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Energy Sector Stock Prices—are Environmental, Social, Governance Factors Important?

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Abstract

The aim of this paper is to analyze the impact of ESG measures on the rates of return in the energy sector. The main hypothesis is as follows: The ESG measures have a significant impact on the energy sector's rates of return, especially in the context of the COVID-19 crisis. An analysis was conducted using the rates on return on stock prices companies listed on stock exchanges all over the world. For the analysis, data from the Refinitiv database were used. To verify the abovementioned hypothesis, quarterly data from financial statements, macroeconomic data, and ESG measures for all companies that have been listed on the stock exchanges worldwide were collected for 2010–2021 period. The sample was divided into sub-samples according to the type of sector and the period of the COVID-19 crisis. In the analysis, the significance of the size of the company, the value of capitalization, political indicators, and the level of the economy divisions was assessed.

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1. Introduction

In the past two years, huge problems connected with the COVID-19 pandemic have arisen. Before the mentioned situation, the environmental, social, and governance (ESG) measures had been analyzed and tested to a certain extent; however, the one of the main reasons for the increasing interest in this topic is related to the COVID-19 crisis. Climate change, leading to consequences including new tornados, hurricanes, sweltering heat (at nearly 50 degrees Celsius), and huge fires with very large areas, has started to be one of the main problems globally. Not without significance is the increasing pollution of water and air, one of the reasons for which is CO_2 emissions. As a result of the pandemic, more attention has also put on the conditions in which people work and the government policies relating to companies. The effect of this situation is an increasing number of regulations connected with reduced environmental risks, improved social conditions, and governance polices.

In this paper, a specific sector is considered for analysis; specifically, the energy sector. The reason for testing the impacts of the ESG measures in this sector is strictly connected with the changes in regulations for particular regions and countries. These new laws mostly rely on the reduction of CO_2 emissions, water savings, pollution reduction, and the replacement of traditional energy sources with renewable energy. The mentioned measures seek to address declarations such as one of the main goals of the COP26 meeting in December 2021, in which secure global net zero carbon emission by mid-century and keeping global warming below 1.5 degrees Celsius were posed. The ambitious 2030 emissions reductions targets rely on: accelerating the transition from coal, curtailing deforestation, speeding up the transition to electric vehicles, and encouraging investments in renewables. Goals to protect and restore ecosystems

have also been presented. The developed countries promised to deliver 100 billion USD in climate finance risk, and also made decisions to finalize the Paris rulebook. In April 2021, a draft of the Directive on non-financial reporting by the European Commission was published, which will replace a Non-financial Reporting Directive. The CSRD (Corporate Sustainable Reporting Directive) imposes more reporting obligations and expands the list of entities which are obligated to report. All large companies—not only these listed on the stock exchanges—will have to report ESG statements. The CSRD will be implemented into the national regulations of the Member States by the end of the 2023. Initial reporting will be started in 2024, taking data for 2023.

The analyses prepared by the OECD suggested that, by 2040, the demand for energy will increase by 20%. As a result, the energy sector has placed attention on a few key tasks. The first is the increase the share of the renewable energy sources. In 2020 303.5 milliards USD were invested into renewable energy, 2% more than in 2019. China has started two huge hydroenergy projects based on low-cost green hydrogen, which will reduce global CO_2 emissions. Partial governments have also introduced green regulations. The United States rejoined the Paris Agreement, and President Biden announced plans to invest into green infrastructure and clean energy. Following the pandemic, U.S. economic stimulus packages were designated to free up state budgets for clean energy packages. It has been reported that the United States is also conducting researching on an increase in the social cost of coal, which is around 50 USD per ton. The U.K. government has put forward extensive plans to meet the climate goals. The U.K. Oil and Gas Authority (OGA) has established a Task Force to define a series of investor disclosure and reporting requirements for operators and licensees. The next problem for traditional energy sectors relies on a decline in fossil fuel production and use. Before the COVID-19 pandemic, the oil industry was already struggling due to pressures to switch to renewable resources, and recent years have made the situation worse. Investors are concerned about physical, political, and liability risks, making the markets challenging for large oil companies. BP, Total, and Shell have all announced a strategic transition to renewable energy. The production of electricity from coal has fallen by 32% over the last four years. International coal demand is expected to continue to decline, and several U.S. coal producers have permanently closed their mines.

The presented situation has changed various investment policies. In 2020, Blackrock—the world's largest asset manager—announced that it would withdraw from investing in coal mining. Demand for coal has already peaked, and oil and gas are expected to follow the same trajectory in 2029 and 2037, respectively. On March 2, 2021, the U.S. House of Representatives Energy and Trade Committee proposed a Bill on Climate Leadership and Environmental Action for the Future of Our Nation (CLEAN Act). The CLEAN Act significantly amends the Stock Exchange Act of 1934 and mandates SEC-specific disclosure of direct and indirect greenhouse gas emissions, including any fossil fuel-related assets. The re-orientation of the investment strategy for renewable energy has been also presented by the OECD in ESG Investing. The Environmental Pillar Scoring and Reporting from 2020 describes the significance of the adaptation of climate-related risk management, as well as operational processes, to improve water use, waste management, and impacts on biodiversity.

In all of the presented documents, the main idea relies on a reduction of the carbon footprint and promotion of the carbon transition. This has created a new risk that must be taken into account when making investment decisions; namely, climate risk. This situation is strictly connected with the introduction of new regulations. Banks from OECD countries are now in the process of integrating ESG assessments into their investment approaches as one of the tools to better align their portfolios with the transition to low-carbon, climate-resilient economies. This is an effect of initiatives such the Network for Greening the Financial System (NGFS). It has also been noted that the risk of higher volatility is lower in the case of higher ESG indices and funds. ESG investment is growing rapidly, being worth 18 trillion USD globally in 2019 (GSIA, 2019), and the growth of ESG-related traded investment products exceeded 1 trillion USD.

The presented relationship led to the need to analyze the impacts of ESG measures on the rates of return in the energy sector. First, this sector is one of the most sensitive to the ESG measures and relevant regulations. Nearly all of the mentioned regulations are based on analysis of the E-factor, especially the low-carbon emission polices, during investment decisions. Next, companies forming the energy sector—especially these from the coal, oil, and gas sub-sectors—are some of the biggest companies listed on stock exchanges. As a result, knowledge on the impact of the ESG measures on their rates of return is very significant for guiding investment decisions, transferring capital between companies from other sectors. It will also give an answer to the question about how to re-build the structure of the energy sector. The third reason to take into account in the analysis is the varied opinion regarding the significance of ESG measures in investment decisions. The COVID-19 pandemic brought about a new view on the topic. Previous studies have also been conducted based on all sectors, without divisions on the particular ones, which can lead to false results. Each sector has its specific risk, activity, and sensitivity with respect to environmental, social, and/or governance risks. For example, Friede et al. (2015) suggested that ESG criteria are not taken into consideration during investment decisions, even if they are important. However, the situation is different now. As a result, the aim of this paper is to analyze the impact of ESG measures on rates of return in the energy sector. Our main hypothesis is as follows: The ESG measures have a significant impact on rate of return in the energy sector, especially in the context of the COVID-19 crisis. Thus, we empirically examined the impacts of ESG factors and the financial condition of companies belonging to the energy sector from the sample of all public and private entities worldwide, using data available for the years 2010–2021.

The remainder of this paper proceeds as follows. In Section 2, a review of previous studies that have investigated the relationship between ESG criteria and the rates on returns on stock prices and a practical analysis of the impact of the mentioned factors on investment decisions are presented. Section 3 reports on the methodology by describing the features of the data sample and the specifications of the modeling process used in this study. Section 4 discusses the obtained findings, while Section 5 concludes the paper by discussing the limitations of the current study and consequently suggesting future lines of research.

2. Literature Review

An analysis of the previous studies focused on the relationship between ESG measures and their impact on the financial condition of companies and their rates on returns on stock prices gives varied results. On one hand, they have presented opinions regarding the lack of influence of the ESG measures on the value of companies and additional profits gained by introducing the ESG policies (Friede et al., 2015; Orlitzky et al., 2003). Revelli and Viviani (2015) could not validate the existence of a positive or negative relationship between socially responsible investments (SRI) and the rates of return. Friede et al. (2015) also did not find a statistically significant impact of ESG on rates of return; however, they observed geographical differences. In Europe, 26.1% of studies suggested a positive relationship, but 65.9% reported insignificant connections. Similar results have been reported by Sargis and Wang (2020). The differences between the obtained results may be an effect of the use of different methods and data (Giese et al., 2019). Some researchers believe that social and environmental factors are not taken into account by financial institutions when verifying the potential value of the company, even if they have a potential positive impact (Cellier & Chollet, 2016; Fatemi et al., 2018; Gutsche et al., 2017; Lins et al., 2017)

On the other hand, some studies have focused on the impact of ESG investments on the portfolio rates of return (Brooks & Oikonomou, **2017**; Ciciretti et al., **2019**). Companies usually do not analyze the ESG risk, as low CSR and SRI policy can destroy the value for stockholders. As a result, companies with higher ESG measures can be threatening, as a socially responsible investment, providing a way to improve investment profits. Furthermore, the period of investment is not without significance. Investors who prefer companies with higher ESG measures

tend to invest over a longer period. The reaction of the stock market is stronger for the one-year period than shorter or longer investment times (Giese & Nagy, 2018). Such investors also take ESG policies into consideration when they are making decisions about selling companies with negative rates of return. Analysis of the Intangible Value Assessment (IVA) also confirms the previous findings, where companies with a higher value of IVA received higher rates of return from active portfolios. Moreover, the research has shown that, even if ESG indices do not directly influence stock prices, they may affect the performance of the best and worst companies in terms of ESG investments.

The reaction of the stock market to ESG measures can vary when taking a particular group of factors into the analysis. Gibson and Krüger (2018) have measured investor profits by taking into account only environmental and social investments. Kruger (2015) divided information connected with CSR on positive and negative and conducted an analysis according to perspective theory on the significance of the type of information. This response was weakly negative for positive CSR events and strongly negative for adverse events. The author showed that CSR messages, which carry important legal and economic information, have the greatest impact on the reactions of investors. The second issue that Krüger examined concerned the "inverse causal relationship" between ESG and financial outcomes. In his opinion, the effects of ESG investments can be measured in both the short- and long-term. In the latter scenario, it is difficult to determine whether companies are doing "well," in terms of ESG performance thanks to good financial results, or vice versa. According to Hong et al. (2012), enterprises that are more profitable in terms of ESG standards are subject to lighter financial constraints. Giese and Nagy (2018) found, by taking lagged data into account, that the stock prices of companies which do not have extremal ESG measures react more sensitively to ESG information. They also confirmed that the reaction to increased ESG measures was more significant than their decrease.

The literature has also suggested that the impact on the rates of return on stock prices are related to the types of investors. Investors that make socially responsible investments are less sensitive to the rates on return that traditional investors (Bollen, 2007; Renneboog et al., 2001). As an effect, stock prices are more stable, and lower liquidity and volatility of the mentioned stocks has been noted. Investing in companies with ESG policies can also bring additional profits for stakeholders, based on reduction of the risk of the company's situation worsening, especially in the case of environmental risk (Hoepner et al., 2016). As a result, ESG–CSR policies can help to create additional profits for companies. Albuquerque et al. (2019) have suggested that CSR reduces systemic risk and increases profits, especially in the case of diversified companies. On the other hand, Lys et al. (2015) have shown that CSR signals higher profits, but does not necessarily create positive rates of return and additional value for the company. The presented opinions have changed in more recent research, as related to changes in regulations and the increased significance of climate risks. The significance of the particular ESG factors also varied in recent studies. For years, the most-often analyzed factor was the S-factor. Weber et al. (2010) have verified the impact of social announcements on abnormal rates of return on stock prices.

The impacts of ESG–CSR policies on the rates of return during crisis periods also vary. Demers et al. (2020) have suggest that, in difficult times, ESG investments can be considered a waste of money, as they do not help to deal with the crisis itself. Based on this view, companies with high ESG investments may be more affected by crises. The opposite opinion has been presented by Lins et al. (2017), who found that, during the 2008–2009 crisis, ESG investments hedged against stock drops, and companies with higher developed CSR gained higher rates on returns than those that obtained lower social capital results. These companies built the reputation between shareholders and stockholders, bringing positive effects during crises. The difference in the reaction of the stock market before and during a crisis has been observed Bouslha et al. (2018), who found that CSR reduces risk during market turmoil. SRI funds also received higher profits during crises that traditional ones (Nofsinger & Varma, 2014), but received lower profits during boom periods. Other opinion has been stated by Leite and Corteza (2015), who

believe that SRI funds did not bring additional profits during the 2008–2009 crisis in Europe and, in periods of economic growth, they create lower profits than traditional funds.

A key problem related to estimating the impact of ESG on the rates of return during the COVID-19 pandemic relies on its unpredictability, as companies had no time to prepare for the crisis. In this way, is created an external shock for economies (Albuquerque et al., 2020). Previous crises have been also shorter. Dai et al. (2020) have shown that companies are more interested ESG problems during periods of instability in the financial market, which can build trust during crisis periods. As a result, limitations may be created during the assessment impact of ESG policies during a crisis, with respect to the stability and capitalization of companies. Ding et al. (2021) have suggested that companies with more developed activities registered a lower decrease in their rates of returns, which may be an effect of the positive impact of CSR policies on the relationship between companies and shareholders, which helps to react to the pandemic risk. The mentioned effect is stronger in countries that value fair treatment of people and are interested in limiting climate change. A similar opinion has been noticed for the American market (Albuquerque et al., 2020), where companies with higher ESG ratings received higher rates on return and lower volatility in the first quarter of 2020. Another opinion has been reported by Demers et al. (2020), who did not observe a connection between ESG and rates on return in the U.S. during the first quarter of 2020, but found a negative relationship during the second quarter of 2020. The mentioned period can be treated as a market recovery. They found that financial flexibility was crucial for the performance of companies during the crisis, which is in line with a long line of economic research. The authors also noted that investments in internally produced intangible assets were important in explaining the abnormal returns for both periods. They also suggested that there is a lot of talk in the U.S. market but little of CSR enforcement, which differs from Europe, where ESG is taken more seriously. The differences between reaction stock prices on the ESG measures can be noticed for particular countries. According to Takahashi and Yamada (2020), the Asian stock market was insensitive to ESG measures during COVID-19. The received differences can be explained by two reasons. First, the ESG was conceived in Europe and USA. Second, the size of the sample should be taken into consideration. For the analyses, a small number of observations and a short period were used. This situation is relate to various factors connected with a specific period. For example, Demers et al. (2020) only researched U.S. stocks, while Ding et al. (2021) researched a global sample including mostly non-U.S. stocks. Demers et al. (2020) argued that the study Ding et al. (2021) cannot generalize directly to U.S. stocks, while their own study can generalize to the U.S.-only setting.

Analysis of the studies focused on the determinants of the rates of return on stock prices suggests that other financial indicators should also be taken into account when considering the COVID-19 crisis. In their research, Jagannathan and Zhang (2020) found that companies with high quality assets are in better financial condition than others. Regarding the liquidity measures considered by Acharya and Steffen (2020), companies with high liquidity performed better during the first quarter of 2020. Companies with not only higher liquidity and but also lower leverage ratios are less sensitive to stock price volatility (Fahlenbrach et al., 2020). The impact also extends to the macroeconomic situation. Companies based on international connections, as well as high export and import shares presented higher stock prices drop. This creates a contagion effect between markets. This phenomenon has been noted especially in the case of economies with higher size during the COVID-19 pandemic (Hassan et al, 2020, Pagano et al., 2020).

The OECD (2020) presented findings connected with the ESG providers. First, the low correlation between E-scores and ESG scores was noted. Investing in high-scoring ESG portfolios does not necessarily mean that companies that have received high ratings for managing their carbon emissions or risk management have been included. E-scores other than environmental metrics have greater weights in certain methodologies, which can help investors to understand the long-term transition. As a result, investing in high E-score companies may, in some

cases, inadvertently result in a greater carbon footprint in portfolios. Next, the opinion that portfolios exposed to the energy sector and other industries with high emissions did not decrease—and, in some cases, materially increased—was presented. Quantitative analysis has indicated that the emissions in these high-ESG portfolios are higher on a gross and average basis for some of the very large ESG funds. This draws attention to the sustainability of such funds for investors that wish to achieve risk-adjusted returns and reduce the carbon footprint of their portfolios. Other types of investment products, such as those tailored to climate transitions, may provide more targeted tools for investors to re-balance their portfolios away from companies with carbon-extensive outputs or supply chains. Highly tailored low-carbon or carbon-transition portfolios may have asset composition and risk characteristics that stray widely from the standard market benchmarks that are most-used by institutional investors.

The presented literature reveals a few problems. First, the obtained findings are varied and do not allow for the formation of a consistent opinion regarding the impact of ESG on the rates of return on stock prices. Contradictory opinions have been presented, especially with respect to crisis periods. The presented studies also did not include divisions on the sub-sectors, in which the reaction during the COVID-19 pandemic varied (Chodnicka-Jaworska & Jaworski, 2020). As a result, an analysis of the impact of ESG factors on the rates of return on the stock prices for particular sectors should be conducted (Khan et al., 2016). In the presented paper, the analysis takes the energy sector into account, as one of the sectors most exposed to ESG regulatory risk. Next, most research has verified the described phenomenon for a particular country, such as the U.S. (Demers et al., 2020); however, in practice, the received findings are inaccurate. As a result, it is worthwhile to test the mentioned phenomenon for other countries, considering economic and political divisions. The presented studies also present one strong limitation: the ESG indices market is still at an early stage, which may result in misleading research results. Dorfleitner et al. (2015) were not able to find ESG conceptions, while Escrig-Olmedo et al. (2019) have suggested that ESG indices do not take into consideration the full principles of the sustainability development ideas in the presented methodology. This has been confirmed by the OECD (2020). Each of the ESG indices has its own methodology, significance of the variables, and list of factors included for analysis, which yields different results in various estimations (Berg et al., 2019; Kruger, 2015). Therefore, on one hand, ESG rating agencies help to reduce information asymmetry; however, on the other hand, the evaluation of ESG ratings may be misled by various rating standards. Despite this situation, in practice, investors take into account the mentioned ESG measures when making investment decisions. To reduce the risk of the varied methodology in the presented papers, we also analyzed the ESG indices presented by Refinitiv. In the present study, a homogeneous sample is used, with energy sector divided into various sub-sectors. As a result, the received findings can be considered more appropriate and better represent the research problem.

3. Materials and Methods

The aim of the paper is to analyze the impacts of the ESG measures on the rates of return on stock prices in the energy sector. The main hypothesis that is as follows: The ESG measures have a significant impact on the rates of return in the energy sector, especially in the context of the COVID-19 crisis. An analysis was conducted by using the rates of return on stock prices of companies listed on stock exchanges all over the world. In the analysis, more than 2800 companies from all countries were analyzed, where the data were collected from Refinitiv database. To verify the abovementioned hypothesis, we collected quarterly data from financial statements, macroeconomic data, and ESG measures for all companies listed on stock exchanges worldwide for the period 2010–2021. The energy sector was divided into sub-sectors according to the type of sector, considering the COVID-19 crisis period. In the analysis, we also tested the significance of the size of the company, political indicators, and the level of economic division.

The data were divided on two groups, the first of which represents financial factors. Daniel and Titman (1997) have shown that factors connected with the financial indicators can have a significant impact on the rates of return on stock prices. As a result, it was decided to verify the significance of this group of factors. The list of variables, along with their abbreviations, is presented in Table 1.

Table 1. List of independent financial variables.

Variable name	Description	Abbreviation
	Profitability	
EBITDA margin	Annual Earnings Before Interest, Taxes and Depreciation to Total Revenue	**EBIT**
Effective tax rate	Total Income Tax to Income Before Taxes	**TAX**
	Earning Power	
Asset Turnover	Primary Revenue for to Average Total Assets	**TUR**
Pretax ROA	Income Before Tax to Average Total Assets	**ROA**
Earnings Retention	Retained Earnings to Income Available to Common Excluding Extraordinary Items	**EAR**
	Liquidity	
Current Ratio	Total Current Assets to Total Current Liabilities	**CUR**
Time Interest Earned	Earnings Before Interest and Taxes to Interest Expense	**TIM**
	Leverage	
Assets/Equity	Total Assets to Common Shareholders Equity	**EQ**
LT Debt/Equity	Long-Term Debt to Total Equity	**DEBT**
Tax Complement	Net Income Including Extraordinary Items to Income Before Tax	**COM**
(Total Debt-Cash)/EBITDA	Net Debt to EBITDA	**HIS**
	Operating	
A/R Turnover	Primary Revenue to Average Total Net Receivables	**AR**
Inv Turnover	Total Cost of Revenue to Average Total Inventory	**VEN**
Average Payable Days	Average Accounts Payable to Total Cost of Revenue.	**PAY**
Average Inventory Days	Average Days Inventory (Ratio) for the fiscal interim multiplied by Days In interim (364).	**AV**
Bad Debt Allowance Ratio	Allowance for Doubtful Accounts to Accounts Receivable	**AD**
Fixed Assets Turnover	Primary Revenue to the sum of Total Net Property, Plant & Equipment, and Total Net Utility Plant	**FIX**
WC/Sales Growth	Working Capital to Sales	**WC**
ROIC	Income After Tax to Average Total Long Term Capital	**RET**

The ESG measures that were used in the analysis are presented in Table 2. The mentioned variables were obtained from Refinitiv, and are commonly used in practice to analyze and build portfolios.

Table 2. Description of the ESG measures

Variable name	Description	Abbreviation
CO2 Emission	The logarithmized vale of CO2 emissions in giga tones.	**CO**
ESG Score	Overall company score based on the self-reported information in the environmental, social, and corporate governance pillars.	**ESG**
Environmental Pillar Score	The company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best	**ENV**

	management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long-term shareholder value.	
Social Pillar Score	The company's capacity to generate trust and loyalty with its workforce, customers and society, through its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long-term shareholder value.	**SOC**
Corporate Governance Pillar Score	It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances, in order to generate long-term shareholder value.	**GOV**
ESG Controversies Score	The company's exposure to environmental, social, and governance controversies and negative events reflected in global media.	**CONT**

The main benefit of panel data is that it can handle both firm- and time-specific effects. By controlling for these largely unobserved effects, omitted variable bias can be reduced and the inference effect can be improved. Panel data might also reduce the issues related to multicollinearity that arise for cross-sectional data. The final version of the model is as follows:

$$\Lambda y_{it}^{*} = \Lambda\alpha y_{it-1}^{*} + \Lambda\beta F_{it-1}' + \gamma Z_{it} + \delta(F * Z)_{it} + \varepsilon_{it}$$

where Λy_{it} is an unobservable latent variable that measures the first differences on the rates of returns on the stock prices of a company from energy sector *i* in period *t*, and ΔF_{it} is a vector of the first differences on the explanatory variables:

$$\Delta F_{it} = [\Delta A_{it-1},\ \Delta B_{it}\ ]$$

where A_{it-1} is a vector of lagged micro financial variables:

$$A_{it-1} = [EBIT_{it-1},\ TAX_{it-1},\ TUR_{it-1}\ ,\ ROA_{it-1},\ EQ_{it-1}, COM_{it-1}, EAR_{it-1},\ TIM_{it-1},\ CUR_{it-1}\ DEBT_{it-1}, HIS_{it-1},\ AR_{it-1},\ AV_{it-1},\ AD_{it-1},\ PAY_{it-1}, VEN_{it-1},\ FIX_{it-1},\ WC_{it-1}, RET_{it-1}, SIZE_{it-1}]$$

B_{it} is a vector of explanatory variables connected with the ESG measures:

$$B_{it} = [ESG_{it},\ ESGE_{it},\ ESGS_{it}\ ,\ ESGG_{it}]$$

Z_{it} contains time invariant regressors that are generally dummy variables, and ε_{it} is a random disturbance term.

The strong correlation between ESG measures leads to the need to conduct analysis for the factors separately. For the presented analysis, models were prepared in a sub-sample for each type of sector. The sub-sectors were divided according to four groups: renewable energy, uranium, coal, and oil and gas. The next division relied on the classification according to the COVID-19 crisis. In the literature, it has been suggested that, during crisis periods, ESG measures should have a positive statistically impact on the rates of return.

The last classification refers to the analysis according to the size of the company. The companies were divided into two groups: small and large. A large company is classified as a company that has assets higher than 95% of entities. We also analyzed the level of fragmentation in the shareholder structure, where concentrated shareholding means that the share of the five biggest stockholders is higher than 50%, while a lower concentration indicates that the share of the five biggest shareholders is less than 50%. The sample was also divided according to whether the government was one of the investors in a company.

The presented analysis was prepared in two ways. First, we checked which factors are significant for estimation of the energy sector's rates of return. Next, we analyzed the impacts of the ESG measures, according to classification. To prepare the final models, robustness checks were also conducted.

4. Results

The aim of this paper was to analyze the impact of ESG measures on the rates of return on stock prices for the energy sector. The analysis started with an assessment of the impact of the ESG measures, and the estimation results are presented in Table 3. A significant impact of

the ESG scores was observed for the oil and gas and uranium subsectors. In both cases, an increase in the ESG scores led to higher rates of return. The strongest effect was observed for the uranium sub-sector. In the comparison between large and small companies, a significant impact of the ESG scores was noticed for the smaller companies, especially those in the oil and gas subsector. The bigger entities were insensitive to the mentioned variable. The next step relied on testing of the particular groups of ESG measures on the rates of return on stock prices. The conducted analysis suggested that the E-factors—measured by the Environmental Pillar Score presented by Refinitiv—were insignificant for the changes in the rates of return on stock prices in the whole sample, as well as in the small and large company subsamples. The next determinant was the S-factors. The prepared model suggested that the mentioned variable had a positive significant influence on the oil and gas and uranium subsectors, and a negative influence on the renewable energy subsector. The mentioned subsectors are competitors, which may explain the observed relationship. The analysis of the impact of the S-factors for the large entities suggested that a strong significant reaction was observed for the uranium sub-sector. The companies in the mentioned sector are usually bigger and more stable. In the case of the smaller entities, significant relationships were observed for the oil and gas (positive) and uranium (negative) subsectors. As in the case for the ESG score, the mentioned reaction was stronger for the smaller companies than for the whole sample. The G-factors did not influence the rates of return on stock prices for the whole sample, as well as in the subsamples according to the size of the company.

The obtained findings suggest that the ESG score is mostly significant for the smaller companies, and insignificant for larger ones. Increases in the mentioned variables led to higher rates of return on stock prices. The presented findings can be explained by a few reasons. First, companies must bear the high costs connected with the implementation of ESG polices. Bigger entities have been facing these costs for the last few years, while smaller ones are only adjusting now. As a result, investors see the possibility to receive higher profits in the group of mentioned entities. Next, the smaller entities are only recently obligated to implement ESG laws, while larger ones had done so earlier. In the opinion of some, ESG policies pose a threat as a marketing treatment. Managers can use ESG to distract from inappropriate company behavior or accounting inaccuracies [55]. It is assumed that over-investing in ESG binds meager (financial) resources, such that poor ESG performance should be associated with lower credit risk, and vice versa [56]. The mentioned differences between smaller and bigger companies can be connected with the type of investors and the level of concentration of the stakeholders. Investing in companies with ESG policies can bring additional profits for stakeholders, based on reduction of the risk of a company's situation worsening, especially in the case of environmental risk [23].

The significant impacts in the mentioned group of ESG measures were primarily related to S-factors, with both E- and G-factors being unimportant. The received findings suggested that, in the case of the bigger entities, the social and environmental factors are not taken into account by financial institutions when verifying the potential value of the company, even if they have potential positive impacts [6 - 9].

Table 3. ESG indicators' impact on energy sector's rates of return on stock prices.

dret	**coal**		**oil & gas**		**renewable energy**		**uranium**	
	Coef.	P>t	Coef.	P>z	Coef.	P>t	Coef.	P>z
total								
dESG	.000985	0.813	.0023546	0.078	-.0051724	0.352	.0192431	0.023
_cons	.0090945	0.827	.0224968	0.122	.0147376	0.807	-.0621651	0.650
no obs	154		1795		124		53	
no group			337				10	
Wald	0.8134		0.0783		0.3523		0.0227	

R sq	0.0004				0			
Hausman			0				0	
BP			0.0016				0	
big								
dESG	0.05	0.958	-.0007398	0.797	-.0019582	0.838	.0423108	0.171
_cons	0.17	0.867	.0363057	0.200	.0690024	0.458	-.3564186	0.327
no obs	66		386		31		10	
test F	0.9577		0.7973		0.8379		0.1709	
R sq	0		0		0		0	
small								
dESG	.0012681	0.817	.002714	0.066	-.0055285	0.404	.0060962	0.540
_cons	.008999	0.876	.0191693	0.154	-.0082601	0.912	.0327529	0.730
no obs	92		1427		93		43	
test F	0.81		0.0658		0.4041		0.5397	
R sq	0		0.0017		0		0	
total								
dESGE	-.0012982	0.604	.0012631	0.173	.0006156	0.852	.0095734	0.046
_cons	-.0054959	0.656	.0312373	0.013	-.0312452	0.531	.0384487	0.742
no obs	154		1795		124		53	
no group			337				10	
Wald	0.9925		0.1727		0.8521		0.0467	
R sq	0				0			
Hausman			1				0	
BP			0.0012				0	
big								
dESGE	-.0012172	0.815	.0008286	0.694	-.0043099	0.439	.0166457	0.305
_cons	.017492	0.717	.0265209	0.252	.0838571	0.243	-.1727515	0.585
no obs	62		368		31		10	
test F	0.8149		0.6917		0.4391		0.3049	
R sq	0		0		0		0	
small								
dESGE	.0003125	0.926	.0014645	0.154	.0020705	0.600	.0028305	0.641
_cons	.0166023	0.717	.0292304	0.007	-.0713264	0.254	.0655955	0.315
no obs	92		1427		93		43	
test F	0.9257		0.1544		0.6003		0.6415	
R sq	0		0.0007		0		0	
total								
dESGS	-.0033368	0.358	.0019901	0.035	-.0065646	0.063	.0135156	0.017
_cons	.0315503	0.345	.0275618	0.027	.0202684	0.673	.0157486	0.897
no obs	154		1795		124		53	
no group			337				10	
Wald	0.3584		0.0349		0.0626		0.0169	
R sq	0				0.0202			
Hausman			1				0	
BP			0.0012				0	
big								
dESGS	-.0054432	0.320	-.000614	0.789	-.0049958	0.476	.0402018	0.023
_cons	.0334558	0.480	.0341754	0.136	.0914994	0.253	-.2514985	0.279
no obs	62		368		31		10	
test F	0.32		0.7892		0.4760		0.0232	
R sq	0		0		0		0.4317	
small								

dESGS	-.0021012	0.668	.0025689	0.013	-.0068776	0.092	.0048431	0.421
_cons	.0294934	0.528	.025143	0.060	-.0051389	0.930	.0532562	0.619
no obs	92		1437		93		43	
no group			280				8	
Wald	0.6682		0.013		0.0922		0.4212	
R sq	0				0.0202			
Hausman			0				1	
BP			0.0012				0.0003	
total								
dESGG	-.0003968	0.883	-.000862	0.214	-.0022379	0.495	-.0000667	0.989
_cons	.0190786	0.588	.0438168	0.000	-.0081699	0.868	.1058233	0.395
no obs	154		1795		124		53	
no group			337				10	
Wald	0.8828		0.2142		0.4950		9890	
R sq	0				0			
Hausman			0				0	
BP			0.0011				0	
big								
dESGG	.0011289	0.791	-.0024693	0.121	.0039356	0.405	-.0200905	0.509
_cons	.0059796	0.902	.0493707	0.033	.0240097	0.734	.0332009	0.906
no obs	62		368		31		10	
test F	0.7907		0.121		0.4054		0.5094	
R sq	0		0.0038		0		0	
small								
dESGG	-.001327	0.711	-.0004684	0.544	-.0042896	0.293	.001402	0.736
_cons	.030377	0.547	.0419036	0.002	-.0183413	0.764	.0666653	0.597
no obs	92		1427		93		43	
no group			280				8	
Wald	0.7107		0.544		0.2933		0.7364	
R sq	0				0			
Hausman			0				0	
BP			0.0008				0.0003	

The insignificance or reduced significance of the G-factors has been reported for years. An improvement of the mentioned index is posed as an easy and cheap way to increase ESG indicators. Recent studies have shown that the most significant factors are E- and S-indicators. English [57] has found that environmental problems, such as climate change or water pollution, are more universal and have a longer-term perspective than social- and management-related risks, which are mostly limited internally. This has been confirmed by Han et al. [58] and Ga-Young Jang et al. [59]. A negative relationship between environmental risk and a company's financial conditions may be noticed when social measures are insignificant.

The presented results indicated differences between particular energy sub-sectors, also taking into account the size of a company.

As mentioned above, the impact on the reaction can be affected by the type of investor. Investors that make socially responsible investments are less sensitive to the rates of return that traditional ones [21, 22]. As an effect, relevant stock prices are more stable, and lower liquidity and volatility of the mentioned stocks can be noted.

The next step of the analysis relied on verification of the effect of stakeholder concentration on the rates of return on stock prices, the results of which are presented in Table 4. The received results were varied. In the case of the coal sub-sector, a significant reaction to the ESG measures in the rates of return on stock prices was not observed. A significant reaction to the ESG measures, especially regarding the S-factors, was noted for the oil and gas sub-sector in the case

of low stockholder concentration. The stock prices of the renewable energy sub-sector were insensitive on the ESG measures in both cases of concentrated and unconcentrated shareholding. The uranium sub-sector reacted to E- and S-factor changes, but only in the low stakeholder concentration sample; the mentioned reaction was stronger for the S-factors.

The presented research suggests that only two sub-sectors react to ESG factor changes; namely, the oil and gas and uranium sub-sectors. Furthermore, a more significant reaction was observed in the case of diversified stakeholders, while companies with concentrated shareholding were insensitive to the ESG measures, as investors making investment decisions tend to primarily pay attention to financial indicators.

The analysis of impact of the type of investor suggested that a significant impact of ESG measures can be noticed in the case of private investors. The stock prices of those companies in which one of the biggest five investors was the government were insensitive to the ESG measures. As a result, only private investors pay attention to these factors when making investment decisions. The analysis presented in Table 5 suggests that the rates of return on stock prices of the companies with private investors react to S-factor changes, as the mentioned investors tend to pay attention to SRI policies.

The next part of the analysis relied on testing the impact of the ESG measures before and during the COVID-19 crisis, the results of which are presented in Table 6. During the crisis, the significant impact of the ESG measures on the rates of return varied. In the case of the oil and gas sub-sector, the most important variable was G-factors changes, while S-measures were significant for the renewable energy sub-sector. In both cases, the impact was negative. This confirms the opinion presented by Demers et al. [27], who suggested that, in difficult times, ESG investments can be considered a waste of money, as they do not help to deal with the crisis itself. Companies with higher ESG investments may be more affected by crises. The obtained findings are in opposition to the opinion of Ding et al. [33].

In the case of the uranium sub-sector, the most significant impact was observed for E-factors, with an increase in the E-factors leading to higher rates of return on stock price changes. The received results are compatible with the opinion of Lins et al. [9]. Companies with a higher developed E-factor build a reputation between the shareholders and stockholders, which brings positive effects during crises. SRI funds also receive higher profits during crises than traditional ones [29]. The received findings differ from those in the study of Dai et al. [32].

Table 4. ESG Score measures impact on energy sector rates of return on stock prices by taking into account the stakeholders concentration.

sector	**coal**				**oil & gas**				**renewable energy**				**uranium**			
concentration	1		0		1		0		1		0		1		0	
dret	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
dESG	-.0076657	0.113	.0068347	0.376	-.0006715	0.760	.0029354	0.070	.0010034	0.903	-.0092695	0.211	-.0108804	0.568	.028203	0.018
_cons	.0354939	0.390	.0160954	0.865	.0616163	0.003	.0073593	0.622	.0024659	0.975	.0247791	0.769	.0965887	0.755	-.116795	0.273
no obs	103		51		540		1255		43		76		5		48	
test F	0.1124		0.3762		0.7597		0.007		0.9025		0.2107		0.5677		0.0183	
R sq	0.015		0		0		0.0018		0		0.0079		0		0.0959	
dESGE	-.003419	0.191	.0070606	0.270	.0007052	0.636	.0015515	0.182	-.0003141	0.939	-.0000829	0.986	-.0117445	0.206	.0114101	0.075
_cons	.0067364	0.831	.0338763	0.657	.0529504	0.001	.0186291	0.123	.012268	0.836	-.0490449	0.497	.0777701	0.592	.0213449	0.784
no obs	103		57		540		1255		43		76		5		48	
test F	0.1915		0.2101		0.6356		0.182		0.9393		0.9862		0.2062		0.0748	
R sq	0		0		0		0		0		0		0		0.0471	
dESGS	-.0014754	0.678	-.0069785	0.395	.0007774	0.623	.0025125	0.032	-.0066388	0.252	-.0071871	0.114	.0059316	0.484	.0214108	0.011
_cons	-.0065488	0.839	.1086322	0.164	.0527703	0.002	.0139858	0.244	.0454349	0.437	.0075109	0.914	-.1252131	0.427	-.049423	0.557
no obs	103		51		540		1255		43		76		5		48	
test F	0.6785		0.3952		0.6231		0.0319		0.2518		0.1138		0.4839		0.0112	
R sq	0		0		0		0.0029		0.0083		0.0204		0		0.113	
dESGG	-.0007605	0.773	-.0001109	0.985	-.0018007	0.111	-.0004033	0.643	.0039256	0.351	-.0059472	0.204	.0033031	0.690	-.0006967	0.913
_cons	-.0078147	0.817	.0763881	0.360	.066761	0.000	.0295171	0.015	-.0238946	0.697	-.003393	0.961	-.1054675	0.535	.0832679	0.351
no obs	103		51		540		1255		43		76		5		48	
test F	0.7728		0.9855		0.1114		0.6428		0.3511		0.2040		0.6902		0.9135	
R sq	0		0		0.0029		0		0		0.0085		0		0	

Table 5. ESG Score measures impact on energy sector's rates of return on stock prices by taking into account the government as one of the investors.

sector	**coal**				**oil & gas**				**renewable energy**		**uranium**	
government	1		0		1		0		0		0	
dRET	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>z	Coef.	P>t	Coef.	P>t
dESGE	-.0059992	0.503	.0020282	0.665	.0021898	0.334	.0023935	0.116	-.006923	0.221	.0178127	0.080
_cons	-.0045718	0.956	.0146351	0.757	.0080715	0.737	.0241699	0.134	.0257633	0.672	-.0725188	0.474
no obs	27		127		233		1562		119		53	
no group							300					
Wald	0.5033		0.6645		0.3343		0.1162		0.0128		0.0799	
R sq	0		0		0				0.0043		0.0405	
Hausman							1					
BP							0.0038					
dESGE	-.0028487	0.547	.0007072	0.826	.0002604	0.885	.0014497	0.160	-.0002054	0.952	.0077136	0.179
_cons	-.0297481	0.628	.0250368	0.513	.0233761	0.229	.03187	0.022	-.0265531	0.599	.0205591	0.781
no obs	27		127		233		1562		119		53	
no group							300					
Wald	0.5474		0.826		0.8849		1602		0.952		0.1752	
R sq	0		0		0				0		0.0162	
Hausman							0.6412					
BP							0.0028					
dESGS	.0033977	0.637	-.0044001	0.289	-.0006093	0.696	.0026514	0.015	-.0072579	0.041	.0165886	0.018
_cons	-.0654679	0.352	.0484244	0.199	.0283838	0.137	.0259343	0.060	.0227736	0.639	-.0403952	0.600
no obs	27		127		233		1562		119		53	
no group							300					
Wald	0.6365		0.2885		0.6956		0.0142		0.0414		0.0175	
R sq	0		0.0011		0				0.0268		0.0882	
Hausman							1					
BP							0.0031					
dESGG	-.0020056	0.666	-.0001035	0.974	-.0000682	0.956	-.0010125	0.196	-.0026635	0.432	-.0003148	0.955
_cons	-.0327766	0.604	.0300297	0.465	.0252192	0.169	.0465421	0.001	-.0066683	0.895	.0667188	0.413
no obs	27		127		233		1562		119		53	
no group							300					
Wald	0.6656		0.974		0.9564		0.196		0.4315		0.955	
R sq	0		0		0				0		0	
Hausman							0					
BP							0.0026					

Table 6. ESG Score measures impact on energy sector rates of return on stock prices by taking into account the COVID-19 crisis period.

sector	**crisis**								**before crisis**							
crisis	coal		oil & gas		renewable energy		uranium		coal		oil & gas		renewable energy		uranium	
dretstock	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>z	Coef.	P>t	Coef.	P>t
dESG	-.0076777	0.745	.0022479	0.643	-.0221888	0.180	.0396844	0.227	.0018852	0.660	.0023546	0.078	.0030812	0.542	.0050292	0.664
_cons	.1299742	0.357	.328942	0.000	.0996495	0.623	-.1382469	0.777	-.0094833	0.832	.0224968	0.122	-.0371879	0.482	-.0148638	0.886
no obs	20		211		25		6		134		1795		99		47	
no group											337					
Wald	0.7450		0.6434		0.1803		0.2272		0.6602		0.0783		0.5422		0.6636	
R sq	0		0		0.0365		0		0				0		0	
Hausman											0					
BP											0.0016					
dESGE	-.0032145	0.341	.0005092	0.647	-.0018297	0.720	.0341043	0.010	.0010748	0.706	.0012631	0.173	.0013214	0.641	-.0072373	0.298
_cons	.1920091	0.235	.324255	0.000	.0508015	0.820	-.2746732	0.222	-.0021335	0.953	.0312373	0.013	-.0242582	0.567	.0472924	0.506
no obs	21		252		41		6		134		1795		99		47	
no group											337					
Wald	0.3414		0.6473		0.7195		0.8422		0.7036		0.1727		0.6408		0.2978	
R sq	0		0		0		0		0				0		0	
Hausman											0					
BP											0					
dESGS	-.003043	0.847	.0025973	0.412	-.0165252	0.066	.0373271	0.222	-.003046	0.418	.0019901	0.035	.0016048	0.653	.0132156	0.057
_cons	.1020053	0.284	.3274742	0.000	.0855488	0.620	.122797	0.715	.0194878	0.589	.0275618	0.027	-.0231207	0.577	-.0611125	0.425
no obs	20		211		25		6		134		1795		99		47	
no group											337					
Wald	0.8473		0.4115		0.0659		0.2217		0.4183		0.1727		0.6529		0.0569	
R sq	0		0		0.1021		0.1791		0				0		0.0578	
Hausman											0					
BP											0					
dESGG	.0069826	0.360	-.0047617	0.076	-.0107614	0.318	-.0148954	0.348	-.001597	0.580	-.000862	0.214	.0010741	0.709	.0042534	0.483
_cons	.0329789	0.749	.3700456	0.000	.0195497	0.916	.5644409	0.132	.0162476	0.665	.0438168	0.000	-.021266	0.607	-.0134623	0.869
no obs	20		211		25		6		134		1795		99		47	
no group											337					
Wald	0.3597		0.0755		0.3175		0.3476		0.5804		0.2144		0.7086		0.4833	
R sq	0		0.0103		0.0018		0.0255		0				0		0	
Hausman											0					
BP											0.0011					

The analysis conducted on the period before the COVID-19 crisis suggested that the significant impact of the S-factor was noticeable for the oil and gas and uranium sub-sectors. The mentioned relationship confirms the opinion that investors do not prefer to invest in ESG polices during the crises, as they treat it as a waste of money; however, during financial market booms, the mentioned type of investment can bring additional profits. In the opinion of investors, this type of financial sourcing should be carried out in the context of a stable financial market. During crises, companies should transfer capital to the more important areas, in order to not lose their solvency and reduce their bankruptcy risk.

The last part of the analysis relied on testing the significance of not only ESG measures but also financial indicators on the rates of return on stock prices in particular sub-sectors. We first analyzed the coal sub-sector (Table 7). The presented findings confirm the previous analyses regarding the impact of ESG measures on stock prices. The S-factor had an especially significant impact, with an increase in the mentioned variable causing a decrease in the rates of return on stock prices. Investments into ESG policies are seen by investors as a waste of money. This sector is very specific in practice, with high share of the companies, with the government is an investor. As a result of current regulations based on the reduction of CO_2 emissions, this sub-sector has lost its significance. In the future, analysis should be conducted with respect to divisions according to the type of investor, the concentration of stakeholders, the size of the company, and the time period (crisis or not); however, during the preparation of the presented research, the sample was too small to obtain satisfactory results. The results of the present study also suggest that E-factors are unimportant when assessing rates of return changes. On the other hand, investors do not typically place attention on CO_2 emissions. The presented results confirm the opinion of the OECD (2020) that ESG indicators have a low correlation with CO_2 emissions. The CO_2 emissions is not the main factor that is taken into consideration in the analysis when making investment decisions. The obtained findings also suggest that the stock prices of companies in the coal sub-sector are sensitive to profit measures such as the EBITDA margin. If a company is more profitable—especially when measured by the EBITDA margin—higher rates of return are noticed. The mentioned relationship has been confirmed by previous studies. It provides investors a snapshot of their short-term operational efficiency. As the margin ignores the impacts of non-operating factors, such as interest expenses, taxes, or intangible assets, the result is a metric that is a more accurate reflection of a firm's operating profitability. EBITDA is, therefore, a useful tool for evaluating how a business portfolio may function when integrated into the overall operations of a larger firm. The next group of factors are earning power measures, including the assets turnover ratio, the return on assets ratio, and the earnings retention rate. From the mentioned group of factors, only the return on assets ratio had a significant impact on the rates of return changes on stock prices. It was noticed that this variable had a strong positive impact on the rate of return. The liquidity and leverage ratio changes did not have an influence on the rates of return changes. The mentioned companies, especially those in developing countries, tend to have problems with liquidity and have high debt. The final group of indicators was factors connected with the operating indicators. The following indicators had statistically significant impacts: The value of working capital to sale ratio, the revenue to net receivables and the return on long-term capital ratio. The working capital to sales growth has a varied impact on the decisions taken by investors. While many investors feel that a company must use as little working capital as possible, there are many that have other opinions. These are conservative investors that fear having too little working capital can be dangerous, as it is capable of causing a cash crunch and bringing the operations to a halt. These investors believe that, in a cash crunch situation, the company may have to borrow at unfavorable terms, nullifying the advantage gained by maintaining lower working capital and causing loss in the form of lost reputation. This research shows that the higher the value of the presented indicator, the lower the rates of return that are generated. The receivables turnover ratio is an accounting measure used to quantify a company's effectiveness in collecting its accounts receivable, or the money owed by customers or clients. This ratio measures how well a company uses and manages the credit it extends to customers and how quickly that short-term debt is collected or is

paid. A firm that is efficient at collecting on its payments due will have a higher accounts receivable turnover ratio. Companies that maintain accounts receivables indirectly extend interest-free loans to their clients, as accounts receivable is money owed without interest. This ratio also measures how many times a company's receivables are converted to cash in a period. The receivables turnover ratio can be calculated on an annual, quarterly, or monthly basis. A company's receivables turnover ratio should be monitored and tracked to determine whether a trend or pattern is developing over time. Furthermore, companies can track and correlate the collection of receivables, in order to earnings to measure the impact that the company's credit practices have on profitability. If one company has a much higher receivables turnover ratio than another, it may be a safer investment. As a result, it was noticed that this variable had a negative impact on the rates of return on stock price changes. Return on invested capital (ROIC) is a variable which is used to assess a company's efficiency to allocate the capital under its control to profitable investments. ROIC gives a sense of how well a company uses its capital to generate profits. Comparing a company's return on invested capital with its weighted average cost of capital reveals whether its invested capital is being used effectively. An increase in these variables leads to higher rates of return.

The rates of return on stock prices of the companies in the coal sub-sector were insensitive to the size of the entities, indicating that investors do not pay attention to the size of a company when making investment decisions.

The analysis conducted for the oils and gas sub-sector confirmed the positive impact of the ESG measures, especially E- and S-factors, on the rates of return changes (Table 7). The significance of the mentioned variables was similar, and the significance of the S- and E-factors was strictly connected with the regulations presented in previous chapters, confirming that the mentioned sector is sensitive to the new laws adopted in particular countries (i.e., low-carbon policies). The stock prices of the companies are mostly connected with the prices of oil and gas. The obtained findings suggest that the size of the entity does not have an impact on the rates of return changes. The received findings suggest that the reaction of the stock market is varied, and the mentioned division should be taken into consideration. For the financial indicators, significant impacts were observed for earnings power indicators such as the asset turnover ratio and the return on assets. The second variable had a statistically significant positive impact on the rates of return changes. The strength of the mentioned variable was smaller than that in the case of the coal sub-sector. The asset turnover ratio measures the value of a company's sales or revenues relative to the value of its assets. It can be used as an indicator of the efficiency with which a company uses its assets to generate revenue. The higher the value of the mentioned variable, the higher the rates of return. The liquidity and the operational ratios did not present statistically significant impacts on the rates of return changes. For the leverage ratios, a significant impact was observed for the assets to common shareholders equity ratio. If the mentioned variable is higher, the rates of return also increase. The shareholder equity ratio indicates how much of a company's assets have been generated by issuing equity shares, rather than by taking on debt. The lower the ratio, the more debt a company has used to pay for its assets. It also indicates how much shareholders might receive in the event that the company is forced into liquidation. This tends to be more expensive than debt, and it requires some dilution of ownership and the provision of voting rights to new shareholders.

Table 7. Determinants of rates of return on stock prices for coal and oil and gas sub-sectors.

dRET	coal								oil & gas							
	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
dEBIT	.0005045	0.092	.000499	0.096	.0004674	0.117	.0005002	0.095	5.06e-06	0.320	5.09e-06	0.317	5.03e-06	0.322	5.06e-06	0.320
dTAX	.0004089	0.210	.0004036	0.216	.0003974	0.220	.0004079	0.212	4.51e-06	0.416	4.48e-06	0.419	4.57e-06	0.409	4.51e-06	0.416
dTUR	-1.028739	0.630	-1.017508	0.634	-1.024582	0.629	-1.054673	0.621	1.242884	0.000	1.239105	0.000	1.240541	0.000	1.241004	0.000
dROA	.0541123	0.000	.0544574	0.000	0562423	0.000	.0547941	0.000	.0081122	0.003	.0081481	0.003	.0081675	0.003	.0080708	0.003
dEAR	.0077338	0.422	.0077847	0.420	.0056435	0.558	.0075194	0.436	.0000745	0.923	.0000746	0.923	.0000666	0.931	.0000701	0.928
dCUR	-.0672401	0.195	-.0673667	0.194	-.0721375	0.162	-.0680541	0.189	-.0044013	0.130	-.0043996	0.130	-.0043634	0.133	-.0044058	0.130
dTIM	.0006078	0.623	.0005853	0.637	.0002404	0.844	.0005521	0.654	-1.58e-06	0.738	-1.59e-06	0.737	-1.62e-06	0.732	-1.56e-06	0.741
dEQ	.0047894	0.643	.0043993	0.670	.0030538	0.766	.0047739	0.646	.0023792	0.000	.0023792	0.000	.0023804	0.000	.0023811	0.000
dDEBT	.0015815	0.435	.0014867	0.460	.0013766	0.491	.0014409	0.475	-.0006004	0.393	-.0005894	0.402	-.0005999	0.393	-.0005912	0.400
dHIS	.0001116	0.200	.0001114	0.202	.0001119	0.197	.000111	0.203	.0000311	0.219	.0000308	0.223	.0000313	0.216	.000031	0.221
dAR	-.0573827	0.000	-.0573711	0.000	-.0574512	0.000	-.0574161	0.000	-.0033004	0.186	-.0032758	0.190	-.0032655	0.191	-.0033491	0.180
dVEN	.0090489	0.835	.0090816	0.834	.0124511	0.773	.009273	0.831	.000282	0.424	.0002818	0.424	.0002798	0.428	.0002807	0.426
dPAY	-.0000442	0.778	-.0000452	0.772	-.0000439	0.777	-.0000474	0.762	8.46e-07	0.426	8.46e-07	0.426	8.45e-07	0.426	8.43e-07	0.428
dAV	-.0002172	0.358	-.0002127	0.368	-.0002186	0.352	-.0002106	0.373	.0000748	0.145	.0000762	0.137	.0000748	0.145	.0000737	0.151
dAD	-.0499457	0.586	-.0519453	0.571	-.0585342	0.521	-.0504686	0.582	-1.03e-06	0.867	-1.03e-06	0.866	-1.03e-06	0.867	-1.04e-06	0.866
dFIX	-.0667941	0.938	-.0718821	0.934	-.1040138	0.904	-.0608292	0.944	.0043885	0.676	.0043562	0.679	.004402	0.675	.0044143	0.675
dWC	-.0000444	0.075	-.0000442	0.076	-.0000438	0.077	-.0000445	0.074	3.18e-07	0.207	3.18e-07	0.208	3.18e-07	0.208	3.17e-07	0.208
dRET	.0383696	0.000	.0385838	0.000	.0390101	0.000	.0386679	0.000	.001308	0.590	.0012947	0.594	.0012594	0.604	.0013377	0.581
dSIZE	-.3201967	0.293	-.3240375	0.289	-.2956813	0.329	-.3116835	0.308	-.0291527	0.431	-.0296053	0.423	-.0289658	0.433	-.0284878	0.441
dESG	.0024689	0.623							.001998	0.148						
dESGE			.0014347	0.751							.0023286	0.069				
dESGS					-.0127925	0.052							.0027276	0.034		
dESGG							.000872	0.823							.0001356	0.871
_cons	.0118865	0.596	.0119769	0.594	.0179413	0.422	.0127527	0.568	-.0029895	0.573	-.0034487	0.517	-.0034586	0.515	-.0021742	0.680
no obs	317		317		317		317		8129		8129		8129		8129	
Wald	0		0		0		0		0		0		0		0	
R sq	0.3273		0.3270		0.3353		0.3269		0.0349		0.035		0.0352		0.0346	
Hausman	0		0		0		0		0		0		0		0	
BP	1		1		1		1		1		1		1		1	

Table 8. Determinants of rates of return on stock prices for renewable energy and uranium subsector.

dRET	renewable energy								uranium							
	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
dEBIT	.0000164	0.169	.0000165	0.170	.0000165	0.165	.0000164	0.171	-.0000111	0.263	-.0000113	0.253	-.0000111	0.260	-.0000109	0.271
dTAX	.0000936	0.111	.0000941	0.110	.0000933	0.111	.0000937	0.110	-.0007375	0.198	-.0007345	0.200	-.0007197	0.209	-.0007315	0.201
dTUR	-.2444605	0.626	-.2422806	0.631	-.2282169	0.648	-.2380614	0.635	4.474541	0.611	3.809697	0.664	4.519989	0.607	4.364116	0.618
dROA	.0073209	0.492	.0088121	0.410	.006415	0.546	.0088956	0.402	-.0041831	0.485	-.0033918	0.572	-.0038992	0.514	-.0050071	0.406
dEAR	.0055862	0.528	.005792	0.514	.0058285	0.508	.0056724	0.521	-.0161069	0.472	-.0157801	0.481	-.0158772	0.479	-.0164364	0.463
dCUR	-.0033005	0.681	-.0036905	0.647	-.0034973	0.662	-.0034162	0.671	.0043804	0.183	.004465	0.174	.0043478	0.186	.0043054	0.190
dTIM	-.0000349	0.753	-.0000372	0.738	-.0000303	0.784	-.0000369	0.739	-.0000105	0.564	-.0000107	0.555	-.0000105	0.565	-.0000102	0.575
dEQ	-.0029259	0.074	-.0028962	0.078	-.0026191	0.109	-.0031078	0.059	-.0861214	0.037	-.083792	0.042	-.0878108	0.034	-.0858311	0.037
dDEBT	.0010991	0.629	.0009981	0.662	.000933	0.680	.0008602	0.705	.0064283	0.067	.0062139	0.076	.0065647	0.062	.0065281	0.062
dHIS	.0000252	0.825	-9.28e-07	0.993	.0000103	0.927	.0000181	0.873	-.0012587	0.253	-.0012402	0.259	-.00128	0.245	-.0012596	0.251
dAR	.001459	0.457	.0013656	0.488	.0015688	0.423	.0013265	0.499	-.0851092	0.069	-.0872446	0.063	-.0810253	0.083	-.0878884	0.060
dVEN	.0021104	0.814	.0015855	0.861	.00192	0.830	.0016564	0.854	.0590088	0.590	.0637011	0.559	.0566491	0.605	.0525778	0.631
dPAY	.0006202	0.284	.0005742	0.322	.0006156	0.286	.0006133	0.289	-.0003676	0.602	-.000277	0.694	-.0003602	0.609	-.0004911	0.492
dAV	-.0008232	0.209	-.0007693	0.241	-.000819	0.209	-.000814	0.214	-.0000333	0.750	-.0000352	0.736	-.0000317	0.762	-.0000316	0.762
dAD	-.0751666	0.003	-.0759041	0.003	-.0764747	0.003	-.0754921	0.003								
dFIX	.0270494	0.567	.0262737	0.580	.0278858	0.554	.0277651	0.557	-1.184283	0.817	-.7433117	0.884	-1.289532	0.802	-1.026644	0.841
dWC	1.24e-06	0.099	1.24e-06	0.099	1.24e-06	0.097	1.23e-06	0.100	-1.28e-07	0.827	-1.39e-07	0.814	-1.25e-07	0.832	-1.24e-07	0.833
dRET	-.0017774	0.797	-.002415	0.727	-.0015299	0.824	-.002574	0.708	.0079704	0.006	.007469	0.010	.0079879	0.006	.0083676	0.004
dSIZE	-.4852099	0.005	-.4855096	0.005	-.4676253	0.006	-.4892414	0.004	-.1165694	0.071	-.1179045	0.068	-.1154407	0.074	-.1174926	0.068
dESG	-.0105373	0.086							.0050207	0.401						
dESGE			-.001442	0.753							.0062589	0.305				
dESGS					-.0108458	0.021							.0048352	0.378		
dESGG							-.0069039	0.099							.0049813	0.201
_cons	.0066804	0.806	.0000393	0.999	.0075759	0.779	.002781	0.918	.002315	0.925	.0018817	0.939	.0025874	0.916	.0016839	0.945
no obs	408		408		408		408		266		266		266		266	
Wald	0.0113		0.0246		0.0057		0.012		0.0515		0.0471		0.0506		0.0406	
R sq	0.0425		0.0325		0.0483		0.042		0.0427		0.0441		0.043		0.0463	
Hausman	0		0		0		0		0		0		0		0	
BP	1		1		1		1		1		1		1		1	

Next, the determinants of the rates of return on stock prices were analyzed for the renewable energy and uranium sub-sectors (Table 8). The presented analysis suggests no significant impact on the rates of return on stock prices by ESG measures for the uranium sub-sector. This situation confirms the opinion of the OECD (2020) regarding the lack of the relationship between ESG measures and CO_2 emissions. However, negative impacts of the S- and G-factors were noticed for the renewable energy sub-sector. These relationships may be connected with the specific characteristics of this sub-sector. It is the one of the main competitors of the coal and oil and gas sub-sectors. The renewable energy sub-sector is designed to be a green energy sector with zero emissions as the main goal. As a result, the increasing value of ESG measures can threaten other sub-sectors, being seen as a waste of money by investors. The additional value of the mentioned investments does not create high additional social and governance profits. This opinion was confirmed by lack of the impact of the E-factor. It can be also connected to the attractiveness of the mentioned entities for investors.

Investors also pay attention to the leverage ratios and operational indicators. Insignificant impacts were observed for the earnings power, probability, and liquidity indicators. For the leverage indicators, significant impacts were observed for the assets to common shareholders equity ratio and the long-term debt to total equity ratio, with the former having a stronger impact. The mentioned relationship indicates two things: renewable energy companies, as new technology entities, are usually sensitive to the mentioned ratio. For investors, it is more important to re-invest profits than receive dividends. These companies also require a lot of new, expensive technologies, especially in the initial stages. The long-term debt to equity ratio had a positive impact on the rates of return changes in the case of the uranium sub-sector. These companies are usually characterized by long-term activity.

The operational indicators also presented significant impacts on the rates of return changes. The uranium sub-sector is sensitive to the return on invested capital. If this variable increases, the rates of return also increase. The significance of this variable was smaller than in the case of the coal sub-sector. In the case of the renewable energy sub-sector, the allowance for bad debt and the working capital to sales ratios presented significant impacts, with the latter having a very low positive impact on the change of the rates of return. The allowance for bad debt is a valuation index used to estimate the amount of a firm's receivables that may ultimately be uncollectible; it is also known as an allowance for doubtful accounts. When a borrower defaults on a loan, the allowance for bad debt account and the loan receivable balance are both reduced for the book value of the loan. The unpaid receivables create costs and has a negative impact on the rates of return.

In both cases, for the uranium and renewable energy sub-sectors, an increase in the size of the company led to a decrease in the rates of return. This means that investors focus on the additional profits that may be obtained from growing companies. They believe that it is easier to earn in the first stage of the activity, while bigger entities have to bear higher costs, reducing the possibility to earn more.

5. Discussions and Conclusions

The aim of this paper was to analyze the impact of the ESG measures on the rates of return on stock prices in the energy sector. The main hypothesis was as follows: The ESG measures have a significant impact on the rates of return in the energy sector, especially in the context of the COVID-19 crisis. The presented findings suggested that, during the COVID-19 crisis, less attention was placed on the ESG measures than before the crisis. The presented opinion is in opposition to previous studies, and may be an effect of the specific type of sector considered. Decisions based on behavioral finance also had an impact, as typical for the first part of 2020. Investment into ESG policies during crises may be considered as a waste of money. The new

regulations connected with the ESG measures significantly increase regulatory costs, especially in the case of the oil and gas sub-sector. The presented findings suggest that this kind of investment should be carried out during financial market booms, during which they increase value for investors. The mentioned type of investments, especially of the social type, bring additional profits for smaller companies in the oil and gas and uranium sub-sectors. Not without significance is also the type of investor, as has been mentioned before. The main reaction was noticed for the ESG measures in the case of the oil and gas sub-sector, which is connected to the types of regulation that have been introduced over the past two years. Both mentioned sub-sectors were found to be especially sensitive to the E- and S-factors. Higher rates of return are created by companies with diversified, less concentrated shareholding. In the mentioned type of entities, potential additional value can be seen. Analysis of the type of investor also brought varied results. For all sub-sectors where one of the five biggest stakeholders in a companies is government, the rates of return did not react to ESG score changes and changes in the E-, S-, and G-factors individually. The mentioned reaction was noticed only in the case of private investors. The S-factor was found to be more significant. In the case of the oil and gas sub-sector, the rates of return were sensitive to the ESG measures only for the group of companies with private stakeholders. A significant impact was also observed with respect to the level of concentration of the stakeholders. The rates of return on stock prices of companies where the five biggest investors had more than 50% of the shares were more sensitive to changes in the ESG measures. The mentioned reaction was observed for the coal, oil and gas, uranium, and renewable energy sub-sectors. As in the previous cases, the E- and S-factor indicators were the most significant.

The presented analysis indicated that not only are there differences between particular sectors in terms of the reaction of the rates of return on stock prices to the ESG measures, but also in sub-sectors. Generally, the coal sub-sector was insensitive to ESG measure changes. Next, the opinion that ESG measures are not connected with CO_2 emissions was confirmed. In the case of the biggest companies, the situation that even those with high CO_2 emissions still obtained high ESG scores was observed. As a result, it is still necessary to develop a more valuable index to assess the mentioned risk. The current laws based on the low-carbon policy are not without significance. In the case of the smaller entities, implementing ESG policy—especially based on environmental and social aspects—helps to build reputation. The effect of this is increased rates of return. However, in the case of the biggest companies, this reaction is insignificant. In some cases, ESG policy is seen as a threat by investors, acting like a marketing strategy.

The presented research had some limitations. Initially, the analysis was also designed for political and economic development divisions. However, there were insufficient observations to assess the mentioned impacts in the sub-sector analysis. Results were received only for one sample, and could not be prepared for another. The small number of observations was connected to the low volume of published ESG information, creating the need to prepare for associated studies in future. The ESG Directive and similar regulations in particular countries will help to increase the number of entities obligated to publish this type of data.

The presented results can be used to help investors in making investment decisions according to ESG internal policies. The provided findings indicate how the type of company, sector, investor, stakeholder concentration, and the size of the entity affect its sensitivity to ESG measures, including which of the E-, S-, and G-factors are most important. Regulators and supervisors should also aim to receive information about the sensitivity of stock prices related to the energy sub-sectors in terms of the mentioned group of indicators. This is expected to help in supervising and reacting to policies affecting both issuers and investors.

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