The impact of Environmental, social, and governance (ESG) on risk-adjusted performance in the oil and gas sector in Europe

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ABSTRACT,
Lately, the Environmental, Social and Governance (ESG) elements has become more important within the stock market. The oil and gas industry is known as one of the worst industries when it comes to the ESG elements. In this research there will be looked at the impact of ESG variables on the risk-adjusted performance (RAP) of companies in the oil and gas industry in Europe. By using the Sharpe ratio variable as measurement for the RAP and using multiple criteria for the ESG elements, the impact of these ESG elements on the RAP is measured. This is done by first looking at the relationship between the two, using the Pearson correlation and secondly a regression analysis has been conducted. The results show that there is somewhat a form of correlation between the Sharpe ratio and the ESG variables. However, there is no significant proof that the ESG variables have impact on the Sharpe ratio and so the RAP within this research.

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Oil and gas sector, Risk-Adjusted performance (RAP), Environmental, Social and Governance (ESG), Sharpe Ratio, Regression analysis, correlation

1. INTRODUCTION

In today's complicated and ever-changing global economic scene, incorporating Environmental, Social, and Governance (ESG) elements has become a crucial consideration for investors wanting to make informed portfolio selections (CGEP, 2020). ESG principles have evolved as a critical framework for analysing organizations' and sectors' sustainability and ethical practices, shaping investment strategies and influencing capital allocation. As the world faces greater environmental and social issues, the oil and gas sector, which has long been a backbone of the European economy, has come under increasing pressure. In this paper there will be delved into the relationship between ESG criteria and risk-adjusted performance (RAP) in the oil and gas sector in Europe (Wanday & Ajour El Zein, 2022).

The oil and gas industry, long known for its economic importance, has recently come under fire due to worries about environmental degradation, carbon emissions and community impacts. The move to sustainable, environmentally responsible energy techniques is driving public debate and legislative measures across Europe. In turn, investors are considering the possible financial and non-financial risks and opportunities connected with oil and gas projects. Within this changing framework, the importance of ESG factors in driving investment results becomes critical (Redmond et al., 2019) (de Souza Barbosa et al., 2023) (Rushton, 2021).

In a way it is possible that this changing impact of ESG factors results to a change in the risk-adjusted performances of companies. Risk-adjusted performance is a financial statistic that compares the return on an investment or portfolio to the level of risk required to generate that return. It allows investors to assess how well a company or investment has managed the inherent volatility in their prices (Modigliani & Modigliami, 1997). If the RAP of a company is shifting downwards, it will be less attractive to invest in this company. This could lead to a negative spiral and change the direction of the company (Ramírez-Orellana et al., 2023). So for companies it could be a problem if there are some variables which negatively influences their RAP.

However, on this day it is not known exactly how big the impact of the ESG factors is on the risk-adjusted performances of European oil and gas companies. There has been some research on the impact of ESG in other sectors, for example in the article of Eratalay & Cortés Ángel (2022) where they look at the S&P Europe 350 stocks and in the article of Anton Raneses (2020). However, in the oil and gas sector in Europe, the research focuses on how organizations with ESG strategy succeed in returns, like in the article of Wanday & Ajour El Zein (2022). In this research they use the SARIMA formula which looks at patterns in data. There has not been looked into the impact of ESG factors in the risk of performances and the relationship between the two. The impact of the ESG factors on the risk of performances of a company is something which is important for the future and it could influence the decision making process for investors. For companies it could become a problem if it is not clear how big the impact of the ESG factors will be. They could lose investors if they fall behind or it could cost the company a lot of money if they react in wrong terms (Parikh et al., 2023).

With the recent trend of becoming more sustainable aware of the environment, this subject is interesting to look into. It is common knowledge that the gas and oil industry is not a positive influence on the environment. Governments all over the world are taking actions to reduce the negative consequences. Now, to become aware of what the future holds for the oil and gas industry in Europe, it is a good start to look into the influence the ESG factors already have on the oil and gas sector. By looking into this, you could prepare yourself for possible outcomes within the oil and gas sector.

This paper aims to examine how ESG considerations impact the risk-adjusted performance of investments in the oil and gas sector in Europe. By analysing multiple measurements of ESG and risk-adjusted performance factors, we will assess the extent to which ESG factors influence financial performance which could influence investors' decision-making processes. The research takes into account Environmental aspects, Social aspects and also corporate governance practices, aiming to offer a holistic perspective on the interplay between ESG and risk-adjusted performances.

The research objective of this study is to use the relationship between environmental, social and governance (ESG) and the risk-adjusted performance to find results on the issues for investments in the oil and gas sector within Europe.

Taking all this into account, we will investigate this relation between ESG and RAP by using the following research question:
"What is the impact of Environmental, social, and governance (ESG) on the risk-adjusted performance for investments in the oil and gas sector in Europe?"

2. LITERATURE REVIEW

In this section, there will be looked at the literature in multiple perspectives. There will be looked at challenges of the oil and gas sector within Europe, the risk-adjusted performance, ESG and its relation with risk-adjusted performance and correlation & regression. At last the hypothesis will be formulated as well.

2.1 Challenges of the oil and gas sector within Europe

First, we will look at the challenges within the oil and gas sector in Europe. Nowadays, the oil and gas sector in Europe faces more and more challenging issues. The more challenges there are in the industry, the more difficult it becomes to make a profit. Here, we will look at four different challenges of which the first issue will be about the climate policies. Bogmans et al. (2023) stated that investors are increasingly pricing in climate policy risks in Europe, which can affect firm investment through powerful anticipation effects. An example of these climate policies is that the carbon emission needs to be reduced. A higher cost of capital due to stricter climate policies should reduce investment by affected firms. This could lead to more difficult times for the companies and that could result into higher prices (McGlade, 2020) (Grasso, 2018) (Semieniuk et al., 2022) (Papadis & Tsatsaronis, 2020).

Further, the next issue is stated in an article of Wilkes (2023). In this article they talk about the issue of reduced financing. It

is stated that investors managing assets worth more than $1.5 trillion have urged European banks to stop directly financing new oil and gas fields, as this risks jeopardizing the path to net-zero carbon emissions and the growth of renewable energy (Jain, 2023).

A third challenge within this sector is that recently there has been an issue with the energy crisis. In the article of Zettel et al. (2022) it is stated that Europe's energy system faces an unprecedented crisis, with supplies of Russian gas critical for heating and electricity generation. The reduction of Russian supply has caused a massive increase in European gas prices, and the cost of liquefied natural gas (LNG) has more than doubled since Russia's invasion of Ukraine (IEA, 2023).

Furthermore, There is also an issue for the investments in the oil and gas sector because of the transition to renewable energy. There are a lot of restrictions made by the European Union to make sure that in the future there will be a greater share of renewable energy. In the article of Katanich (2023) it is stated that the goal of the EU is to require 42.5% of EU energy to be renewable by 2030. The shift towards renewable energy sources like wind, solar, and hydropower can impact the long-term prospects of oil and gas investments. This transition may result in declining demand for fossil fuels (McGlade, 2020) (Fattouh et al., 2019).

2.2 Risk-adjusted performance

The risk-adjusted performance is a measure used in finance and investing that evaluates the profit or potential profit of an investment relative to the amount of risk it represents. It is crucial for investors to understand risk-adjusted performance as it provides a more accurate picture of an investment's performance by taking into account not just the returns but also the level of risk taken to achieve those returns. This is crucial because higher returns often come with higher risks, and comparing investments solely on returns can be misleading (Fisher & DAlessandro, 2018) (Malhotra et al., 2023).

The risk-adjusted performance could be used in several methods, for example in portfolio management, comparing investments, performance benchmarking and strategic planning. Furthermore, there are several methods for evaluating risk-adjusted performance, such as the Sharpe ratio, Treynor ratio, alpha, beta, and standard deviation. All of these measures looks at risks and returns and could say something about the RAP (Samarakoon & Hasan, 2022).

The risk-adjusted performance include some key benefits for investors. The first one is the benefit of better decision-making. The RAP metrics help investors make more informed decisions about their investments, reducing the risk of significant losses. A second benefit is the understanding of trade-offs. Risk-adjusted returns allow investors to see the relationship between risk and return, helping them understand the trade-offs they need to make to achieve their investment goals. The third benefit of risk-adjusted performance is the possibility to compare investments. Risk-adjusted performance metrics enable investors to compare the performance of different investments with different levels of risk, allowing them to make more informed decisions (Carles, 2015).

To calculate risk-adjusted return, like told, one of the most commonly used methods is the Sharpe ratio, which divides a portfolio's excess returns by a measure of its volatility to assess risk-adjusted performance (Sharpe, 1998) (Lioudis, 2022). So in this research there will be looked further into the Sharpe ratio as dependent variable. It is widely used in finance to evaluate the performance of an investment by adjusting for its risk (Baldridge, 2023). The Sharpe ratio is calculated by subtracting the risk-free rate of return from the investment's rate of return and dividing the result by the standard deviation of returns for the investment. The ratio’s utility relies on the assumption that the historical record of relative risk-adjusted returns has at least some predictive value. A higher Sharpe ratio indicates a more attractive RAP. (Sharpe, 1998).

2.3 ESG and its relation with risk-adjusted performance

ESG investing has become increasingly popular among investors who are concerned with integrating ESG criteria into their portfolios. The influence of ESG on risk-adjusted performance is a topic of interest for many investors (Boffo & Patalano, 2020) (Eccles & Klimenko, 2019).

ESG focusses on the Environmental, Social and Governance part of a company. Each of the three compartments have their own variables. The Environmental compartment focuses on the impact of a company's operations on the environment. It includes issues such as climate change, pollution, waste management, and resource depletion. Companies can reduce their environmental impact by implementing sustainable practices, such as reducing carbon emissions, conserving energy and water, and using renewable resources (Ellis, 2023) (Novisto, 2023).

The Social compartment focuses on a company's impact on society, including its employees, customers, suppliers, and communities. It includes issues such as labour practices, human rights, diversity and inclusion, health and safety, and community engagement. Companies can improve their social outcomes by implementing responsible practices, such as fair labour practices, ethical sourcing, and community development initiatives (Ellis, 2023) (Novisto, 2023).

The Governance compartment focuses on how a company is governed and managed. It includes issues such as transparency, accountability, board structures, and ethical behaviour. Companies can build better governance structures by implementing responsible practices, such as transparent reporting, independent board oversight, and effective risk management (Ellis, 2023) (Novisto, 2023).

In the article of Le Sourd (2023) it is stated that incorporating ESG criteria reduces non-financial risks, such as reputation, political, and regulatory risks. Companies that do not consider ESG criteria expose themselves to risks of consumer boycotts, environmental disasters, or reputation scandals.

Furthermore, in the study of (Jin, 2020) they tried to improve the understanding of the impact of ESG-screening on performances in combination with risks. In this research they looked at performances of ESG-screened portfolios. They stated that in their research, they found that the ESG-screened portfolios were improving both risks and return performance.

They do, however, also state that investors would choose the degree of ESG screening concentration according on how often and serious they believed ESG events to be.

2.4 Correlation and regression

In research, there are multiple ways to look at the relationship between different variables. One way to test the relationship between two variables is by taking the regression between those variables. Regression analysis determines the relationship between variables by expressing it as an equation, such as a straight line. In healthcare, for example, regression analysis can be used to predict urea levels based on age. There are numerous types of regression, including simple linear regression, multiple regression, polynomial regression and logistic regression, each appropriate for particular sorts of data and research issues. So is the simple linear regression used when there is a linear relationship between two variables. It involves two variables, with one being the predictor and the other being the response variable. The multiple regression is used when there are two or more predictor variables to understand how the predictors are related to the response variable. The polynomial regression is used when the relationship between the independent and dependent variables is not linear. It involves the use of an equation to represent the relationship. At last the logistic regression is used, unlike the previous types, when the response variable is categorical. It predicts the probability of the outcome being true. The choice of regression type depends on the nature of the data and the specific research question being investigated (TheBMJ, 2020) (Cuemath, 2023) (Kozak, 2021).

Where the regression analysis tests if there is a form of relationship, the correlation tests the strength of this relationship. There are four main types of correlation coefficients used to measure the strength of a relationship between two variables. These types of correlation coefficients are; the Pearson correlation, the Kendall rank correlation, the Spearman correlation and the Point-Biserial correlation. Of these correlation coefficients, the Pearson correlation is the most widely used. This is used when both variables are continues and normally distributed. The Kendall rank - and Spearman correlation are used when variables can be ranked but not measured on a continues scale. The Point-Biserial correlation is used when one variable is continuous and the other is binary, which means that it can only take two values. Just as with the regression analysis, the choice of regression type depends on the nature of the data and the specific research question being investigated. These correlations could give three different results which are a positive correlation, a negative correlation and no correlation at all (Schober et al., 2018) (TheBMJ, 2020).

2.5 Hypothesis

In the research of Wanday & Ajour El Zein (2022) they provide evidence that implementing a good ESG strategy can lead to higher returns for investors in the oil and gas sector. The article suggests that oil and gas companies must analyse their own and their employees' demands to develop an ESG strategy that encompasses social and governance activities as well as the environment

Looking further, environmental performance in the oil and gas industry can greatly improve financial results by lowering fines and enhancing reputation. Research indicates that taking proactive measures to manage resources sustainably and reduce carbon emissions can result in cost savings and investor interest, which can have a beneficial effect on financial performance. Higher levels of environmental disclosure are correlated with better financial performance metrics, such as return on equity (ROE) and return on assets (ROA), according to research by Al Amosh et al. (2022).

In the article of Boffo & Patalano (2020), they addressed increased investor interest in ESG criteria and how they can affect issuers' long-term success. The paper discovered that ESG factors may be utilized to establish a risk-weighted performance measure and that ESG funds outperform non-ESG funds in terms of risk-adjusted returns. Further, they state that the social dimension of ESG focuses on managing relationships with stakeholders and it may lower risks and increase operational efficiency. Companies with strong social practices, such as community involvement and worker safety, typically have happier employees and better relationships with the local community. Consequently, this lowers operational risks and improves financial performance over the long run. Research indicates that companies that incorporate social elements into their operations tend to achieve higher risk-adjusted returns than those that do not.

Furthermore, good governance practices, including transparent decision-making and robust internal controls are critical for mitigating risks and ensuring sustainable growth. Reducing regulatory fines, preventing fraud, and boosting investor confidence are all possible with effective governance. Strong governance structures enhance risk management and decision-making processes, which has a beneficial impact on financial performance, according to research by Gonçalves et al. (2021).

Three distinct hypotheses are developed from these articles and the literature review; hence, each of the three pillars will be examined separately. Through a three-part breakdown of the ESG influence, the primary question will be addressed in detail. The following hypotheses are formed:

H_1: ***"****The Environmental part of the ESG factors has significant impact on the risk-adjusted performance for investments in the oil and gas sector in Europe."*

H_2: ***"****The Social part of the ESG factors has significant impact on the risk-adjusted performance for investments in the oil and gas sector in Europe."*

H_3: ***"****The Governance part of the ESG factors has significant impact on the risk-adjusted performance for investments in the oil and gas sector in Europe."*

3. METHODOLOGY

In this section there will be explained how the research is conducted and which choices are made. This paper's methodology will look into the selection of companies, the issues within the oil and gas sector, the ESG variables, the RAP variables, correlation & outliers and the regression analysis.

3.1 Selection of companies

For this research, there has been looked at the biggest companies in the oil and gas sector in Europe, by market gap. There are 14 companies selected for this research. These companies were chosen because, according to market capitalization, they are the only ones located in Europe among the top 100 largest oil and gas corporations. The selection of these companies including their market gap is shown in Appendix A.

3.2 Issues within the oil and gas sector

First, the issues for investing in the oil and gas sector within Europe will be determined. In the literature research before, there has been stated some challenges which will be used. These issues were; the climate policies, the reduced financing, the energy crisis and the transition to renewable energy. These issues will be looked at with the results of the following parts.

3.3 ESG variables

In the second step, the measurements for the Environmental, Social and Governance (ESG) variables in the oil and gas sector are determined. The ESG ratings from the different companies are conducted from Refinitiv Eikon. Refinitiv is one of the major providers of data and insights of financial markets. A section of the data of Refinitiv is about ESG scores of companies. With these ESG scores, Refinitiv is one of the main providers next to MSCI, Bloomberg, Sustainalytics and FTSE Russell.

Refinitiv Eikon uses a database with 630 company-level ESG measures. From these 630 ESG measures, a subset of 186 ESG measures which are the most comparable per industry, is used in the scoring process of the ESG scores. These 186 variables are divided over ten different categories which come from the Environmental, Governance and Social pillars. The Environmental pillar has three categories, which are; resource use, emissions and innovation. The Social pillar has four categories which are; workforce, human rights, community and product responsibility. The Governance pillar has the last three categories, which are; management, shareholders and CSR strategy (LSEG, 2023). In Appendix B is shown how many variables each of the categories got. The definitions of each of the categories is stated in Appendix C.

The different categories are all evaluated separately, however they are not all equally important. For each of the categories, there is looked at their importance for a specific sector or company, and weights are linked to these categories. Within the oil and gas industry, the weights are divided between the three ESG pillars as follows; the Environmental pillar has a weight of 0,34, the Social pillar has a weight of 0,42 and the Governance pillar has a weight of 0,24. With the scores of the three pillars and the corresponding weights, the ESG score can be established.

For the 14 companies the Environmental, Social, Governance and the total weighted ratings are subtracted from Refinitiv for a total of five years. So the data will be from the years 2018, 2019, 2020, 2021 and 2022. These are the five most recent years available on the program of Refinitiv. The data is subtracted from five years to get a well estimated view on the relationship between the Sharpe ratio and the ESG variables. When less years will be taken into account, the results will not be as reliable as with five years. The more data points used, the more precise the outcome of a relationship will become.

3.4 RAP variable

The measurements for the risk-adjusted performance in the oil and gas sector has to be determined. The variable that will be tested, as told in the literature research, is the Sharpe Ratio. There are other variables to test the RAP as well, like the Treynor ratio, the information ratio, the Sortino ratio and the Calmer ratio. However, the Sharpe ratio has been chosen because it provides a comprehensive measure of risk-adjusted performance by considering the total risk (standard deviation of returns). Besides this, the Sharpe ratio considers both return and risk, making it appropriate for a comprehensive assessment of ESG effect (Gatfaoui, 2009). The influence of the ESG factors on the Sharpe ratio will be investigated, so the data needs to be from the same period of time. Therefore, the historical Sharpe ratios will be used from the years 2018, 2019, 2020, 2021 and 2022. The historical Sharpe ratios per month are retrieved from YCharts.

After the historical Sharpe ratio has been conducted, the yearly annualized Sharpe ratio will be calculated so that the time window of the ESG variables and the Sharpe ratio is the same. The yearly annualized Sharpe ratio can be calculated by multiplying the average of the historical Sharpe ratios per month of one year by the square root of 12 (Lo, 2002). This calculation is shown in equation 1.

$$Annualized\ SR = \left(\frac{1}{12}\sum SR_m\right) * \sqrt{12} \text{ (Equation 1)}$$

The results of the annualized Sharpe ratio per company per year are shown in Appendix D.

3.5 Correlation & outliers

When the data of the Sharpe ratio and the ESG factors is known, the influence of ESG on the RAP can be investigated. First the correlation between the two variables will be conducted. We start with the correlation to quantify the strength and direction of the association between the two variables. The correlation coefficient will provide an initial understanding of the relationship without implying causation. The type of correlation that will be used in this research is the Pearson correlation coefficient. The Pearson correlation coefficient has been chosen because the two variables, the ESG rating and the Sharpe ratio, are both continuous and can be assumed to be normally distributed (Schober et al., 2018).

When the result of the correlation is between 0,00 and 0,30 (0,00 to -0,30), the result can be interpret as a negligible correlation. When the result is between 0,30 and 0,50 (0,30 to -0,50), the result can be interpret as a low positive (negative) correlation. When the result is between 0,50 and 0,70 (0,50 to -0,70), the result can be interpret as a moderate positive (negative) correlation. When the result is between 0,70 and 0,90 (0,70 to -0,90), the result can be interpret as a high positive (negative) correlation. At last, when the result is between 0,90 and 1,00 (0,90 to -1,00), the result can be interpret as a very high positive (negative) correlation (Mukaka, 2012).

Before the correlation between the ESG score and the Sharpe ratio will be conducted, the data has to be tested for outliers. Because the Pearson correlation coefficient is used, the interquartile range method will be used to determine the outliers. The interquartile range method is a straightforward method and provides a systematic way to identify potential outliers based on the spread of the data. For this test, the first and third quartile needs to be determined. To find these quartiles, first, the annualised Sharpe ratio needs to be arranged in ascending order. Now the first quartile is the median of the lower half of the dataset and the third quartile is the median of the upper half of the dataset. Now the interquartile range (IQR) could be calculated. This is done by taking the difference between the third quartile and the first quartile. So it will look as stated in equation 2.

$$Interquartile\ Range\ (IQR) = Q3 - Q1$$
(Equation 2)

After the IQR has been set, the range for the outlier thresholds could be calculated. This will be done by subtracting 1,5 times the IQR from the value of Q1 and by adding 1,5 times the IQR to the value of Q3. The range created from these calculations is the range with values of Sharpe ratios that will be used, all the values outside of this range will be determined as outliers. These outliers won't be taken into account with the calculations. The calculation of the range is shown in equation 3.

$$(Q1 - 1{,}5 * IQR; Q3 + 1{,}5 * IQR) \quad \text{(Equation 3)}$$

In this research, the years 2018 up to 2022 will be taken into account. This means that there will be looked at the correlation between the Sharpe ratio and the ESG scores during these five years. However, the COVID-19 pandemic took place within these years as well. This study will examine whether the correlation between the Sharpe ratio and ESG scores has changed as a result of the COVID-19 epidemic. The pandemic began in 2020, hence in addition to the correlation across a five-year period, the correlation of the first two years before COVID-19, 2018 and 2019, and the three years following COVID-19's beginning, so 2020, 2021 and 2022, will be examined separately.

3.6 Regression analysis

Next, the regression of the data points will be analysed and tested for significance. For this research there has been chosen for a multiple regression analysis, this means that there will be one dependent variable and two independent variables. One of the independent variables will be the control variable. The assumption is made that the relationship of the variables is linear and this regression analysis is a good starting point for exploration (Sureiman & Mangera, 2020). In this research the dependent variable will be the Sharpe ratio, the first independent variable will be the four different ESG scores and the control variable will be the log-transformed market cap of the company in that period of time. The log-transformed market cap will be used as control variable because the size of the company could influence the risk-return profiles, which in turn could influence the Sharpe ratio. The control variable will be log-transformed, because this will give a more distinguished regression line, resulting in a better prediction model.

The four different ESG scores will all be taken into account in a multiple regression, because the impact of those scores will be tested individually. A multiple regression model is written as in equation 4.

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + e \quad \text{(Equation 4)}$$

Within this equation the y is the dependent variable and the x's are the values of the independent variables.

The α (Alpha) gives the value of the dependent variable when the independent variables are equal to zero. The β (beta) is the coefficient which represents the slope of the regression model. So when the independent variable increases by one, the dependent variable will increase by the value of the beta. The β_1 and β_2 has a standard error which is normally distributed (Sarstedt & Mooi, *Regression Analysis*, 2019). Following Sarstedt & Mooi (*Hypothesis Testing and ANOVA*, 2019) to test if the β_1 is significantly different from zero, the t-test can be used. For calculating the t-test, first, the hypothesis that will be tested is set and the level of significance will be determined. The level of significance that will be used for this test is 5%. This is the most common value used to test significance. There will be four different regression models and they will be analysed within the program SPSS. These regression models will be made individually and summarised in one table. Within these results, the t-test will be stated as well.

When the t-value has been conducted, it can be compared to the critical value in the t-distribution table. Here there will be looked at the degrees of freedom to find the critical value needed for the test.

4. RESULTS

In this section, the results of the methodology in chapter 3 will be presented and analysed.

4.1 Variable selection

For the Environmental, Social and Governance variables and the annualized Sharpe ratio, the scores are retrieved from Refinitiv Eikon and calculated as told in the Methodology. The final scores used for this research are listed in Appendix D.

4.2 Outliers

There are fourteen companies with five years of data, so in total there are 70 data points which are taken into account.

The annualised Sharpe ratios were listed from low to high and the quartiles were calculated as told in section 3.5 and determined as Q1 = 0,784 and Q3 = 1,676. So the IQR which follows from equation 2 is set at 1,676 - 0,784 = 0,892. With the IQR determined, the range of valid data is calculated with equation 3 and set at (-0,555;3,015). With the range defined, the Sharpe ratios which are shown in table 1 are stated as outliers.

	N	Minimum	Maximum	Mean	Std. Deviation
Sharpe ratio	64	-,451	2,918	1,170	,6619
ESG score	64	56,58	94,01	77,083	12,162
Environmental score	64	45,49	92,51	75,208	10,597
Social score	64	56,89	95,29	80,567	19,232
Governance score	64	30,73	98,01	73,173	9,929

Table 2; Descriptive statistics of variables

Company & year	Sharpe ratio
Neste 2020	3,034
Aker BP 2022	6,485
Aker BP 2021	7,314
Aker BP 2020	7,966
Aker BP 2019	8,517
Aker BP 2018	10,036

Table 1; Outliers of dataset

The data points mentioned in table 1 are not taken into account for the calculations from now on. These points would influence the results for this research to much. After these outliers are taken out, there are still 64 data points left. The descriptive statistics from the variables used are shown in table 2.

4.3 Correlation

In this part there will be looked at the correlation between the Sharpe ratio and the four ESG variables, the total ESG score, the Environmental score, the Social score and the Governance score, separately. This will be done with three different scenarios. These scenarios are the correlation over five years, the correlation before the COVID-19 pandemic and the correlation since the COVID-19 pandemic started.

4.3.1 Correlation over five years

The correlation has been calculated between the Sharpe ratio (SR) and the four different ESG variables over the years 2018 up to 2022. The ESG variables are the total ESG score (ESG score), the Environmental score (E score), the Social score (S score) and the Governance score (G score). The results of the Pearson correlation r between the Sharpe ratio and these four different variables are shown in table 3.

The results of correlations over five years show that the correlation of the Sharpe ratio with the total ESG score and the Governance score individually exhibit a low positive correlation. The Sharpe ratio in combination with the Environmental and the Social score individually show a negligible correlation.

4.3.2 Correlation before COVID-19

For the calculation of the correlation between the Sharpe ratio and the four different ESG variables before COVID-19, only the years 2018 and 2019 will be taken into account. The results of the Pearson correlation r between the Sharpe ratio and these four different variables, before COVID-19, are shown in table 3.

The results of correlations before COVID-19 show that the correlation of the Sharpe ratio with the total ESG score, the Environmental score and the Governance score, individually exhibit a low positive correlation. The Sharpe ratio in combination with the variable of the Social score shows a negligible correlation.

4.3.3 Correlation since COVID-19

For the calculation of the correlation between the Sharpe ratio and the four different ESG variables since COVID-19 started, the years 2020, 2021 and 2022 will be taken into account. The results of the Pearson correlation r between the Sharpe ratio and these four different variables, since COVID-19 started, are shown in table 3.

The results of correlations since COVID-19 started show that only the correlation of the Sharpe ratio with the total ESG score exhibit a low positive correlation. The Sharpe ratio in combination with the variables of the Environmental score, the Social score and the Governance score show a negligible correlation.

4.4 Regression analysis

In this part, there will be looked at the results of two regression models. The first one is the regression model including the total ESG score and second regression model includes the Environmental, Social and Governance scores. For both models, the log-transformed market cap is used as control variable as told in 3.6.

4.4.1 Sharpe ratio and the total ESG score

First there will be looked at the regression between the Sharpe ratio and the total ESG score. For this regression, the Sharpe ratio has been set as dependent variable which will be the same for both regression models.

	r over 5 years	r before COVID-19	r since COVID-19
SR & ESG score	0,366	0,432	0,309
SR & E score	0,292	0,319	0,263
SR & S score	0,231	0,251	0,217
SR & G score	0,319	0,473	0,205

Table 3; Correlations in three different scenarios

Model	Unstandardized β	Coefficients Std. Error	t-value	Sig. (p-value)	Standardized Beta	R-squared
(Constant)	,525	,703	,747	,458		,249
ESG score	-,004	,012	-,371	,712	-,067	
Log(market cap)	,306	,100	3,058	,003	,550	

Table 4; Summary table regression model ESG score

Model	Unstandardized β	Coefficients Std. Error	t-value	Sig. (p-value)	Standardized Beta	R-squared
(Constant)	,740	,720	1,027	,309		,270
Environmental score	-,012	,010	-1,222	,227	-,227	
Social score	,001	,008	,153	,879	,021	
Governance score	,001	,005	,314	,755	,042	
Log(market cap)	,356	,112	3,176	,002	,639	

Table 5; Summary table regression model Environmental, Social and Governance score

The ESG score has been set as independent variable, the log-transformed market cap has been set as control variable and the number of observations is 64.

The variables has been put into SPSS and the results of the regression model analysis has been set in table 4. If we look at the overall fit of the model, we see that R-squared is 0,249, indicating that approximately 24.9% of the variance in the Sharpe ratio is explained by the ESG score and log-transformed market cap.

If we look at the significance of the variables, it can be stated that the coefficient for the ESG score is -0.004 with a p-value of 0.712, indicating that it is not statistically significant. Besides this, the t-value of the ESG score variable is -0,371 which would not exceed the critical value and show no statistical significance with a 95% confidence level.

In this first regression model the control variable, the log-transformed market cap, shows a coefficient of 0,306 which indicate that the log-transformed market cap is a strong predictor of the Sharpe ratio. Further, it shows a p-value of 0,003 and a t-value of 3,058. Both these values indicate that the coefficient for the log-transformed market cap is positive and statistically significant, suggesting that as the market cap increases, the Sharpe ratio also increases.

4.4.2 Sharpe ratio and Environmental, Social and Governance score

Now, there will be looked at the second regression model between the Sharpe ratio and the Environmental score, the Social score and the Governance score. In this regression, the Sharpe ratio will, again, be set as the dependent variable. As independent variables, there will be the Environmental score, the Social score and the Governance score. The log-transformed market cap is set as control variable and the number of observations is 64.

The variables has been put into SPSS and the results of this regression has been stated in table 5. First we look at the overall fit of the model. It is stated that R-squared is 0.270, indicating that approximately 27.0% of the variance in the Sharpe ratio is explained by the environmental, social, and governance scores, along with the log-transformed market cap.

We will look at the significance of the four variables in this regression model individually. The first independent variable is the Environmental score. Looking at the results of the Environmental score, it can be stated that the coefficient is -0,012, the p-value is 0,227 and the t-value is set at -1,222. These results indicate that the Environmental score variable is

not statistically significant with a confidence level of 95%. The p-value is higher than 0,05 and the t-value does not exceed the critical value.

The second independent variable is the Social score. Looking at the results of the Social score, it can be stated that the coefficient is 0,001, the p-value is 0,879 and the t-value is set at 0,153. These results indicate that the Social score variable is not statistically significant with a confidence level of 95%. The p-value is higher than 0,05 and the t-value does not exceed the critical value.

Looking at the third independent variable, the Governance score, the results are quite the same as the Environmental and Social score. It can be stated that the coefficient is 0,001, the p-value is 0,755 and the t-value is set at 0,314. These results indicate again that the Governance score variable is not statistically significant with a confidence level of 95%. The p-value is higher than 0,05 and the t-value does not exceed the critical value.

Within this regression model the control variable, the log-transformed market cap, shows a coefficient of 0,356 which indicate that the log-transformed market cap is a strong predictor of the Sharpe ratio. Further, it shows a p-value of 0,002 and a t-value of 3,176. Both these values indicate that the coefficient for the log-transformed market cap is positive and statistically significant, suggesting that as the market cap increases, the Sharpe ratio also increases.

5. DISCUSSION

This study conducted a research about the influence of the ESG factors on the RAP of the oil and gas sector in Europe. For this research the Sharpe ratio has been chosen as variable of the RAP. To investigate the influence of ESG on the RAP, other variables of the RAP could have been chosen as well. In this research, there has not been found a form of regression and so a causation between the ESG variables and the Sharpe ratio. It is a possibility, when other/more variables of the RAP has been used for this research, that the results would have been different. For these regression models there has been one control variable which is the market cap. Within the big companies which were used for this research, there could be more variables which influence the Sharpe ratio of a company than just the ESG scores and the market cap. So for a more specific result on the research, more control variables could have been used.

Furthermore, the data which has been chosen for the ESG variables has been set by Refinitiv Eikon. This is one of the major ESG score providers, however the way they conduct their data is different from the other providers of ESG ratings. For this research the data of ESG variables has been found for five years at the provider Refinitiv. The data of more years couldn't be retrieved from the other providers of ESG scores in this time. But by looking at the most recent scores at different providers and the methodology used, there are some differences in conducting the scores. By taking the ESG variables of multiple providers, the research could have been more precise and it would have been looked at from multiple perspectives.

Further, for the methods used in this research, assumptions has been made. One assumption has been that the relationship between the ESG variables and the Sharpe ratio is linear. In reality it is possible that such an assumption could be wrong which would influence the choice of tests used for the research.

In prior research on the influence of ESG variables, there has been research which stated that ESG variables did have impact on the RAP, but there were papers which concluded that there was no influence at all as well. In the research of Wanday & Ajour El Zein (2022), for example, they provide some coherence between ESG strategies and the level of returns for investors in the oil and gas sector. However, this study has not looked at the relationship in the form of correlation or regression. In this research there has not been found any causation of regression between the ESG variables and the Sharpe ratio and therefore it has a different result than most studies before.

5.1 Recommendation

Like told, there has been some points which could have influenced the research of this paper. If further research would be conducted on this topic, I would recommend to use multiple sources for the data collection of the ESG variables. A broader perspective of the providers of the ESG variables would give a more specific result on how different companies are performing within the ESG, which would led to a more specific result of the tests.

Further recommendation would be to not just use the Sharpe ratio as variable of the RAP. The Sharpe ratio is a good component to look at the RAP, however, it is not the only one which shows results of the RAP. So for further research I would suggest to look additionally in the possibilities of variables which could be used.

6. CONCLUSION

In this research, the research question which is investigated is as follows: *"What is the impact of Environmental, social, and governance (ESG) on the risk-adjusted performance for investments in the oil and gas sector in Europe?"*.

This question has been researched by looking into the relationship between the ESG compartments and the Sharpe ratio as variable of the RAP. This relationship has been looked into by conducting a multiple regression analysis to look for a possible causation and there has been looked at the statistical significance of the ESG variables on the Sharpe ratio. The correlation between the variables has been investigated as well to see how strong a possible relationship would be.

Looking at the results, it can be concluded that there is no significant impact from any of the three different compartments of the ESG variables, or the overall ESG score, on the Sharpe ratio and so the RAP. The hypothesis that there would be no significant impact form the variables on the Sharpe ratio, could not be rejected based on any of the four results. This tells us that the ESG variables are not impacting the scores of the RAP. However, there is no causation between the ESG variables and the Sharpe ratio, but there has been a small result on the correlation.

For the correlation between the Sharpe ratio and the four different ESG variables, there has been looked at the correlation over five years, the correlation before COVID-19 and the correlation since COVID-19 started, all in the years from 2018 up to 2022. If we look at the difference between the correlations before COVID-19 and since COVID-19, we can state that all of the correlations showed a decrease since COVID-19 started. The most noticeable decrease is seen in the Governance sector. The correlation between the Sharpe ratio and the Governance variable decreased from 0,473 to 0,205 since COVID-19 started.

Overall, the correlation before COVID-19 between the Sharpe ratio and the total ESG score, the Environmental score and the Governance score were all found as a low positive correlation. This means that there was a small form of relationship between the Sharpe ratio and those variables. Here, the correlation between the Sharpe ratio and the Social score is negligible

The correlation since the beginning of COVID-19 shows as result that there was only a low positive correlation between the Sharpe ratio and the total ESG score. This means that since COVID-19, instead of three variables, just one variable has a small form of relationship with the Sharpe ratio. The Sharpe ratio in combination with the variables of the Environmental score, the Social score and the Governance score showed a negligible correlation.

If we look at the correlations over five years, we see that the correlation between the Sharpe ratio and both the total ESG score and the Governance score has a low positive correlation. This indicates that there was a small form of relationship between the Sharpe ratio and those two variables over a period of five years. The Sharpe ratio in combination with the variables of the Environmental score and the Social score showed a negligible correlation.

Overall, the onset of COVID-19 has led to a noticeable decrease in the correlation between the Sharpe ratio and the ESG variables, especially in the Governance sector. While there was initially a small positive relationship with multiple ESG variables, this relationship has weakened since COVID-19, with only the total ESG score maintaining a low positive correlation with the Sharpe ratio in the more recent period.

Further, the issues mentioned in the report were; the climate policies, the reduced financing, the energy crisis and the transition to renewable energy. These issues are linked to the oil and gas sector in Europe and they are formed out of ESG concerns. If the ESG scores would be increased for the oil and gas sector in Europe, it is a possibility that some of these issues would be solved. However, out of this research it could not be said that it would benefit these issues from the oil and gas sector in Europe with certainty.

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8. REFERENCES

1) Al Amosh, H., Khatib, S. F. A., & Ananzeh, H. (2022). Environmental, social and governance impact on financial performance: Evidence from the Levant countries. *Corporate Governance: The International Journal of Business in Society*, *23*(3), 493–513. https://doi.org/10.1108/cg-03-2022-0105
2) Baldridge, R. (2023, November 9). *Understanding the Sharpe ratio*. Forbes. https://www.forbes.com/advisor/investing/sharpe-ratio/
3) Boffo, R., and R. Patalano (2020). *ESG Investing: Practices, Progress and Challenges*. OECD Paris. www.oecd.org/finance/ESG-Investing-Practices-Progress-and-Challenges.pdf
4) Bogmans, C., Pescatori, A., & Prifti, E. (2023, October 29). *The impact of climate policies on oil and Gas Investment*. CEPR. https://cepr.org/voxeu/columns/impact-climate-policies-oil-and-gas-investment
5) Carles, P. G. (2015). Risk-adjusted performance measurement. *Investment Risk Management*, 365–386. https://doi.org/10.1093/acprof:oso/9780199331963.003.0019
6) CGEP, C. |. (2020, November 18). *ESG investing and the oil and gas industry: Moving toward a holistic approach to risk, governance; performance measurement, Disclosure, and Results - Center on Global Energy Policy at Columbia University Sipa: CGEP*. Center on Global Energy Policy at Columbia University SIPA | CGEP. https://www.energypolicy.columbia.edu/publications/esg-investing-and-oil-and-gas-industry-moving-toward-holistic-approach-risk-governance-performance/
7) Cuemath. (2023). *Correlation and regression - difference, definition, examples*. Cuemath. https://www.cuemath.com/data/correlation-and-regression/
8) de Souza Barbosa, A., da Silva, M. C. B. C., da Silva, L. B., Morioka, S. N., & de Souza, V. F. (2023, July 13). *Integration of environmental, social, and governance (ESG) criteria: Their impacts on corporate sustainability performance*. Nature News. https://www.nature.com/articles/s41599-023-01919-0
9) Eccles, R. G., & Klimenko, S. (2019, June). *Shareholders are getting serious about sustainability*. Harvard Business Review. https://hbr.org/2019/05/the-investor-revolution
10) Ellis, J. (2023, April 6). *What are the three pillars of ESG?*. The Corporate Governance Institute. https://www.thecorporategovernanceinstitute.com/insights/lexicon/three-pillars-of-esg-ultimate-guide-to-esg/
11) Eratalay, M., & Cortés Ángel, A. (2022). The impact of ESG ratings on the systemic risk of European blue-chip firms. *Journal of Risk and Financial Management*, *15*(4). https://doi.org/10.3390/jrfm15040153
12) Fattouh, B., Poudineh, R., & West, R. (2019). The rise of renewables and energy transition: What adaptation strategy exists for oil companies and oil-exporting countries? *Energy Transitions*, *3*(1–2), 45–58. https://doi.org/10.1007/s41825-019-00013-x
13) Fisher, J. D., & DAlessandro, J. (2018). Risk adjusted performance attribution. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3232392
14) Gatfaoui, H. (2009). Estimating fundamental Sharpe ratios. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1438258
15) Gonçalves, T., Pimentel, D., & Gaio, C. (2021). Risk and performance of European Green and conventional funds. *Sustainability*, *13*(8). https://doi.org/10.3390/su13084226
16) Grasso, M. (2018). Oily politics: A critical assessment of the oil and gas industry's contribution to climate change. *Energy Research & Social Science*, *50*, 106–115. https://doi.org/10.1016/j.erss.2018.11.017
17) IEA. (2023). *Global energy crisis – topics*. https://www.iea.org/topics/global-energy-crisis
18) Jain, G. (2023, March 2). *Investing in oil and gas transition assets en route to net zero - center on global energy policy at Columbia University Sipa: CGEP*. Center on Global Energy Policy at Columbia University SIPA | CGEP. https://www.energypolicy.columbia.edu/publications/investing-in-oil-and-gas-transition-assets-en-route-to-net-zero-2/
19) Jin, I. (2020). ESG-screening and factor-risk-adjusted performance: The concentration level of screening does matter. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3722485
20) Katanich, D. (2023, October 9). *What Europe needs to be powered exclusively by renewables by 2030*. euronews. https://www.euronews.com/2023/10/09/europe-can-become-energy-self-sufficient-by-2030-but-it-comes-with-a-hefty-price-tag-study
21) Kozak, K. (2021). *Chapter 10: Regression and Correlation*. Coconino college. https://www.coconino.edu/resources/files/pdfs/academics/sabbatical-reports/kate-kozak/chapter_10.pdf
22) le Sourd, V. (2023, August 23). *Does ESG investing improve risk-adjusted performance?*. EDHEC Risk Climate Impact Institute. https://climateimpact.edhec.edu/does-esg-investing-improve-risk-adjusted-performance
23) Lioudis, N. (2022, June 3). *Understanding the Sharpe ratio*. Investopedia. https://www.investopedia.com/articles/07/sharpe_ratio.asp
24) Lo, A. W. (2002). The statistics of Sharpe ratios. *Financial Analysts Journal*, *58*(4), 36–52. https://doi.org/10.2469/faj.v58.n4.2453
25) LSEG. (2023, December). Environmental, Social & Governance Scores Guide. https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf
26) Malhotra, D. K., Mooney, T., Poteau, R., & Russel, P. (2023). Assessing the performance and risk-adjusted returns of Financial Mutual Funds. *International Journal of Financial Studies*, *11*(4). https://doi.org/10.3390/ijfs11040136
27) Mallin, C. A. (2019). Directors and Board structure. In *Corporate governance* (pp. 199–236). essay, Oxford University Press.
28) McGlade, C. (2020). *The Oil and Gas Industry in Energy Transitions*. https://doi.org/10.1787/aef89fbd-en

29) Modigliani, F., & Modigliami, L. (1997). Risk-Adjusted Performance – How to measure it and why. *Journal of Portfolio Management, 45-54.* https://spauldinggrp.com/wp-content/uploads/2020/11/modigliani-modigliani.pdf
30) Mukaka, M. M. (2012, September). *Statistics corner: A guide to appropriate use of correlation coefficient in medical research*. Malawi medical journal : the journal of Medical Association of Malawi. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3576830/
31) Novisto. (2023, July 28). *The importance of environmental, social, and governance practices in business*. https://novisto.com/the-importance-of-esg-practices-in-business/
32) Papadis, E., & Tsatsaronis, G. (2020). Challenges in the decarbonization of the Energy Sector. *Energy*, *205*. https://doi.org/10.1016/j.energy.2020.118025
33) Parikh, A., Kumari, D., Johann, M., & Mladenović, D. (2023). The impact of environmental, social and governance score on shareholder wealth: A new dimension in investment philosophy. *Cleaner and Responsible Consumption*, *8*. https://doi.org/10.1016/j.clrc.2023.100101
34) Ramírez-Orellana, A., Martínez-Victoria, Mc., García-Amate, A., & Rojo-Ramírez, A. A. (2023). Is the corporate financial strategy in the oil and gas sector affected by ESG dimensions? *Resources Policy*, *81*, 103303. https://doi.org/10.1016/j.resourpol.2023.103303
35) Raneses, Anton (2020). Beyond Firms Doing Good: The Impact of Environmental, Social, and Governance Factors (ESG) on the Financial Performance of Philippine Companies. *Harvard University.* https://scholar.harvard.edu/files/antonraneses/files/raneses_anton_capstone-clean_copy_final_draft_v_rgate.pdf
36) Redmond, S., Watters, T. A., & Grande, M. (2019, June 3). *ESG Industry Report Card: Oil and Gas*. S&P Global Homepage. https://www.spglobal.com/en/research-insights/articles/esg-industry-report-card-oil-and-gas
37) Rushton, L. (2021, September 22). *ESG: How it applies to the oil & gas industry and why it matters*. Womble Bond Dickinson. https://www.womblebonddickinson.com/us/insights/articles-and-briefings/esg-how-it-applies-oil-gas-industry-and-why-it-matters
38) Samarakoon, L. P., & Hasan, T. (2022). Methods for portfolio performance evaluation. *Encyclopedia of Finance*, 983–990. https://doi.org/10.1007/978-3-030-91231-4_35
39) Sarstedt, M., & Mooi, E. (2019). Hypothesis Testing and ANOVA. In *A Concise Guide to Market Research* (pp. 151–208). Springer Texts in Business and Economics. Springer, Berlin, Heidelberg.
40) Sarstedt, M., & Mooi, E. (2019). Regression Analysis. In *A Concise Guide to Market Research* (pp. 209–256). Springer Texts in Business and Economics. Springer, Berlin, Heidelberg.
41) Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia & Analgesia*, *126*(5), 1763–1768. https://doi.org/10.1213/ane.0000000000002864
42) Semieniuk, G., Holden, P. B., Mercure, J.-F., Salas, P., Pollitt, H., Jobson, K., Vercoulen, P., Chewpreecha, U., Edwards, N. R., & Viñuales, J. E. (2022). Stranded fossil-fuel assets translate to major losses for investors in Advanced Economies. *Nature Climate Change*, *12*(6), 532–538. https://doi.org/10.1038/s41558-022-01356-y
43) Sharpe, W. F. (1998). The Sharpe ratio. In *Streetwise: The best of the journal of portfolio management* (pp. 169–187). essay, Princeton University.
44) Sureiman, O., & Mangera, C. (2020). F-test of overall significance in regression analysis simplified. *Journal of the Practice of Cardiovascular Sciences*, *6*(2), 116. https://doi.org/10.4103/jpcs.jpcs_18_20
45) The BMJ. (2020b, October 28). *11. correlation and regression: The BMJ*. The BMJ | The BMJ: leading general medical journal. Research. Education. Comment. https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression
46) Wanday, J., & Ajour El Zein, S. (2022). Higher expected returns for investors in the energy sector in Europe using an ESG strategy. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.1031827
47) Wilkes, T. (2023, February 10). *Investors urge European banks to end new oil and Gas Financing*. Reuters. https://www.reuters.com/business/sustainable-business/investors-call-five-european-banks-end-new-oil-gas-finance-2023-02-10/
48) Zettel, J., Tagliapietra , S., Zachmann , G., & Heussaff , C. (2022, December 1). *Beating the European Energy Crisis*. IMF. https://www.imf.org/en/Publications/fandd/issues/2022/12/beating-the-european-energy-crisis-Zettelmeyer

9. APPENDICES

9.1. Appendix A

COMPANY	MARKET GAP AT THE END OF 2023
SHELL	$ 214,73 B
TOTALENERGIES	$ 163,46 B
BP	$ 102,31 B
EQUINOR	$ 94,55 B
ENI	$ 55,21 B
NESTE	$ 27,33 B
CEZ GROUP	$ 23,02 B
REPSOL	$ 18,25 B
AKER BP	$ 18,37 B
OMV	$ 14,30 B
GALP ENERGIA	$ 12,03 B
CENTRICA	$ 9,76 B
TÜRKIYE PETROL RAFINERILERI	$ 9,34 B
TECHNIPFMC	$ 8,77 B

Table 6; List of selected companies by market gap

9.2 Appendix B

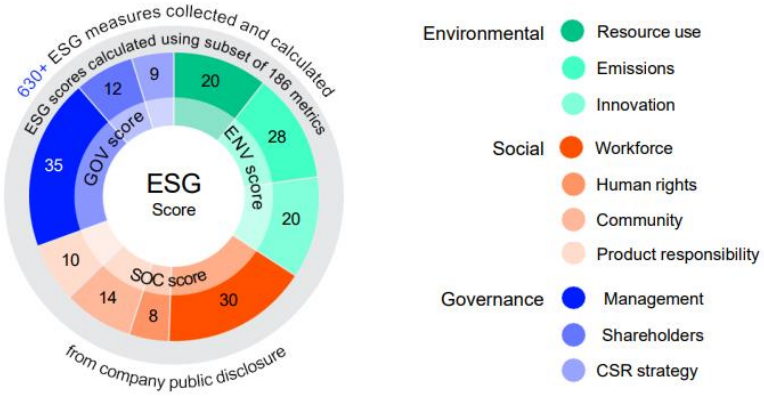

Figure 1; Distribution of categories over ESG variables

9.3 Appendix C

Score	Definition
LSEG ESG resource use score	The resource use score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.
LSEG ESG emissions reduction score	The emission reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes.
LSEG ESG innovation score	The innovation score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or eco-designed products.
LSEG ESG workforce score	The workforce score measures a company's effectiveness in terms of providing job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.
LSEG ESG human rights score	The human rights score measures a company's effectiveness in terms of respecting fundamental human rights conventions.
LSEG ESG community score	The community score measures the company's commitment to being a good citizen, protecting public health and respecting business ethics.
LSEG ESG product responsibility score	The product responsibility score reflects a company's capacity to produce quality goods and services, integrating the customer's health and safety, integrity and data privacy.
LSEG ESG management score	The management score measures a company's commitment and effectiveness towards following best practice corporate governance principles.
LSEG ESG shareholders score	The shareholders score measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.
LSEG ESG CSR strategy score	The CSR strategy score reflects a company's practices to communicate that it integrates economic (financial), social and environmental dimensions into its day-to-day decision-making processes.

Table 7; Definitions of ESG categories on Refinitiv Eikon

9.4 Appendix D

Company	Annualized Sharpe Ratio	ESG score	Environmental score	Social score	Governance score
Shell 2022	1,8689	93,39	92,43	93,78	94,1
Shell 2021	1,8569	92,73	90,9	92,59	95,66
Shell 2020	1,6849	94,01	91,35	95,29	95,65
Shell 2019	1,8951	87,37	90,34	78,95	98,01
Shell 2018	2,0989	87,68	91,66	80,01	95,5
TotalEnergies 2022	1,2656	82,1	90,55	87,7	59,73
TotalEnergies 2021	1,6704	83,89	91,1	87,41	67,03
TotalEnergies 2020	1,6762	89,51	92,51	90,1	84,06
TotalEnergies 2019	1,4539	85,46	92,21	83,42	79,2
TotalEnergies 2018	1,5567	84,95	92,19	84,13	75,79
BP 2022	0,7838	87,15	89,79	82,39	91,8
BP 2021	1,1343	89,86	89,81	88,04	93,2
BP 2020	1,1055	86,32	80,24	87,73	92,74
BP 2019	0,9137	87,42	80,34	89,86	93,47
BP 2018	1,1317	90,35	85,26	92,6	93,8
Equinor 2022	1,3842	76,56	75,67	72,07	85,87
Equinor 2021	1,8533	77,94	77,21	71,7	90,17
Equinor 2020	1,6463	80,5	76,72	77,75	90,95
Equinor 2019	1,3252	78,68	75,92	77,66	84,55
Equinor 2018	1,4826	81,97	84,73	79,25	82,76
ENI 2022	0,9987	87,28	83,91	92,69	82,58
ENI 2021	1,3732	83,84	70,68	93,45	85,99
ENI 2020	1,3876	83,16	71,5	91,27	85,8
ENI 2019	1,1106	82	69,84	93,15	79,95
ENI 2018	1,3156	83,52	71,52	93,06	84,11
Neste 2022	2,1004	78,34	71,23	80,08	85,68
Neste 2021	2,5844	78,91	72,23	79,63	87,43
Neste 2020	3,0345	72,3	73,08	67,94	78,92
Neste 2019	2,9177	74,4	68,63	75,31	81,22
Neste 2018	2,8236	77,91	70,32	78,07	88,75
CEZ Group 2022	1,5163	66,32	79,69	71	37,5
CEZ Group 2021	1,9202	67,19	75,21	66,72	54,17
CEZ Group 2020	1,5284	65,24	76,63	67,85	42,5
CEZ Group 2019	0,6562	63,28	78,26	62,25	39,17
CEZ Group 2018	1,5686	63,7	72,6	70,93	39,17
Repsol 2022	0,4894	88,44	89,46	94,31	76,47
Repsol 2021	0,7792	85,34	88,34	90,68	71,44
Repsol 2020	0,7522	83,07	89,44	87,8	65,28
Repsol 2019	0,3906	87,53	86,6	90,11	84,33
Repsol 2018	0,5549	84,19	89,47	87,7	70,21
Aker BP 2022	6,4854	62,57	51,72	66,18	72,02
Aker BP 2021	7,3145	68,81	57,92	70,03	82,62
Aker BP 2020	7,9663	68,65	58,99	69,26	81,71

Aker BP 2019	8,5171	61,02	53,98	62,08	69,45
Aker BP 2018	10,0364	59,93	51,59	64,07	64,8
OMV 2022	0,7661	83,54	76,47	89,63	83,06
OMV 2021	1,1007	83,83	76,87	90,91	81,43
OMV 2020	1,2559	81,14	75,48	82,74	86,57
OMV 2019	0,7407	77,61	66,37	82,16	85,96
OMV 2018	1,1160	77,32	65,32	82,52	85,67
Galp Energia 2022	0,7770	70,99	73,96	90,82	31,27
Galp Energia 2021	1,0496	72,88	75,07	89,26	40,48
Galp Energia 2020	1,0418	71,29	71,18	85,02	46,98
Galp Energia 2019	0,9764	71,58	72,43	85,92	44,76
Galp Energia 2018	1,2726	63,72	66,13	80,22	30,73
Centrica 2022	0,0635	68,84	68,14	62,68	78,95
Centrica 2021	0,0882	67,5	71,17	59,71	72,06
Centrica 2020	-0,0589	64,79	61,87	58,6	78,93
Centrica 2019	-0,4507	58,79	60,13	56,89	59,12
Centrica 2018	-0,3904	59,49	63,59	63,53	46,29
Türkiye Petrol Rafinerileri 2022	0,7817	67,75	59,52	88,96	41,98
Türkiye Petrol Rafinerileri 2021	0,9998	72,89	66,28	88,61	54,55
Türkiye Petrol Rafinerileri 2020	0,8497	66,38	59,61	78,12	55,36
Türkiye Petrol Rafinerileri 2019	0,5058	63,08	45,49	72,52	72,06
Türkiye Petrol Rafinerileri 2018	0,2091	56,58	50,78	72,95	35,89
TechnipFMC 2022	1,0545	67,43	56,73	65,97	81,99
TechnipFMC 2021	1,0505	68,35	58,82	66,81	81,65
TechnipFMC 2020	1,0650	67,61	53,24	69,06	82,32
TechnipFMC 2019	1,0236	65,46	58,74	67,66	70,16
TechnipFMC 2018	1,4524	62,99	53,46	66,53	69,08

Table 8; Selected data for research