UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Power Play: The influence of energy prices on ESG Stocks' performance during the Energy Crisis

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A quantitative study performed on the Swedish stock market

FEK345 - Bachelor Thesis in Industrial and Financial Management

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Gothenburg, June 11th 2023.
Daniella & Jennifer

Abstract

This research paper is focused on the impact of the European energy crisis on ESG (Environmental, Social, and Governance) stocks. The paper aims to examine the extent to which the performance of stocks with high ESG scores has been affected by energy prices and volatility during the energy crisis. The paper emphasizes the significance of sustainability and the increasing importance of ESG stocks for investors and society, particularly in the transition to more sustainable energy sources. The study focuses on the Swedish market, using the Refinitiv Sweden index as a representative sample. The research questions address the impact of energy prices and volatility on the performance of high ESG-scored stocks during the energy crisis. The methodology involves quantitative analysis using data from Refinitiv Eikon and covers the period from 2019 to the end of 2022. The regression models examine the relationship between energy prices/volatility and market-adjusted returns, controlling for variables such as return on assets, book-to-market ratio, and debt-to-equity ratio. Fixed effects are included to account for company-specific and year-specific factors. Regression results indicate a significant negative relationship between energy prices/volatility and the performance of high ESG-scored stocks.

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1. Introduction

Over the past year, it has been incredibly challenging to ignore discussions surrounding the European energy crisis. Numerous factors have contributed to the development of this crisis, and among them is the ongoing war in Ukraine. As the European Commission (2022) states, Russia used the withdrawal of its European energy supply as a weapon both politically and literally. The European Union’s import of Russian gas rapidly decreased from 45% in 2021 to 14% in September 2022. This caused major consequences for the entirety of Europe - as supply dipped, prices spiked. Adding on to this, the main means of gas transportation from Russia to Europe were the two gas pipelines, Nordstream 1 and 2, which were sabotaged in September of 2022 (Åklagarmyndigheten, 2022). This contributed to an even bigger gas shortage, and decreased energy supply even further. Since then, the price of energy has kept on increasing. According to the Council of the European Union (2023), energy prices for domestic industrial producers in the European Union went from 106,20 in January of 2021 - a year prior to the war - to 241,3 in January of 2023. Prices are described using 2015 as the referential. Thus 106.4 would indicate a price 6,4% higher than that of 2015. A similar increase was inevitably made for consumers within the EU, with a price of 105,42 for electricity, gas and other fuels in January 2021 and 172,39 in January 2023. As the price of energy drastically increased, it created somewhat of a downward spiral. Energy is used to produce, and essentially to survive - so with the increased prices, living in general became more expensive, and inflation became a fact. The inflation rate in the EU spiked in October of 2022 at 11,5% - a big difference from 4,1% a year prior.

Not only does an increase in energy prices cause higher fuel prices and production costs for companies, but it also has indirect effects, as stated by Riksbanken (2022). These increased costs, which impact companies of all sizes, eventually trickle down to consumers. The indirect effects of this price increase demonstrate a cause-and-effect relationship. For example, when fuel prices rise, so does the ticket price for public transportation, aligning with the increased costs faced by service providers. Riksbanken (2022) further explains that this phenomenon extends to various industries, property owners, and farmers, leading to consequences such as higher rents and food prices.

Considering the significant influence that fluctuations in energy prices have on Sweden as a whole, conducting research on the subject from a corporate finance perspective could be valuable for many. Such research can provide deeper insights into how financial markets are affected by these changes, beyond what is already known. Wen, Wei, and Huang (2012) discovered significant contagion effects between the energy market and the stock market during the 2007-2008 financial crisis. Their findings demonstrated that the stock market was significantly influenced by the uncertainty experienced in the energy market during times of crisis (Wen, Wei, and Huang, 2012). This thesis aims to investigate whether these impacts apply to the Swedish stock market during the recent energy crisis by examining how the performance of stocks with a high ESG score has been affected by energy prices and volatility in the energy market.

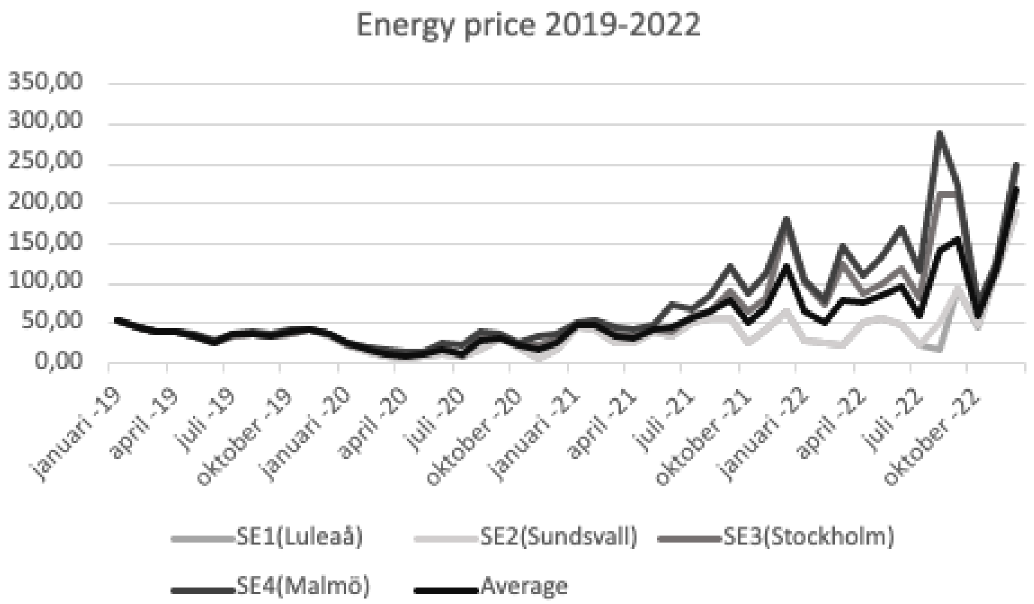

Figure 1: Energy Spot Prices
A diagram visualizing energy spot prices over time(2019-2022) for the four energy areas in Sweden, as well as an average. Data extracted from Nordpool AS server.

The energy market in Sweden is, as stated by SCB (2022), very volatile in general due to several reasons. To start, it is a deregulated market and so the price is dependent on supply and demand. In addition to this, the energy market is free from trade barriers and restrictions within Europe, however, there is a certain transmission capacity that can limit the trade. Although, as long as the transmission capacity allows it, actors all over Europe can trade energy with each other. The same type of energy trade is true for the domestic transmission of energy in Sweden, with Sweden being divided into four energy areas. Secondly, SCB (2022) continues to state that energy is not a resource that can be saved for a longer period, thus sellers will have to lower their prices rather quickly if the demand decreases. Energy demand in Sweden is quite volatile as well, leading to a volatile energy market since it is dependent on demand. Demand will increase during financial booms when energy-heavy industries are booming as well as during winter when buildings require heating, and vice versa during recession and summer (SCB, 2022).

Another reason for energy prices in Sweden being so prone to volatility is due to the many different energy sources. The country relies on thermal power, hydropower, wind power, and nuclear power for energy production, with the majority produced in the northern regions (SCB, 2022). The dependence on weather conditions for hydropower and wind power adds to the market's instability, while the decrease in nuclear power production due to safety concerns further intensifies Sweden's reliance on renewable sources. These factors combined contribute to the volatile nature of energy prices in Sweden.

People and industries are becoming further dependent on energy as a consequence of the conversion to green energy, where oil and carbon is exchanged for electricity (SCB, 2022). Apart from the evident indicators of our heavy reliance on energy, such as electric vehicles and buses, another significant aspect is our continuous dependence on the internet and the presence of large server farms established in Sweden by multinational companies (SCB, 2022). Consequently, the supply of energy is crucial for households, companies and whole industries in Sweden. Given the society's dependence on an already unstable market, it becomes increasingly interesting to conduct research on a crisis that disrupts this equilibrium.

Analyzing the effects of changes in price levels in the energy market on the stock market can provide insights into the relationship between energy prices and overall stock market performance. Previous research conducted by Oberndorfer (2009) suggests that an increase in oil prices has a negative impact on European utilities but a positive effect on gas and oil stocks. While an increase in energy prices leads to higher costs for companies, particularly those heavily reliant on energy sources, energy producers benefit from such events. By examining price levels, one can determine whether the overall stock market gains or loses when energy prices increase. However, it is important to note that this analysis does not account for other factors that may influence stock market performance, such as macroeconomic conditions or company-specific dynamics.

Furthermore, studying the effects of volatility in the energy market on the overall stock market provides insights into the impact of uncertainty on market behavior. Oberndorfer's earlier research (2009) suggests that forecastable oil market volatility negatively affects gas and oil stocks in the European market, indicating that producers may suffer when volatility increases. Given the general volatility and uncertainty of the energy market, this is a constant concern for energy-producing companies. To gain a deeper understanding of the impact of volatility, it is necessary to conduct further investigations using a broader sample that includes various types of companies. This research would shed light on how volatility affects the stock market and how the uncertainty of the energy market influences the overall financial well-being of the stock market. It would provide valuable insights into the interplay between energy market dynamics and stock market performance.

1.1 Why ESG stocks?

The reason why ESG stocks are interesting to look at over this specific period is due to many reasons. For one there is a direct relationship with the energy market. Essentially all parts of ESG are affected by changes in energy prices and policies. In an environmental aspect, ESG stocks generally focus on for example renewable energy and energy efficiency, and opt out of fossil fuels. By using renewable energy, the social aspect can be improved as communities and workers experience better living and working conditions with better air. As for the G, for example, transparency with customers and shareholders, as well as allocation of resources during difficult times shows the way the governance is managed. Therefore, it can be said, without a doubt, that ESG stocks *have* been affected during the energy crisis - however, the *how* remains unanswered.

Furthermore, sustainability is becoming increasingly significant for both investors as well as society altogether. The energy crisis makes a focal point, highlighting the risks of traditional energy sources and stressing the transition to more sustainable energy sources. Thus looking at how ESG stocks have performed during the crisis, investors can see what types of firms are best equipped to handle the changes in the energy sector, but also how companies with high environmental, social and governance scores can navigate a changing business environment. Also, the performance of ESG stocks is an interesting topic in general because of the role ESG ratings play in the asset valuation of a company. The entirety of the ESG standard is thus integrated into all businesses, making it a highly accurate topic to learn more about.

Earlier studies have been done on the subject of wether ESG has an effect on performance. Aissaoui and Gustafsson (2021) could not find that ESG securities would have a significant impact on profitability within the course of the study. However, the study was made on 5-year investments which lead the writers to believe that there could be significant result if the study was to be made on long-term investments. Considering the current energy situation as well as the increased relevancy of ESG in investors strategy it is relevant to investigate wether their Aissaoui and Gustafsson (2021) results can be disproved as a consequense of change of environment.

1.2 ESG scoring

ESG stands for Environmental, Social, and Governance, and aims to ensure sustainability in all three sectors. The consideration of these three factors is a natural part of today when analyzing financial assets. The information regarding companies' engagement in ESG factors, their performance in these areas, as well as their future prospects in these domains, is likely to influence the valuation and risk associated with an investment. Managers' investment strategies have been influenced by ESG and new strategies have been emerging where incorporation of ESG is the main focus when allocating assets. Some managers even choose thematic investing, the objective of the investment is more specific towards a certain industry that includes at least one of the factors in ESG (Refinitiv, n.d.). In short, ESG stocks are stocks that include financial instruments that are ESG-centric. However, ESG is rather unstructured and firms can publish their reports whenever they want, according to Miller (2023).

In addition to this Miller (2023) states that it can be difficult to trust the reports that the firms publish, as it is the firm itself that decides on which information that is shared. To support financial professionals, some companies simplify and standardize the data that is available on ESG and create ESG scores, one example being Refinitiv Eikon. Yearly company reports, CSR reports as well as public information in global media and on company websites are used as the foundation when ESG scores are being constructed (Refinitiv Eikon, 2022). Just having an ESG score does not indicate that a company performs well in terms of sustainability - different scores have different rankings. However, it is common to refer to companies with a 'high' ESG score as an "ESG company". Exactly what is deemed a high score is discussed further on, but it is important to bear in mind that also in this thesis companies with a high ESG score are occasionally referred to as an "ESG company" or "ESG stocks".

1.3 Purpose

The purpose of this thesis is to further develop the research on ESG stocks and performance during periods of crisis. Research on how ESG ratings are related to performance is nothing new, for example Abate, Basile, and Ferrari (2021) conclude that a higher ESG score has a positive effect on mutual fund's performance, however Erhart (2022) questions if the ESG scoring system is to be trusted. Instead of researching ESG ratings effects on funds, we want to investigate what impact it has on stock level. Earlier research has found evidence of a close relationship between the energy market and the stock market during times of crisis (Wen, Wei and Huang, 2012). By producing similar research during the recent energy crisis, it can contribute to the knowledge about the relationship between these two markets even further. In contrast to Wi, Wen and Huang (2012), this thesis focuses on the Swedish stock market and specifically on ESG stocks. By looking at how energy prices directly affect the performance of ESG stocks, it can contribute to more knowledge of the interconnectedness between energy prices and ESG stocks. The volatile nature of Sweden's energy market, which is influenced by various factors, further underscores the importance and interest in understanding if increased volatility affects the performance of ESG stocks, and also the relationship between volatility and performance in general for these types of stocks. The ambition is to use existing research to create hypotheses about how ESG stocks are expected to behave, and subsequently create regressions to test the hypotheses and see if the earlier research stands during the recent energy crisis.

1.4 Research Questions

With this as a background, the thesis aims to answer the following questions:

1. To what extent has the performance of stocks with a high ESG score been affected by energy prices during the energy crisis?
2. To what extent has the performance of stocks with a high ESG score been affected by the volatility of energy prices during the energy crisis?

1.5 Limitations

Several limitations need to be highlighted in this thesis. One notable limitation is the presence of missing data, which restricts the scope of the research. Due to the unavailability of ESG ratings for many companies during the initial stages of the study, the sample size was reduced, potentially introducing bias to the results. However, given the necessity of ESG scores for conducting the research, working with the available data was the only feasible approach. Despite this limitation, efforts were made to mitigate biases and ensure the validity of the findings within the constraints of the available ESG data.

Another limitation of this study is the reliance on ESG scoring, specifically using Refinitiv Eikon's methodology for measuring ESG. It is important to acknowledge that there are various approaches to measuring ESG, and the interpretation of an ESG score is highly subjective. Different rating systems and methodologies may yield different results and conclusions. Therefore, the findings of this thesis should be considered in the context of the specific ESG scoring framework used, recognizing that alternative frameworks may produce different outcomes and implications.

One final aspect is company-specific terms and contracts that could potentially affect their rate of return. For example, certain companies with high energy intensity may have fixed energy rates established through long-term forward contracts, shielding them from the effects of energy price fluctuations or high volatility during the contract duration. While this factor could potentially influence the findings, it is not possible to control or recognize.

2. Theory and literature review

2.1 Theory

To comprehend and analyze the underlying factors influencing the results, it is important to have knowledge of the relevant theories within the subject. This section is organized into three parts - stock market theory, investor behavior, and regulations surrounding ESG scoring methods.

2.1.1 Efficient market theory

Berk and DeMarzo (2020) suggest that investors who possess information about a certain asset will act accordingly to a positive or negative net present value (NPV). Meaning that, for example, an investor who retrieves information that an asset they hold has a negative NPV, would want to sell this asset, and consequently the attempts of selling would push the price down creating a downward spiral. The same principle is applicable if an investment has a positive NPV. Thus, efficient market theory suggests that investor competition causes markets to accumulate information and that market prices are a reflection of this (Berk and DeMarzo, 2010). Furthermore, this scenario implies that assets, based on future cash flows, will be fairly priced. In addition, all opportunities to trade assets with a positive NPV will be diminished with the presence of investor competition, given that investors have access to complete information.

This theory is dependent on the assumption that competition between investors is present, but Berk and DeMarzo (2020) suggest that the presence of competition could be uncertain depending on the types of information and how many investors retrieve all information. Public data sources such as financial statements, new reports, or press releases that the corporations hold are easy to interpret and accessible to the public. This type of information is expected to have a direct impact on the securities price, as a result of the investor competition being in full presence. However, as Berk and DeMarzo state, even public information can sometimes be difficult to interpret and evaluate for someone who does not have a background in the industry, creating an information gap between a “regular” person and an investor who is an expert in the same area. This could result in incomplete investor competition in the market. Incomplete investor competition could also be a consequence of non-public information. This is when certain information is only available to some of the investors on the market, rather than the general public. An example is information regarding the relationships between the corporation and its supplier and/or customers, employees, and competitors. Not all investors have the time or resources to aggregate this type of information, yet again resulting in incomplete investor competition (Berk and DeMarzo, 2020)

2.1.2 Prospect Theory

Kahneman and Tversky (1979) established Prospect theory based on the assumption that investors value gains and losses unequally. The theory relies on the fact that an investor will value a loss on an investment higher than that of a gain of the same amount, and make choices to minimize loss. The concept suggests that the psychological effect of a loss is more powerful than that of a gain, creating risk aversion amongst investors (Kahneman and Tversky, 1979). Further, the theory is centralized around the assumption that people will have different reference points when *concluding* the utility of their losses and gains. The reference point will differ from person to person and is corresponding to each individual's situation, making investment decisions relative and irrational, as stated by Kahneman and Tversky (1979).

2.1.3 EU regulations on non-financial information

Although Miller (2023) makes a valid point recognizing that the reports are written by the firms themselves, it is important to acknowledge that there is a current directive that regulates reports published by companies active within the EU. The European Commission (2023) states that in 2014, the Non-Financial Reporting Directive (NFDR) was implemented by the EU, this requires public companies with over 500 employees to report non-financial information. This includes social and environmental matters, treatment of employees, bribery, and anti-corruption, diversity on company boards, as well as human rights. Recently the EU implemented the Corporate Sustainability Reporting Directive (CSRD).

The purpose of this new directive is to strengthen and modernize the earlier rules regarding firm’s required reports on environmental and social information. Further, the new directive will demand an audit of the sustainability part of the report. The CSDR will require all small and medium companies that are listed, along with a set of large companies to report these matters, which will apply to approximately 50 000 firms active within the EU. The improvements from the old directive will provide investors and stakeholders with more reliable information and create a transparent culture among the companies regarding their environmental impact, making risk assessment more accurate. However, it is not until 2024 that the first companies are required to apply the new directive, and these reports will not be published until the following year. To conclude, we have to be aware of the imperfections of ESG ratings, but as of now, ESG ratings is the easiest way for investors to evaluate risk linked to these matters.

2.2 Literature review

To establish two distinct hypotheses, a thorough literature review was made, using studies which are focusing on sustainable investments, financial performance, investor behavior, and the impact of crises. The review reveals valuable insights from various researchers and studies, which forms the basis for the hypotheses discussed below.

2.2.1 The impacts of higher energy prices

The energy market is highly entwined with numerous sectors of society, not least with the stock market. As mentioned earlier, Wen, Wei, and Huang (2012) measured a significant contagion effect between the two during the financial crisis 2008. A contagion effect works just as the name suggests; a disruption in one area contaminates another. As the interconnectedness is proven, the remaining question is how - *how does higher energy prices affect the stock market?* The question could perhaps be answered by reversing the question, to understand how a stock market crash affects energy prices. By looking at the year of 2008, it is possible to conclude that energy prices increased by 75% compared to 2007 (Sveriges Televsion, 2008). The surge in energy prices observed during the tumultuous year of 2008 implies that fluctuations in the stock market can have a substantial impact on energy prices and possibly indicates that higher energy prices could cause a plunge in the stock market.

Furthermore, it is important to understand the complexity of ESG ratings. Erhart (2022) is critical to the environmental, social, and governance ratings of stock indices and stocks. The author evaluates the limitations of these ratings and argues that they do not provide a correct picture of the actual sustainability of a stock index or company. To strengthen these claims the author investigates several different ESG rating methods. During this examination, various limitations are found. Such as the ratings may not consider the emerging sustainability risks and their impact, as well as these ratings can focus on certain sustainability factors at the expense of other factors. Further, not seldom are the ratings based on data that has been provided by the companies' reports on their ESG, which might not be objective or transparent. Even though the author finds that the companies with higher ESG ratings outperform those with lower, this relationship is not always linear. The uncertainness of ESG stocks and possible biases could cause investors to avoid ESG stocks altogether, and perhaps especially during a crisis when surrounding sectors are uncertain as well. Erhart argues that ESG ratings of stock indices are not to be trusted as they may not reflect a correct picture of the sustainability of the underlying companies. The article highlights the need for more transparency and accountability of ESG reports as well as the need for standardized ESG rating methods.

With that being said, the contagion effect as well as uncertain ESG ratings can create a hypothesis alongside the findings of Huber, Huber & Kirscher (2021). They found investors to become more risk-averse during a crisis, not only opting out of investments that are seen as riskful but also getting a increased sensation of uncertainty in general, creating a downwards spiral. Combining the three, we find that

The hypothesis that can be derived from this information suggests that the combination of higher energy prices, uncertain ESG ratings, and risk-averse investor behavior may create a challenging environment for stocks with higher sustainability ratings. The limitations and potential biases associated with ESG ratings, as highlighted by Erhart (2022), further contribute to the uncertainty surrounding the performance of these stocks during a crisis. Accordingly, stocks with higher ESG ratings may perform even worse in times of crisis due to the contagion effect proven by Wen, Wei, and Huang (2012) and the behavior of investors during such times as studied by Huber, Huber & Kirscher (2021). In conclusion, the hypothesis that have been created states as follows:

H1: Stocks with a high ESG score perform worse when energy prices are increased during the crisis.

2.2.2 Uncertainty in energy prices and its effect on ESG stocks

Aissaoui and Gustafsson (2021) investigate if real estate firms within the EU are financially rewarded by investing in sustainable securities. Their findings come to show that ESG securities have no significant relationship with profitability during the course of the study. However, the study was made with 5-year investments, leading the writers to believe that sustainable investments are worthwhile in the long term, but that they are too costly and lack financial benefits in the short run. This research could be interesting because it provides insights into the relationship between sustainable investments and financial performance.

Furthermore, Huber, Huber, and Kirchler (2021) investigated how the risk-taking behavior of financial professionals was affected compared to that of students during the Covid-19 market crash. The results indicated that the financial professionals invested less in risky assets, even though believing future prices and returns would remain the same and even though they believed the asset to be more risky before the crash than during the crash; This finding would indicate an increase in risk-aversion. This study goes to show that investors change their approach during a crisis, and tend to opt out of riskful behavior.

The study by Aissaoui and Gustafsson (2021) could provide a baseline for comparison, as it analyzes the relationship between sustainable investments and financial performance over a period of five years. By comparing the performance of ESG stocks during the energy crisis to the findings of this study, it may be possible to conclude whether energy prices had a significant impact on the financial performance of ESG stocks. If the behavior presented by Huber, Huber, and Kirchler(2021) is true for all investors, it could potentially affect the performance of ESG stocks during the energy crisis. As an example, if investors became more risk-averse during the energy crisis, they may increase their investments in ESG stocks, as they could be financially profitable long-term according to Aissaoui and Gustafsson (2011) as well as Abate, Basile, and Ferarri (2021). This could lead to an increase in demand for ESG stocks, leading to a higher price and potentially higher return compared to stocks with low ESG ratings. Thus, with the idea of ESG stocks being seen as low risk in general and investors becoming risk-averse in the case of a crisis, the hypothesis would be that fluctuations in energy prices could lead to changes in the risk-taking behavior of investors.

The study made by Huber, Huber, and Kirchler (2021) suggests that investors tend to become more risk-averse during extreme events such as the COVID-19 market crash. Therefore, if energy prices were to experience high volatility, investors may become more risk-averse and shift their investments towards assets such as ESG stocks. This hypothesis is further specified by Wen, Wei, and Huang (2012), who examined the stock market and the energy market during the financial crisis active 2007-2008, to measure the contagion effects between the two markets. The results show evidence that there are contagion effects between the two markets during this period, more specifically the shocks that the energy market experienced during this period had a significant impact on the stock market as well. The study finds that the stock market and energy market are closely related, and during times of crisis, the contagion effect between the markets can be significant, indicating that the crisis will have a negative effect on stock performance. However, in agreement with earlier statements, stocks with high ESG rating will have had better performance compared to stocks with lower ESG rating. With this in mind, the following hypothesis is conducted:

H2: High volatility of energy prices positively affects the financial performance of ESG stocks during the crisis.

3. Data & methodology

A quantitative analysis has been performed with the ambition to evaluate the relationship between energy prices and performance of ESG stocks. This thesis focuses on the Swedish market, and subsequently the index "Refinitiv Sweden" has been chosen to represent the market. The index originally consisted of 266 stocks, but after choosing variables and cleansing the data, our sample consisted of 118 stocks. The biggest reason for this decrease in sample size is the absence of ESG scores, which can be explained by the fact that Refinitiv did not provide ESG scores for European companies of small or midcap size until 2019 (Refinitiv, 2022). Hence, many companies lacked ESG scores in especially 2019 and 2020 leading them to be omitted from the sample. All stocks included in the sample thus have an ESG score above 0. Additionally, the timespan of the energy crisis has been set from week 28 in 2021 to week 52 in 2022. The reason for this is that the volatility in energy prices increased during this period and remained high, as can be seen in Figure 1.

The data is collected from the database Refinitiv Eikon. The sample covers the timespan of 2019 until the end of 2022 and is used as the foundation in the regression to evaluate the correlation between ESG stock performance and the price on energy during the crisis. The reason for the four-year timespan is mainly to be able to discuss and compare the results in terms of years of crisis (midst of 2021- end of 2022) and a normal year (2019) without a global pandemic, energy crisis, or recession. Additionally, the lack of ESG coverage before 2019 added to the reason to start the analysis in 2019. Furthermore, the market index Refinitiv Sweden is used to compare the differences in behavior during this time.

3.1 Data collection

The collection of stocks is defined by the ESG scores that are available, using the scores Refinitiv Eikon offers. More than 630 company-level ESG measurements are captured by

Refinitiv. These measurements are grouped into 10 categories; Resource use, emissions, innovation, workforce, human rights, community, product responsibility, management, shareholders, and CSR strategy. The scores in these categories reformulate into scores for each of the pillar scores of the complete ESG scores, the three pillar scores are Environmental, Social, and governance. The ESG score for each pillar is later combined into a complete score which also includes scores for controversies. The combined ESG score is the one that is being used to make a sample of stocks. The score scale goes from 0 to 100 where scores closer to 0 indicate poor ESG ratings and those closer to 100 indicate excellent ratings. Scores below 50 are considered poor or satisfactory, whilst those above 50 are deemed good or excellent (Refinitiv, 2022). As most companies have an ESG score, a difference must be made between scores that are deemed “high” and those deemed “low”. To do this, an empirical distribution is used to make a difference between those with a score in the 75th percentile and those without. This is done to test the hypotheses and see if or what the difference is between the two different groups.

3.2 Data Cleansing

When analyzing performance for individual stocks, multiple stocks per company may arise, and as ESG ratings are assigned to firms and not individual stocks, it results in duplicate values. Even though these stocks have individual performance levels, there is a high risk of interdependence between the observations which in turn can cause biased results. To prevent this issue, all duplicates have been removed. In our particular dataset, the choice was made to remove all A-stocks in the case of there being a B-stock. This choice was made based on two main reasons. Firstly, as Åstrand (2023) states, B-stocks are generally more liquid and secondly, most A-stocks had not released financial reports for 2022 when the data was collected, thus making B-stocks the only reasonable alternative considering 2022 is such a vital year for this report. By removing all duplicates, the risk of biases is lowered but the sample size is still large enough to make an analysis.

Another issue in the dataset was skewness. Outliers and extreme values create an asymmetric distribution that can create misleading results that cause incorrect conclusions. To handle this problem, the Winsorization technique in Stata has been used. By Winsorizing the data, the extreme values are changed to a specified percentile value rather than just omitting them from the data. In our case, we Winsorized to 1%, replacing the values below the 1st percentile with those of the 1st percentile, and the ones above the 99th percentile were replaced with those of the 99th percentile. The influence of outliers is thus removed, as the method was done on all variables except ESG score, stock ID, time variables, and dummies for obvious reasons.

Furthermore, the weekly energy prices were logarithmized instead of winsorized as the distribution was still skewed even though having been winsorized. Logarithmically transforming the independent variable energy price is done to capture nonlinear relationships, improve interpretability, stabilize variance as well as improve the distributional characteristics of the data. This provides more robustness and accuracy of the regression model later on.

3.3 Definition of variables

To be able to test the above-mentioned hypotheses, several variables have been chosen. All stocks that are missing one of the following variables are excluded from the sample.

Variable	**Definition**	**Period**
Market-adjusted Return	Stock return - market return	Weekly
Myidvar	Individual company ID’s	-
ESG Combined Score	Refinitiv’s overall ESG score of a company, based on the information given of the three different pillars with an overlay of ESG controversies. The score takes a number between 0 and 100, the better the score, the closer to 100 it is.	Yearly
High_ESG	Dummy variable that takes the value “1” if ESG is equal to or higher than 68.73, and “0” otherwise.	Yearly
Dummy	Dummy variable that takes the value “1” if the data is taken during the timespan of the energy crisis, and the value “0” otherwise.	Weekly
ln_Energyprice	Logarithmized price on energy in Sweden.	Weekly

lnEnergyprice_dummy	Logarithmized energy price * dummy. Takes the value of the logarithmized energy price if dummy is “1”, otherwise takes the value “0”.	Weekly
lnEnergyPricevol8	The rolling 8-week standard deviation of the logarithmized energy price.	Weekly
lnEnergyPricevol8_dummy	The rolling 8-week standard deviation of the logarithmized energy price * dummy. Takes the value of the standard deviation if dummy is “1”, and “0” otherwise.	Weekly
Weekly rate of return	Weekly closing price - weekly opening price / weekly opening price	Weekly
lagwDTE	1 year lagged and winsorized debt-to-equity ratio. Total Liabilities / Total Shareholder Equity	Yearly
lagwBTM	1 year lagged and winsorized book-to-market ratio. Common Shareholder Equity / Market Capitalization	Yearly
lagwROA	1 year lagged and winsorized return on assets.	Yearly

3.4 Regression model

Two regressions are made, and the first one is to what extent the energy price has affected performance measured in weekly market-adjusted return. The dependent variable is thus market-adjusted return, and the independent variables are energy price, a dummy that separates the period before the crisis from the one during the crisis, and one with the interaction between these two variables. Additionally, there are three control variables; Return on assets (ROA), Book-to-market ratio (BTM), and Debt-to-equity ratio (DTE). Control variables are chosen with the background of Demer et al. (2021)’s study which investigates the effect of ESG on stock performance. All three control variables can be used to examine the financial health and performance of companies and therefore might hold some level of explanatory power for changes in market-adjusted return. The control variables are lagged one year to account for time lags in the relationships with the dependent variable. Furthermore, the regression is made with a requirement that the included data has a high ESG score, which in the model has been set to 68.73 (75 percentile). Besides this, fixed effects have been effectively used to account for unnoticed heterogeneity and time-specific effects. The variables "myidvar" and "Year" serve as fixed effects in the regression model and controls for company-specific characteristics and year-specific factors that may influence the dependent variable. Finally, the regression model accounts for heteroskedasticity by including robust standard errors.

Equation 1:

$\boldsymbol{MarketAdjustedReturn}_{\boldsymbol{ij}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 lnEnergyPrice_{ij}} + \boldsymbol{\beta_2 Dummy_{ij}} + \boldsymbol{\beta_3 lnEnergyPrice_{ij}} * \boldsymbol{Dummy_{ij}} + \boldsymbol{\beta_4 lagwDTE_{ij}} + \boldsymbol{\beta_5}\, lagwBTM_{ij} + \beta_6 lagwROA_{ij} + \varepsilon$, $if\ high\ ESG = 1$, controlling for fixed effects on myidvar and Year, with robust standard errors (vce). Indices i and j refers to week and stock identity.

$\boldsymbol{MarketAdjustedReturn}_{\boldsymbol{ij}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 lnEnergyPrice_{ij}} + \boldsymbol{\beta_2 Dummy_{ij}} + \boldsymbol{\beta_3 lnEnergyPrice_{ij}} * \boldsymbol{Dummy_{ij}} + \boldsymbol{\beta_4 lagwDTE_{ij}} + \boldsymbol{\beta_5}\, lagwBTM_{ij} + \beta_6 lagwROA_{ij} + \varepsilon$, $if\ high\ ESG = 0$, controlling for fixed effects on myidvar and Year, with robust standard errors (vce). Indices i and j refers to week and stock identity.

The second regression shows to what extent the volatility in energy price has affected performance, measured in weekly market-adjusted return. Hence the dependent variable is the same - market-adjusted return - however the independent variables are instead the 8-week rolling standard deviation on the energy prices, a dummy that separates the period before the crisis from the one during the crisis, and one with the interaction between these two variables. Additionally, there are the same three lagged control variables as in the first regression. The requirement of a high ESG score, fixed effects and robust standard errors are also used in the second regression.

Equation 2:

$MarketAdjustedReturn = \beta_0 + \beta_1 ln\ EnergyPriceVolatility_{ij} + \beta_2 Dummy_{ij} + \beta_3 lnEnergyPriceVolatility_{ij} * Dummy_{ij} + \beta_4 lagwDTE_{ij} + \beta_5 lagwBTM_{ij} + \beta_6 lagwROA_{ij} + \varepsilon$ if high ESG = 1, controlling for fixed effects on myidvar and Year, with robust standard errors (vce). Indices i and j refers to week and stock identity.

$MarketAdjustedReturn = \beta_0 + \beta_1 ln\ EnergyPriceVolatility_{ij} + \beta_2 Dummy_{ij} + \beta_3 lnEnergyPriceVolatility_{ij} * Dummy_{ij} + \beta_4 lagwDTE_{ij} + \beta_5 lagwBTM_{ij} + \beta_6 lagwROA_{ij} + \varepsilon$ if high ESG = 0, controlling for fixed effects on myidvar and Year, with robust standard errors (vce). Indices i and j refers to week and stock identity.

3.5 Energy price index

The energy price index used in the data panel is constructed of data extracted from Nordpool AS's server, which was sent to us directly upon request . Energy spot price is a market price caused by demand and supply changes in the energy market, and is also the price that is used in the energy price index constructed. From Nordpool's server prices have been collected daily, weekly, and monthly from 2019 until 2022. The server contained specific indexes for each energy price area in Sweden which are SE1(Luleå), SE2(Sundsvall), SE3(Stockholm), and SE4(Lund). By extracting the data from each of these indexes we computed a weekly average for Sweden, which is used in our regression model.

3.6 Correlation Matrix

All independent variables have been tested for multicollinearity to ensure the model's reliability. The two correlation matrices that can be seen below, show the correlation between all variables in the two regressions. The highest correlations measured are between the interaction variables and the independent variables that have created said interaction variable, for example, the 97% correlation between 'lnEnergyPrice_Dummy' and 'Dummy'. These correlation values can be overlooked as it does not create a problem for the regression. Besides this, the highest measured correlation in the model is. 20,96%. Calkins (2005) argues that only when a correlation is above 70%, the correlation can be considered as high. As long as the correlation between two variables takes a value below 70% it is considered to be at a moderate level, thus multicollinearity should not occur.

Table 4.1.1: Correlation matrix.
Illustrates correlation between variables included in regression 1.

	MarketAdjustedReturn	**ln_EnergyPrice**	**Dummy**	**lnEnergyPrice_Dummy**	**lagw DTE**	**lagw BTM**	**lagw ROA**
MarketAdjustedReturn	**1.0000**						
ln_EnergyPrice	**0.0146**	**1.0000**					
Dummy	**0.0036**	**0.2096**	**1.0000**				
lnEnergyPrice_	**0.0082**	**0.3429**	**0.9733**	**1.0000**			

Dummy							
lagwDTE	**-0.0046**	**0.0121**	**-0.0239**	**-0.0214**	**1.0000**		
lagwBTM	**-0.0029**	**-0.0180**	**0.0095**	**-0.0044**	**0.0463**	**1.0000**	
lagwROA	**0.0223**	**-0.0396**	**-0.0250**	**-0.0219**	**-0.0982**	**-0.1156**	**1.0000**

Table 4.1.2 Correlation matrix.
Illustrates correlation between variables included in regression 2.

	MarketAdjustedReturn	**ln_EnergyPriceVol8**	**Dummy**	**lnEnergyPricevol8_Dummy**	**lagwDTE**	**lagwBTM**	**lagwROA**
MarketAdjustedReturn	**1.00**						
ln_EnergyPriceVol8	**-0.0003**	**1.00**					
Dummy	**0.0036**	**0.0949**	**1.00**				
lnEnergyPricevol8_Dummy	**0.0034**	**0.5503**	**0.6399**	**1.00**			
lagwDTE	**-0.0046**	**0.0116**	**-0.0239**	**-0.0237**	**1.00**		
lagwBTM	**-0.0029**	**-0.0378**	**0.095**	**-0-0192**	**0.0463**	**1.00**	
lagwROA	**-0.0223**	**0.0178**	**-0.0250**	**0.0020**	**-0.0982**	**-0.1156**	**1.00**

4. Empirical Results

The regression results are presented in Table 6.3 below, in which the first regression that examines energy price, the model shows to be significant at 5%. The analysis indicates that there is a significant negative relationship between energy price and market-adjusted return for companies with a high ESG score. This suggests that an increase of one euro in price on energy, would cause a decrease of 0.00152 euros in the market-adjusted return of such companies. However, neither the coefficients on the dummy variable nor the interaction variable is statistically significant. The lack of significance for the coefficient of the dummy variable implies that there is no discernible difference in market-adjusted return between the two time periods being compared. Consequently, the lack of significance for the interaction variable suggests that the relationship between energy prices and ESG stock performance, in terms of market-adjusted return, does not vary significantly during the crisis compared to before. In other words, the crisis does not seem to have a substantial impact on how energy prices affect the performance of stocks with a high ESG score. Therefore, the first hypothesis is rejected as the crisis does not affect the results.

For the second regression, and the third column in Table 6.3, regarding how the volatility of price on energy has affected stocks with a high ESG rating, the regression was proven to be significant at a 5% level. The first independent variable is the 8-week rolling standard deviation on the energy price, which provided significance with a positive coefficient. If the volatility variable increases by one percentage, while holding other variables constant, the market-adjusted return would be expected to increase by 0.00442 percentage points. This suggests that higher volatility leads to higher returns on stocks with a high ESG score. The dummy in this regression is also positively significant, which indicates that market-adjusted return was higher during the energy crisis. On the other hand, the interaction variable constructed of energy price volatility and the dummy for during/not during the crisis is not significant. This suggests that the overall effect of the energy crisis on the performance of stocks with a high ESG score is significant regardless of the level of energy price volatility. In other words, the performance of ESG stocks during the crisis period is significantly different from non-crisis periods, but the impact of energy price volatility on the performance of ESG stocks does not vary depending on whether it is a crisis period or not. Nonetheless, as it can be proven that stocks with a high ESG score obtain a higher market-adjusted return with an increase in volatility of energy prices, however as it stands true regardless of the energy crisis, the second hypothesis cannot be proven to be true. For the second regression, it can also be seen that the intercept (constant) is significant. This indicates that other factors affect the market-adjusted return negatively even when all the independent variables are set to zero.

Moreover, the same tests were done when High_ESG = 0, which is essentially two identical regressions with the difference being that the companies included have an ESG score lower or equal to 68.73. However, the lack of statistical significance for both regressions (energy price and energy price volatility) makes it impossible to conclude whether there is a difference in performance between high ESG stocks and low ESG stocks. Furthermore, nothing can be said about how energy price or volatility affects stocks with a low ESG score. The results of these two regressions can be found in the appendix further down.

For both regressions, the R-squared value is relatively low with only a value of 2,4%. Consequently, only 2,4% of the variance in market-adjusted return is explained by the independent variables. Thus other factors that are not included in the two models can have high explanatory power to the variance in the dependent variable.

Table 4.2 Regression runs.
Regression 1 and 2 with High_ESG = 1
*** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.

Regression:	1	2
	High ESG = 1	High ESG = 1
Number of observations	5385	5385
F (6, 5330)	2.99	3.05
Prob > F	0.0065	0.0056
R-Squared	0.0242	0.0241
	market-adjusted return	market-adjusted return
ln_EnergyPrice	-0.00152**	
	(0.000607)	
Dummy	-0.00119	0.00126**
	(0.00249)	(0.000636)
EnergyPrice_Dummy	0.000429	
	(0.000662)	
lnEnergyPricevol8		0.00442***

		(0.00168)
lnEnergyPricevol8_dummy		-0.00267
		(0.00211)
lagwDTE	-0.000308*	-0.000318*
	(0.000176)	(0.000176)
lagwBTM	0.00240*	0.00238*
	(0.00139)	(0.00138)
lagwROA	-0.00787	-0.00659
	(0.00893)	(0.00889)
Constant	0.00400	-0.00287***
	(0.00248)	(0.00104)

4.1 Robustness test

Below, robustness tests have been conducted to ensure the reliability and validity of the regression results. Table 6.4.1 shows the results of a regression when the same variables were used as in the final regression models, only that the variable 'High_ESG' was set to all ESG scores above 50 instead of 68,73. Thus, when running the regression, it is shown to be significant at 5%. The one-year lagged book-to-market ratio is found significant in both regressions with a slightly positive coefficient. This means that holding all others constant, the market-adjusted return would increase slightly if the book-to-market ratio was to increase by one. The constant is also found significant for the second regression, which is the same for the final regression that examines energy price volatility. When High_ESG was set to 0, no significance could be found and therefore it is not commented on further.

Energy price is also found significant, just as in the final regression, which is a positive indicator that the final regression is consistent and that it is not sensitive to what is deemed a high ESG score. The same can not be said for energy price volatility, where the significance level is lowered to 90% - indicating that energy price volatility is more sensitive to what is considered a high score. An ESG score of 50 is however not a bad score. As mentioned earlier, scores of 50 and higher are still deemed good or excellent, but as more than 50% of the companies in the sample have an ESG score of above 50, the sample needs to be modified to really separate the companies with a high score. Increasing it to the 75th percentile narrows the sample down and identifies companies with higher scores as more limited and special. For this reason, it is deemed reasonable that the volatility variable is sensitive to changes in what is deemed a high ESG score.

Table 4.3.1 Robustness test
Regression model 1 and 2 with lower ESG scores
*** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.

	High ESG > 50.00			
	High ESG = 1	High ESG = 0	High ESG = 1	High ESG = 0
Regression:	1	1	2	2
	market-adjusted return	market-adjusted return	market-adjusted return	market-adjusted return
ln_EnergyPrice	-0.00114***	-0.000149		
	(0.000401)	(0.000637)		
EnergyPrice_Dummy	0.000857*	0.00179**		
	(0.000448)	(0.000872)		
Dummy	-0.00297*	-0.00701**	0.000731*	0.000333
	(0.00172)	(0.00333)	(0.000433)	(0.000864)
lnEnergyPricevol8			0.00200*	-0.000500
			(0.00110)	(0.00180)
lnEnergyPricevol8_dummy			-0.00135	-0.00326
			(0.00144)	(0.00299)
lagwDTE	-0.000274*	-0.000967	-0.000277*	-0.000908
	(0.000156)	(0.00137)	(0.000156)	(0.00137)
lagwBTM	0.00263**	-0.000562	0.00262**	0.000102
	(0.00104)	(0.00210)	(0.00104)	(0.00206)
lagwROA	-0.00687	-0.00896	-0.00643	-0.00993
	(0.00593)	(0.00623)	(0.00592)	(0.00620)
Constant	0.00274	0.00220	-0.00203***	0.00159
	(0.00170)	(0.00299)	(0.000762)	(0.00186)
Observations	12,916	5,503	12,916	5,503
R-squared	0.013	0.014	0.013	0.014

Regarding Table 6.4.2, both regressions are found statistically significant at 5%. The regressions were the same as the two final regressions when High_ESG = 1, only that the three control variables have not been lagged a year. It is possible to say that energy price is significant with a negative coefficient, meaning that if the energy price goes up with one euro, the market-adjusted return of companies with a high ESG score would go down 0.00114 euros. Additionally, the energy price volatility is also significant at a 10% level however with a positive coefficient. This indicates that with a 1% greater volatility, the market-adjusted return also becomes 0.002 percentage points greater. This finding is the same as when the control variables are lagged which suggests that the results are robust and not sensitive to changes in lagging the control variables when it comes to volatility. This consistency reinforces the validity and reliability of the results.

Table 4.3.2 Robustness test
Regression model 1 and 2 without lagged control variables
*** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.

Regression:	1	2
	High_ESG = 1	High_ESG = 1
	market-adjusted return	market-adjusted return
ln_EnergyPrice	-0.00165***	
	(0.000540)	
Dummy	-0.00219	0.00105*
	(0.00227)	(0.000601)
EnergyPrice_Dummy	0.000688	
	(0.000598)	
wROA	0.00454	0.00214
	(0.00951)	(0.00949)
wBookToMarket	0.000487	0.000433
	(0.00156)	(0.00155)
wDebttoEquity	0.000470	0.000482
	(0.000379)	(0.000377)
lnEnergyPricevol8		0.00391***
		(0.00149)
lnEnergyPricevol8_dummy		-0.00190
		(0.00195)
Constant	0.00443**	-0.00257**
	(0.00221)	(0.00103)
Observations	6,217	6,201
R-squared	0.021	0.020

5. Analysis and Discussion

This section will be divided into two parts which are the two different research questions.

To what extent has the performance of stocks with a high ESG score been affected by energy prices during the energy crisis?

The findings of the analysis indicate that higher energy prices have a detrimental effect on the performance of stocks with a high ESG rating, and this relationship holds not only during the energy crisis but also throughout the entire four-year period under examination. This observation can be linked to the principles of prospect theory, particularly the concept of loss aversion. According to prospect theory, individuals tend to be more sensitive to losses than to gains. Thus loss aversion theory suggests that investors, being more sensitive to losses, may respond to the negative impact of higher energy prices by reducing their investments. As a result, the profitability of stocks with a high ESG rating could decrease.

The significance of loss aversion is not limited to a specific period, such as the energy crisis, but rather extends throughout the entire analyzed period. This implies that the relationship between energy prices and the performance of high ESG stocks is influenced by loss aversion consistently over time. The general idea of Prospect Theory could be linked together with Aissaoui and Gustafssons (2021) study that showed no profitability in the short term for ESG stocks. As investors value losses higher, it would be reasonable for them to opt out of investments in ESG stocks that show no economic gain in the foreseeable future. This adds to the explanation of why there is no difference during the crisis, as prospect theory follows investors at all times.

Another possible explanation for why a higher energy price leads to inferior performance could be due to the close relationship between the energy and stock market. As measured by Wen, Wei, and Huang (2012), there was a contagion effect during the financial crisis in 2008. This creates an idea that the same phenomenon should happen during the current energy crisis - however fails to include the possibility that it is not only a sudden contagion effect but rather the general way the markets work together. Assuming this to be true, it is highly feasible that increased energy costs reduce investments. In general, when energy prices escalate, households and businesses often face financial constraints due to increased energy-related expenses. Higher energy costs can limit discretionary spending by individuals, reducing their capacity to invest in the stock market. Likewise, businesses may experience reduced profitability as higher energy expenses eat into their profit margins, limiting their ability to allocate resources for growth and investment opportunities. Therefore, it is plausible that the negative relationship between energy prices and stock market performance stems from the broader interconnectedness between the two markets.

To what extent has the performance of stocks with a high ESG score been affected by the volatility of energy prices during the energy crisis?

The statistical significance analysis does not provide evidence to support the assertion that changes in the volatility of energy prices specifically impact the performance of ESG stocks during the recent energy crisis. However, it is observed that higher volatility in energy prices tends to increase the profitability of ESG stocks in general. This finding can be attributed to the interconnectedness of the energy market with various sectors of the economy. Investors often perceive the overall market as volatile when they consider the energy market to be volatile, given its widespread impact. This notion is further supported by Wen et al. (2012), who demonstrate the close relationship between the stock and energy markets.

Additionally, Huber et al. (2021) highlight that investors become more cautious about risk during uncertain times and tend to opt for less risky assets. Although the concept of "less risky" is subjective, it is reasonable to assume that stocks intended for long-term holding or those that have consistently demonstrated strong performance are considered less risky. Stocks with a high ESG score align with this notion as they have been shown to outperform those with low scores, as evidenced by studies conducted by Abate, Basile,, and Ferrari (2021) and Erhart (2022). As ESG scores are now prevalent among most stocks, risk-averse investors choosing high ESG stocks is consistent with their preference for stocks that have a track record of profitability.

In summary, while the statistical significance is lacking regarding the impact of energy price volatility on ESG stocks during the energy crisis, there is a general trend indicating that higher volatility in energy prices can lead to increased profitability of ESG stocks. The interconnected nature of the energy market, coupled with investors' risk aversion during uncertain times, contributes to the preference for high ESG stocks, which have demonstrated better performance historically.

Figure 1 shows rather clearly that the fluctuations in energy prices are more extreme during the crisis (the middle of July 2021 - end of 2022) than before. This would indicate that the results would be different before and during the crisis. Yet, the results stand for the entire four year period and not only the energy crisis. This can be explained by the volatile nature of the Swedish Energy market. Given the diverse mix of energy sources, the varying weather conditions affecting renewable energy production, and the continuous shift towards green energy alternatives, it is not surprising that the positive relationship between volatility and performance of ESG stocks extends beyond the energy crisis period. The inherent characteristics of the Swedish energy market contribute to the overall volatility and subsequently drive the positive association between volatility and performance in the ESG stock sector.

Erharts' (2022) critical approach to the ESG rating system challenges the assumption of investor competition in the efficient market theory. Investors who exert greater effort and conduct thorough investigations into a firm's non-financial information gain an advantage over those who rely solely on ESG ratings as an indicator of a firm's management of non-financial areas. This creates an information gap among investors. However, it is important to recognize that the implementation of the Non-Financial Disclosure Regulation (NFDR) and the involvement of third-party entities, such as Refinitiv Eikon, in generating ESG scores, address some of the concerns raised. The NFDR establishes guidelines for what companies are required to report, ensuring that relevant information is included in the assessment of ESG scores.

Additionally, third-party entities play a role in aggregating and analyzing data to provide objective ESG scores. While it is true that assuming all investors have equal access to information may not be entirely realistic in practice, the combination of regulations and standardized ESG scoring methods helps minimize the gap. The involvement of third-party entities adds an additional layer of scrutiny and expertise to the evaluation process, reducing the potential biases and subjectivity that can arise from relying solely on companies' self-reported data. The thesis is based on the understanding that, within the current framework, ESG scores on the market are reasonably accurate and reflect a close approximation to reality. In the future, with the implementation of the Corporate Sustainability Reporting Directive (CSDR), this potential problem will diminish further as it aims to address the issue by mandating approximately 40,000 additional firms to report non-financial information, strengthening the rules surrounding reporting. Nonetheless, considering that third-party ESG scores are partly based on the reports published by corporations themselves, it is and always will be a debatable topic.

6. Conclusion

In this study, we examined the impact of energy prices and their volatility on the performance of stocks with a high ESG score during and prior to the energy crisis. Our findings shed light on two research questions and provide valuable insights into the relationship between energy prices, and ESG stock performance.

To what extent has the performance of stocks with a high ESG score been affected by energy prices during the energy crisis?
Stocks with a high ESG score diminish in performance when energy prices increase. This impact does however not differ during the energy crisis.

To what extent has the performance of stocks with a high ESG score been affected by the volatility of energy prices during the energy crisis?
Stocks with a high ESG score do in fact perform better when energy prices are more volatile. This impact does however not differ during the energy crisis.

In conclusion, our study contributes to the understanding of the relationship between energy prices, ESG scores, and stock performance. Higher energy prices have a negative impact on the performance of high ESG stocks, possibly driven by loss aversion, and this relationship holds consistently over time. While the impact of energy price volatility during the energy crisis lacks statistical significance, there is a general trend suggesting that higher volatility can lead to increased profitability of ESG stocks. Future research can delve deeper into the mechanisms behind these relationships and explore additional factors that may influence the performance of high ESG stocks during energy crises.

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Appendix

Regression runs.
Regression 1 and 2 with High_ESG = 0
*** p<0.01, ** p<0.05, * p<0.1, robust standard errors in parentheses.

Regression:	1	2
	High ESG = 0	High ESG = 0
Number of observations	13036	13036
F (6, 5330)	1.18	0.45
Prob > F	0.3130	0.8450
R-Squared	0.0111	0.0108
	market-adjusted return	market-adjusted return
ln_EnergyPrice	-0.000476	
	(0.000409)	
Dummy	-0.00454**	0.000314
	(0.00194)	(0.000508)
EnergyPrice_Dummy	0.00119**	
	(0.000501)	
lnEnergyPricevol8		0.0000497
		(0.00113)
lnEnergyPricevol8_dummy		-0.00140
		(0.00166)
lagwDTE	-0.000145	0.00000951
	(0.000333)	(0.000176)
lagwBTM	0.000704	0.000765
	(0.00112)	(0.00112)
lagwROA	-0.00362	-0.00365
	(0.00467)	(0.00467)
Constant	0.00134	-0.000477
	(0.00178)	(0.000332)