUTIONS
Conceptualization, writing-original draft, editing – EÖ and SA, data collection, methodology, formal analysis – EBE, Final Approval and Accountability – EÖ and SA

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