

## The Relationship Between Environmental Performance of Firms and Stock Returns: An Analysis in the Energy Sector

Firmaların Çevresel Performansları ile Pay Senedi Getirileri İlişkisi: Enerji Sektöründe Bir Analiz

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## The Relationship between Environmental Performance of Firms and Stock Returns: An Analysis in the Energy Sector

### Abstract

Today, with climate change, firms' reports, environmental disclosures and environmental performances that demonstrate their sensitivity to the environment have begun to be accepted by stakeholders. It is assumed that firms increase their corporate reputation by developing environmental awareness and accordingly, stakeholders have a positive opinion about the firm. When stakeholders have a more positive corporate image of the firm, share prices and firm value can increase. Moreover, environmentally friendly activities of firms can save costs and improve their financial performance. In this context, the role of non-financial activities such as firms' environmental performance on firms' stock returns is discussed in the literature. The study investigates whether the environmental awareness shown by firms in the energy sector in developed and developing country groups is reflected in stock returns. In this study, we examine the causality relationship between firms' activities to prevent environmental pollution and environmental damage and their stock returns. In other words, we ask whether the environmental performance of firms has an impact on investors' investment decisions and whether investors take firms' environmental performance into account when determining stock prices. In line with the objective of the study, the causality relationship between the environmental performance and stock returns of 63 firms operating in the energy sector in developed and developing countries for the period 2009-2020 is analyzed. According to the findings of the study, firms' environmental performance has a statistically significant effect on forecasting. According to the results of Dumitrescu and Hurlin (2012) panel causality test, there is a bidirectional causality relationship between the environmental performance of firms in the energy sector in developed and developing countries and their stock returns. According to the findings of the study, firms' environmental performance has a statistically significant effect on the estimation of stock returns. The finding that there is a bidirectional causal relationship between firms' environmental performance and stock returns suggests that environmental performance can be used as a guiding factor for investors, managers and shareholders in predicting stock returns.

**Keywords:** Sustainable finance, sustainability, environmental performance, stock returns, causality analysis

### Firmaların Çevresel Performansları ile Pay Senedi Getirileri İlişkisi: Enerji Sektöründe Bir Analiz

#### Öz

Günümüzde yaşanan iklim değişikliği ile birlikte firmaların yayınladıkları raporlar, yapmış oldukları çevresel açıklamalar ve çevreye karşı duyarlılıklarını gösteren çevresel performansları paydaşlar tarafından karşılık bulmaya başlamıştır. Firmaların çevre bilinci geliştirmeleri ile kurumsal itibarlarını artırdıkları ve buna bağlı olarak paydaşların firma hakkında olumlu görüşe sahip olduğu varsayılır. Paydaşların firma hakkında daha olumlu bir kurumsal imaja sahip olması, pay fiyatlarının ve firma değerinin artmasına neden olabilmektedir. Bunun yanında firmaların çevre dostu faaliyetler yürütmeleri firmalara maliyet tasarrufu sağlayabilmekte ve finansal performanslarını artırabilmektedir. Bu kapsamda, firmaların çevre performansları gibi finansal olmayan faaliyetlerinin firmaların pay getirileri üzerindeki rolü literatürde tartışılmaktadır. Çalışmada, gelişmiş ve gelişmekte olan ülke gruplarında enerji sektöründe yer alan firmaların göstermiş oldukları çevre bilincinin pay getirilerinde karşılık bulup bulmadığı araştırılmıştır. Bu çalışmada, firmaların çevre kirlilikleri ve çevresel tahribatları önleyici faaliyetleri ile söz konusu firmanın pay getirisi arasındaki nedensellik ilişkisi incelenmiştir. Diğer bir ifadeyle, yatırımcılar açısından firmaların çevre performanslarının yatırım kararlarında etkili olup olmadığı, pay fiyatlarının belirlenmesinde yatırımcıların, firmaların çevre performanslarını dikkate alıp almadığı sorularına cevap aranmıştır. Çalışmanın amacı doğrultusunda gelişmiş ve gelişmekte olan ülkelerdeki enerji sektöründe faaliyet gösteren 63 firmanın 2009-2020 dönemleri arasındaki çevresel performansları ile pay getirileri arasındaki nedensellik ilişkisi incelenmiştir. Çalışmada yapılan Dumitrescu ve Hurlin (2012) panel nedensellik test sonuçlarına göre gelişmiş ve gelişmekte olan ülkelerdeki enerji sektöründeki firmaların çevresel performansları ile pay getirileri arasında çift yönlü nedensellik ilişkisi olduğu tespit edilmiştir. Çalışmanın bulgularına göre firmaların çevre performanslarının pay getirilerinin tahmininde istatistiksel olarak anlamlı etkisi bulunmaktadır. Firmaların çevresel performansları ile hisse senedi getirileri arasında çift yönlü bir nedensellik ilişkisi olduğu bulgusu, çevresel performansın hisse senedi getirilerinin öngörülebilirliğinde yatırımcılar, yöneticiler ve hissedarlar için yol gösterici bir unsur olarak kullanılabileceğini göstermektedir.

**Anahtar Kelimeler:** Sürdürülebilir finans, sürdürülebilirlik, çevre performansı, pay getirileri, nedensellik analizi

## Introduction

With the phenomenon of globalization, the rapid development of many countries' industries and the growth of economies, the increase in the world population and the corresponding increase in the use of motor vehicles, an increase in environmental degradation has also been observed (Ming et al., 2022). With the global climate crises experienced due to these increasing environmental degradation, the awareness of firms towards the environment, such as their statements on environmental activities, renewable energy use, and activities to reduce carbon emissions, has started to be reciprocated by stakeholders (Gavrilakis and Floros, 2023). Especially since the signing of the Kyoto Protocol in 1997, there has been an increase in the number of legislations prepared to reduce environmental degradation in order to prevent environmental degradation. On the other hand, with the increase in environmental awareness of investors and all stakeholders, companies have had to carry out activities in this direction in order to prevent environmental damage and to keep up with the legislation on environmental regulations (Brouwers et al., 2014). As a result of these activities, firms' increased sensitivity to the environment and awareness of their environmental responsibilities mean that they have a good environmental performance. Good environmental performance of firms can increase corporate reputation and trust. This, in turn, may lead investors and customers to have a more favorable corporate image of the firm and accordingly increase stock prices and firm value (Dechant and Altman, 1994; Ye et al., 2022; Ziegler et al., 2007). In addition, firms' environmentally friendly activities can save costs and increase their financial performance (Lewandowski, 2017). Firms acting with environmental awareness may be perceived positively by all stakeholders, especially by investors. For investors, the selection of investment portfolios based on environmental strategies can generate long-term returns and also benefit society and the environment by supporting these environmental activities of firms (Ming Lee et al., 2022).

Accordingly, this study investigates whether there is a causal relationship between firms' environmental performance and their stock prices. In other words, this study seeks to answer the questions of whether the environmental performance of firms is effective for investors in their investment decisions and whether investors take into account the environmental performance of firms in determining stock prices. This study investigates whether companies' environmental sensitivity is reciprocated by their stakeholders. In other words, it was investigated whether it supports the stakeholder theory. It is expected that differences in the development levels of countries may lead to differences in the legal regulations implemented to prevent environmental damage, in the level of importance investors attach to environmental performance and in investment decision processes. To illustrate possible differences, countries are divided into two groups: developed and developing. On the other hand, according to data published by the International Energy Agency (IEA) (2023), firms in the energy sector cause a large portion of carbon emissions. Therefore, firms in the energy sector are focused in the analysis. Unlike other researches, the importance of the study lies in the fact that developed and developing country groups are considered separately and the energy sector is analyzed. The limitation of this study is the limited data of developing countries within the scope of the data set compiled to investigate whether the activities carried out by firms to improve their environmental performance explain the changes in firms' stock returns.

*Hypothesis 1: The changes in firms' environmental performance are the cause of the changes in stock returns.*

*Hypothesis 2: The changes in firms' stock returns are the cause of the changes in their environmental performance.*

This study investigates whether the EPs of firms in the energy sector play a role in determining stock prices in developed and developing country groups. The study considered developed and developing country groups separately. In addition, by including firms in the energy sector, which is the biggest cause of carbon emissions, in the scope of the analysis, it investigates whether firms' environmental performance is accepted by stakeholders.

Previous studies on the subject are presented in the first section, which is the literature section. The data set, methodology and findings of the study are explained in the second section. The findings of the study are evaluated in the conclusion section, which is the third section, and recommendations are made based on the findings of the study.

### **1. Literature Review**

A review of the literature reveals that the relationship between corporate environmental performance of firms and their financial performance, firm value or stock returns has been discussed for a long time. According to the shareholder theory, there is a negative relationship between firms' environmental activities and their stock returns, financial performance and firm value. According to this theory, the sole and primary objective of the firm is shareholder wealth maximization (Jensen, 2001). All activities other than this purpose cause additional costs to firms. Therefore, the shareholder theory argues that the activities carried out by firms to improve their environmental performance put them at a competitive disadvantage and thus negatively affect their stock returns and financial performance. This traditional view states that all expenditures made by firms to reduce carbon emissions, develop technologies for the use of renewable energy sources, and improve their environmental performance will lead to an increase in their marginal costs. It argues that firms will receive a limited amount of benefit in return for their increased marginal costs (Friedman, 1970; Walley and Whitehead, 1994). Hart and Ahuja (1996) examined the relationship between firms' carbon emission reduction activities and their financial performance. The study analyzed the data of S&P 500 firms and found that firms with high carbon emissions have high financial performance. Similarly, King and Lenox (2002) investigate how reducing environmental pollution caused by 614 firms in the US manufacturing sector affects firms' profitability. The study did not find any results indicating that activities carried out to reduce environmental pollution increase returns. Brammer et al. (2006) examined the effect of social performance, including environmental performance criteria, on stock returns for firms in the UK energy and manufacturing sectors. The study concluded that corporate environmental performance and stock returns are negatively related. In parallel with the findings of this study, Haan et al. (2012) also examined the relationship between environmental performance and stock returns of the 500 largest publicly traded US firms and found that environmental performance and stock returns are negatively related. Torre et al. (2020) examined the impact of Eurostoxx50 firms' environmental, social and governance performance on their stock returns. According to the results of the study, the performance of firms in environmental, social and governance areas did not have any effect on stock returns. Reshetnikova et al. (2023) compared the returns

of portfolios formed with "carbon-free firms" that care about reducing carbon emissions with "carbon firms" that do not care about reducing carbon emissions in Russia between January 2014 and December 2021. The findings suggest that the expected returns of carbon firms are higher.

According to stakeholder theory, firms benefit stakeholders and society by improving their environmental performance. As a result, the firm's financial performance and stock returns are also positively affected. When firms act with the awareness of their environmental responsibilities and carry out activities to prevent environmental degradation, it means that the interests of not only shareholders but also all stakeholders and society are taken into consideration. By taking care of the welfare of all stakeholders and society, firms are expected to gain corporate reputation and corporate trust, and accordingly gain competitive advantage. With this competitive advantage, firms are expected to increase their stock returns, financial performance and firm value (Derwall et al., 2005; Donaldson and Preston, 1995; Freeman, 1984; Porter, 1991; Porter and Linde, 1995). Feldman et al. (1996), in their study covering the 300 largest firms in the United States of America (USA), concluded that the improvement of firms' environmental performance is perceived by investors as a signal that they will be less exposed to the legislation against environmental degradation and the risks of environmental disasters, thereby reducing their systematic risks. Khan (2019) found that non-financial information such as firms' activities in environmental, social and governance areas is a criterion for predicting firms' stock returns. Ouadghiri et al. (2019) investigated whether public interest in environmental degradation and climate change in the US is reflected in stock returns. The study concluded that public awareness of environmental degradation and climate change positively affected stock returns between the periods 2004-2018. Chang et al. (2020) analyzed the carbon emissions and stock returns of 18 countries with developed financial markets included in the Morgan Stanley Capital International (MSCI) World Index between the periods 1971-2017. According to the causality analysis between carbon emissions and stock returns, there is a unidirectional causality relationship from stock returns to carbon emissions. However, there is no causality relationship from carbon emissions to stock returns. Accordingly, stock returns affect carbon emissions. The development of financial markets may contribute to mitigate environmental degradation. Brunborg and Haldorsen (2021) constructed portfolios of stocks of low and high carbon emitting firms in the US. When the returns of the portfolios are analyzed over the 2007-2018 period, it is found that the returns of the low-carbon emission portfolio are less risky than the returns of the high-carbon emission portfolio. Miao and Li (2022) investigated whether carbon emissions of Chinese firms affect their stock returns. The findings of the study suggest that firms that undertake activities to reduce carbon emissions have higher stock returns compared to others. Accordingly, the corporate reputation of firms that manage their carbon emissions well is expected to increase and be reflected in stock prices. Ye et al. (2022) investigated how the environmental activities of 473 firms in the European Union region affect their stock returns in the long run. In the study, it is found that firms that carry out environmental activities and disclose these activities achieve higher stock returns. Firms with good environmental performance not only have higher stock returns (Chen et al., 2020) but also have the opportunity to obtain lower-cost financing (Giese et al., 2017). Giansante et al. (2023) examined the impact of stock returns on carbon emissions of listed firms in the European Union. In the study, which analyzed the stock returns of firms for the period 2012-

2021, it was found that the expectation of high carbon emissions decreased the stock returns of firms.

## 2. Data and Methods

Based on the view that the activities carried out by firms to improve their environmental performance, which is one of the non-financial performance criteria, increase their returns in the long run. This study examines the causality relationship between the environmental performance and stock returns of 63 firms operating in the energy sector in developed and developing country groups between 2009 and 2020. These periods are chosen in order to include more firms in the analysis.

The countries included in the analysis are divided into two subgroups: Developed and developing countries. The United Nations classification (United Nations, 2014) was used to classify countries into developed and developing country groups. The developed countries include 54 firms operating in the energy sector in Germany, the USA, the UK, Italy, Japan and Canada. The developing country group includes Brazil, China, India, Turkey and Russia. In the developing country group, there are 9 firms in the energy sector. The reason for choosing the energy sector in the study is that it is one of the sectors that can cause the most environmental degradation (IAC, 2023).

There are many studies that use the environmental performance score of firms taken from the Datastream database as a variable (Lahouel et al., 2022; Gavrilakis and Floros, 2023; Mühr, 2020; Nuber et al., 2020). There are also studies that use stock returns as an indicator of firms' financial performance (Aswani et al., 2015; Berg et al., 2022; Chang et al., 2020; Dinh, 2023; Haan et al., 2012; Machdar, 2017; Ouadghiri et al., 2019; Ye et al., 2022; Yin et al., 2023). The explanations and data sources of the variables used in the models to examine the causality relationship between firms' environmental performance and stock returns are given in Table 1.

**Table 1.** Variable Descriptions and Data Sources

Variables	Description	Data Source
EP	Environmental Performance	DataStream
R	Stock Returns	<a href="https://finance.yahoo.com/">https://finance.yahoo.com/</a>

Among the variables presented in Table 1, firms' environmental performance, expressed as EP, is scored between 0 and 100. Rating criteria include resource utilization, emissions and innovation. Stock returns of firms are obtained from their adjusted stock prices<sup>1</sup>. Stock returns;

$$R_{it} = \frac{(P_{it} - P_{it-1})}{(P_{it-1})} \quad (1)$$

calculated with the formula. In the formula,  $R_{it}$  is the return of stock  $i$  at time  $t$ ,  $P_{it}$  is the price of stock  $i$ , and  $P_{it-1}$  is the price of stock  $i$  at time  $t-1$ . After the data set of the study

<sup>1</sup> The local currency of each country is converted into US dollars.



was created, descriptive summary statistics, correlation matrix, pretests and then the findings of the analysis were presented.

### 3. Findings

Annual stock returns of firms in the energy sector in developed and developing country groups for the period 2009-2020 are calculated. Descriptive summary statistics of the variables used are presented in Table 2.

**Table 2.** Descriptive Summary Statistics

	Observation	Mean	Standard Dev.	Min.	Max.
<b>Developed Countries</b>					
EP	648	51.60	23.39	2.43	96.34
R	648	0.01	0.45	-0.90	4.30
<b>Developing Countries</b>					
EP	108	59.68	14.43	25.58	89.36
R	108	0.10	0.40	-0.48	1.76

The summary statistics given in Table 2 show that the minimum value of the environmental scores of firms in developed countries is 2.43 and the maximum value is 96.34. The minimum value of the environmental scores of firms in developing countries is 25.58 and the maximum value is 89.36, and there is a relatively smaller difference between the minimum and maximum values. While the average stock return of firms in developed countries is 0.01, the average stock return of firms in developing countries is much higher at 0.10. The correlation matrix of the environmental scores and stock returns of firms in the energy sector in developed and developing countries is presented in Table 3.

**Table 3.** Correlation Matrix

<b>Developed Countries</b>		
<b>Variables</b>	<b>EP</b>	<b>R</b>
EP	1.00	
R	-0.04	1.00
<b>Developing Countries</b>		
<b>Variables</b>	<b>EP</b>	<b>R</b>
EP	1.00	
R	-0.08	1.00

The correlation matrix presented in Table 3 shows that there is no high correlation between the variables.

The empirical models to analyze the Dumitrescu and Hurlin (2012) causality relationship between firms' environmental performance and stock returns are presented in Equation (2) and Equation (3).

$$EP_{it} = \alpha_i + \sum_{k=1}^k EP_i^{(k)} EP_{i,t-k} + \sum_{k=1}^k \beta_i^{(k)} R_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

$$R_{it} = \alpha_i + \sum_{k=1}^k R_i^{(k)} R_{i,t-k} + \sum_{k=1}^k \beta_i^{(k)} EP_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

Following this, the study presents the tests conducted to analyze the causality relationship between the environmental performance and stock returns of firms in the energy sector in developed and developing countries for the period 2009-2020.

If there is cross-sectional dependence in the series, second generation tests are recommended (Yerdelen Tatoğlu, 2020). The cross-sectional dependence of the variables is tested with the Pesaran (2004) CD test.

**Table 4.** Pesaran (2004) CD Test

	Developed Countries	Developing Countries
Variables	CD test	CD test
EP	17.06***	-2.59***
R	49.846***	11.76***

**Note:** \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.10.

The probability values of the Pesaran (2004) CD test presented in Table 4 indicate that the null hypothesis  $H_0$  "there is no correlation between units" is rejected. There is cross-sectional dependence and accordingly, Im, Pesaran and Shin (2003) (IPS) test, one of the second generation unit root tests, is preferred (Yerdelen Tatoğlu, 2020).

**Table 5.** Im, Pesaran and Shin (2003) (IPS) Unit Root Test

	Developed Countries	Developing Countries
Variables	IPS test	IPS test
EP	-2.28**	-1.46*
R	-16.60***	-8.02***

**Note:** \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.10.

In the presence of horizontal cross-section dependence, the parameter is considered to be heterogeneous (Yerdelen Tatoğlu, 2020). According to Table 5, where the IPS panel unit root test results, which allow the parameter to be heterogeneous, the  $H_0$  hypothesis "all units contain unit root" is rejected for all series. It is concluded that the series are stationary. Following the preliminary tests, Dumitrescu and Hurlin (2012) causality test was applied on models with heterogeneous parameters. Dumitrescu and Hurlin (2012) extend the Granger causality test for heterogeneous panels. Dumitrescu and Hurlin (2012) causality test results are presented in Table 6.

**Table 6.** Dumitrescu and Hurlin (2012) Panel Causality Test

	Optimal Lag Length	R → EP	EP → R
Developed Countries	1		6.40***
	2	3.04***	
Developing Countries	2	1.97**	11.45***

**Note:** \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.10; ➡ refers to the unidirectional causality relationship.



Optimal lag lengths are selected according to the Akaike information criterion. According to the test results, the main hypotheses stating that there is no causality between the variables are rejected. Accordingly, there is a bidirectional causality relationship between the environmental performance and stock returns of firms in the energy sector in developed and developing countries. While the findings of the study are in line with the results of Khan (2019), Ouadghiri et al. (2019) and Ye et al. (2022), they are contrary to the findings of King and Lenox (2002) and Torre et al. (2020).

### **Conclusion and Recommendations**

With the global climate crises, environmental destruction, and reports published on global warming (IPCC, 2019), the magnitude of the ecological impacts of the activities carried out by economic units such as companies have become better understood. Environmental performance refers to the reduction of carbon emissions, the use of renewable energy sources, and the use of new technologies to prevent environmental degradation as a result of the activities carried out in a certain economic area such as a country, region or firm. This study investigates how investors respond to the environmental performance of firms. In this context, the main objective of the study is to investigate whether the environmental awareness shown by firms in the energy sector in developed and developing country groups is reflected in their stock returns. In the study, Germany, USA, UK, Italy, Japan and Canada are considered as developed countries while Brazil, China, India, Turkey and Russia are considered as developing countries. In order to observe the differences between the practices carried out to prevent environmental degradation in developing countries and the practices carried out in developed countries and the differences in the possible perspectives of the managers of the firms in the investor portfolio of the countries, the countries are analyzed in two subgroups. As a result of the analyses conducted in the study, it was concluded that there is a bidirectional causality relationship between the environmental performance and stock returns of firms in the energy sector in developed and developing countries for the period 2009-2020. According to the results of this study, firms' stock returns can affect their environmental performance and environmental performance can affect their stock returns. Accordingly, firms' activities to prevent environmental degradation cause changes in their stock returns. On the other hand, increases or decreases in firms' stock returns also cause changes in their environmental performance. This is believed to be due to the fact that activities aimed at improving environmental performance require additional financing for firms. Accordingly, the development of countries' financial markets may also reduce environmental degradation. The finding that there is a bidirectional causality relationship between firms' environmental performance and stock returns implies that environmental performance can be used as a guiding factor for predictability of stock returns for investors, managers and shareholders. Firms' compliance with environmental regulations, conducting activities to prevent environmental damages and using renewable energy sources that reduce carbon emissions may lead to an increase in stock returns. Improving firms' environmental performance may increase their resilience to risks due to their enhanced corporate reputation and the resulting competitive advantage. Accordingly, it is recommended that owners and managers of firms carry out activities to improve their environmental performance and share information about these activities with the public and stakeholders.

This result of the study provides extremely important findings not only for investors, managers and shareholders but also for policy makers. In order to support sustainable development and economic growth, firms should be encouraged to improve their environmental performance through various legal regulations, reductions in interest rates and taxes in lending, incentives or penalties. Improving firms' environmental performance may increase risk resilience due to enhanced corporate reputation and the resulting competitive advantage. On the other hand, sustainable development can be supported by policymakers tightening audits and inspections of firms' environmental management activities. Finally, policymakers should encourage firms to transparently disclose information about their activities to improve their environmental performance to the public and encourage firms to ensure the accuracy and reliability of the information provided. This transparent and accurate information provided to stakeholders is expected to contribute to the development of financial markets and thus to the economic and sustainable development of the country.

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