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The Effect of ESG Ratings on Firm Performance During the COVID-19 Recovery: Evidence from the Dutch Market

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Abstract

Amid the growing importance of sustainable investing, this thesis investigates the influence of ESG ratings and industry-specific effects on Dutch companies' firm performance during the post-COVID-19 recovery period. The focus lies on Dutch companies listed on Euronext. Data is collected through Thomson Reuters and Eikon Datastream. Firm performance is measured through Total Shareholder Return and Share Risk. Regressions are conducted in Stata using panel data regression with random effects models, control variables, and industry-fixed effects. Robustness checks that exclude the crisis period are conducted to confirm the results. The study finds no significant effect of ESG scores or industry-specific effects on Total Shareholder Return or Share Rusk during the COVID-19 recovery period.

Keywords: *ESG, Industry-Specific effects, COVID-19, Total Shareholder Return, Share Risk*

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Chapter 1 Introduction

The term ''Environmental, Social and Governance'' was first mentioned in the United Nation's Principles for Responsible Investment (PRI) in 2004. Although the term ESG has only been around for 20 years, Socially Responsible Investing (SRI) has been for much longer. Since then, an extensive market has developed surrounding ESG. ESG has become an indispensable component in today's corporate policies and investment strategies. Now that firms have started implementing ESG practices into their business operations, this has given rise to the question whether these ESG rankings have any influence over corporate performance. Literature shows that firms with higher ESG scores are linked to higher firm performance (Friede et al., 2015). It is particularly relevant to examine the effect of this relationship in extraordinary market conditions. Studies have been conducted in the 2008 financial crisis, which resulted in differing views with regards to the effect of ESG on firm performance. In one instance, firms with unusually high and low Corporate Social Performance (CSP) resulted in having a higher financial performance during the financial crisis (Brammer & Millington, 2008). Another research suggested that firms with high Environmental and Social (E&S) performance profited from lower bond spreads, while no effect was found in the period outside of the crisis (Amiraslani et al., 2023). A more recent financial crisis which has intrigued many academics is the COVID-19 crisis. The pandemic was marked by high market uncertainty, which led to a decline in market return and an increase in volatility. This period is a good measure to prove the robustness of ESG practices. Therefore, this thesis aims to explore the effect of ESG scores on firm performance during the COVID-19 recovery period.

What is most remarkable from existing literature is that the impact of ESG scores can vary per sector. Khan (2019) and Garcia et al. (2017) revealed that especially firms in the Energy and Technology sectors benefit from higher ESG scores. These types of industries rely heavily on innovation and sustainable practices. The Energy sector, for example, has strict regulations and experiences increased pressure to operate sustainably. As a result, companies in the Energy Sector with high ESG scores tend do better financially than those with low ESG scores.

In the United States extensive research has already been conducted on this relationship. On the contrary, surprisingly little is known about how ESG scores affect companies in the Netherlands. In particular, the question of whether sector-specific patterns are present has not yet been researched. This thesis therefore focuses on filling this gap within existing literature by analyzing how ESG scores affect firm performance of Dutch companies during the COVID-19 recovery period. A special industry specific focus is investigated to analyze whether these patterns are present in the influence of ESG scores.

This leads to the research question to which this thesis is looking to find an answer to:

How do ESG ratings influence stock performance across various industries in the Dutch market during the post-COVID-19 economic recovery, and does this influence exhibit industry-specific patterns?

Chapter 2 Literature Review

This thesis analyses the ESG ratings of Dutch companies combined with their stock returns in time of the COVID-19 crisis. The first subchapter (2.1) describes ESG ratings and explains how they are managed based on available literature. The second subchapter (2.2) deals with studies that analyze firm performance in relation to ESG rankings. The third subchapter (2.3) links the results on ESG scores and stock performance to the COVID-19 crisis. Finally, two hypotheses are formed based on this information.

2.1 ESG ratings and firm performance

Environmental, Social and Governance (ESG) criteria date back to the early 1970s (Friede et al., 2015). Since then, they have become indispensable in financial analyses. As a result, companies have started assigning scores to ESG standards – known as ESG rankings. One of the main providers of ESG ratings, and the one used for this thesis, is Thomson Reuters ESG. Thomson Reuters calculates its ESG scores by collecting data on more than 400 ESG metrics (Thomson Reuters, 2023). These statistics are divided into 10 themes under the ESG pillars.

The term ‘’ESG’’ was first mentioned in the United Nations Principles of Responsible Investment in 2004 (Alareeni & Hamdan, 2020). Since then, the market surrounding ESG has developed significantly. ESG scores have been standardized, thus making them more reliable. This allows for easier comparisons between companies and sectors. However, the reliability of ESG scores has been subject to considerable scrutiny in recent years. Rankings have been discredited due to the inconsistencies and lack of uniformities between rating agencies. In fact, there are substantial differences in ESG ratings amongst the most prominent providers (Berg et al., 2022). These differences have greatly weakened the reliability and credibility of ESG scores. Despite these perils, ESG ratings continue to play a vital role in assessing corporate performance and investment decisions. Many studies have therefore researched this relationship. According to a study, with findings from more than 2,000 empirical studies, there is a positive relationship between ESG criteria and financial performance (Friede et al., 2015). About 90% of the studies reviewed showed a nonnegative correlation between ESG scores and financial performance. A large majority of the studies even found a positive result. Furthermore, these findings were constant over time. This study also brought to light that the relationship between ESG and firm performance can differ per region. North America showed a higher percentage of positive results than Europe. In addition, emerging markets had an even higher percentage of positive outcomes. Shanaev and Ghimire (2022) further build on these findings. They examined market reactions based on ESG rating changes, rather than levels, with a particular focus on the asymmetry between positive and

negative changes surrounding ESG. Indeed, their study found that downgrades in ESG ratings have a greater impact on stock performance than positive upgrades.

In short, it is of importance to have a well-defined measure of financial performance so that the impact of ESG scores can be measured. One such measure is Total Shareholder Return. Total Shareholder Return calculates the increase in share price and dividend paid over a given period. TSR is often used to measure a company's financial performance, especially from the perspective of stakeholders (Burgman & Van Clieaf, 2012). It combines both capital gains and income returns to shareholders. By taking into account market expectation and dividend payments, TSR provides a clear measure of company value for shareholders. One of the ways this thesis measures firm performance is by using Total Shareholder Return. Therefore, the first hypothesis is as follows:

H1: High ESG scores positively impact Total Shareholder Return (TSR) during the post-COVID-19 economic recovery compared to firms with lower ESG ratings.

2.2 ESG and firm performance during the COVID-19 crisis

During a crisis, both consumer and investor confidence is at a low. One would assume that companies with strong ESG practices can gain an advantage during such periods. This is also the conclusion drawn by Lins et al. (2017). Companies with high social capital performed better during the 2008 financial crisis than those with low social capital. This was because higher social capital led to increased trust and support from stakeholders. The vigor and performance of ESG stocks during financial crises has intrigued many academics, especially in context of the COVID-19 crisis. Alberquerque et al. (2020) used panel regression to show that high ESG scores are a predictor of better firm performance. Stocks with high ESG scores had higher stock returns, lower return volatility and better profit margins during the crisis than companies with low scores. The resilience of these stocks was attributed to strong customer and investor loyalty.

Garel and Petit-Romec (2020) investigated the effect of COVID-19 on the share prices of firms with high ESG scores. This study revealed that companies with better ESG performance showed greater resilience. This resilience was strongest during the early stages of the COVID-19 crisis. The early stages of the crisis are indicated as February 20 to March 20, 2020. This is similar to the *crash* period investigated in this thesis. Furthermore, Liu et al. (2023) highlight the role of ESG performance on mitigating the effects of the COVID-19 crisis on the stock market. It was found that companies with high ESG scores performed better and showed less volatility during the pandemic. It appears that investors attach less risk to companies with high ESG scores during the crisis. The findings of this study are particularly relevant to this thesis. This thesis uses share risk, measured through the standard

deviation of stock returns, as the second measure of firm performance. Lower volatility, as indicated by the standard deviation, reflects reduced risk. Therefore, the second hypothesis of this thesis is as follows:

H2: Firms with higher ESG ratings exhibit lower share risk during the COVID-19 crisis compared to firms with lower ESG ratings.

Contrary to previous studies, Pavlova and Boyrie (2021) present quite different views. Their study focuses on the performance of ESG exchange traded funds (ETF's) during the COVID-19 crash. Whereas Friede et al. (2015) and Liu et al. (2023) emphasize the strong relationship between high ESG scores and higher firm performance, Pavlova and Boyrie (2021) dispute the protective role of ESG scores during crises. Before the pandemic, ESG ETFs with high sustainability ratings outperformed ETFs with lower ratings. However, during the market crash, high rated ESG ETFs did not continue to outperform. The protective effect that might be expected from high ESG ratings was thus not consistently observed here. Broadstock et al. (2021) build on this with a study of ESG performance during the COVID-19 crisis in China. The results show that in the short term, ESG scores are positively associated with stock returns. A significant contribution is seen in the Environmental (E) and Governance (G) pillars. The Social (S) pillar, however, shows no positive effect. In some instances, even, a negative effect on stock returns were found. This highlights that not all ESG pillars contribute equally during crises. It rather confirms that high ESG performance matters to some extent during crises but are less significant under normal circumstances.

2.3 ESG and Firm Performance Across Different Industries

The impact of changes in ESG ratings varies by sector. Sensitive industries show better ESG performance (Garcia et al., 2017). Sensitive industries are defined according to Richardson and Welker (2001) and include companies involved in oil, gas, chemicals, mining, and steel production. These industries are subject to strict regulations and stringent monitoring. As their social and environmental performance is closely observed, companies in these sectors tend to adopt rigorous ESG practices. Sectors such as manufacturing, construction, transport, and mining show a stronger positive relationship between ESG disclosure and firm value because of their environmental footprint and social impact (Qureshi et al., 2020). These studies show the importance of taking sector specific ESG risks into account. Therefore, the last two hypotheses read as follows:

H3: The influence of ESG ratings on Total Shareholder Return varies significantly across different industries.

H4: The influence of ESG ratings on share risk varies significantly across different industries.

Khan (2019) elaborates on the relationship between ESG performance and stock returns by focusing on ESG materiality. ESG materiality relates to ESG issues that are most important to a company's core business. The study uses a dataset from MSCI to conduct cross-sectional regression analysis, covering firms across 42 countries. Higher ESG scores, especially scores related to material issues, predict better equity returns. The positive relationship between ESG scores and equity returns is consistent across regions and sectors. The benefits of having good ESG performance, therefore, do not depend on any market in particular. The study emphasizes that high ESG scores result in better long-term stock returns.

Contrary to previous studies which found a positive relationship, Duque-Grisales and Aguilera-Caracuel (2019) show a negative relationship between ESG scores and financial performance for multinational companies in Latin America. Even after considering the three pillars of ESG separately, the negative relationship persists. The studies by Friede et al. (2015) and Khan (2019) emphasize the positive relationship between ESG and firm performance in developing markets. Duque-Grisales and Aguilera-Caracuel present an opposing perspective for emerging markets. In fact, they describe that the findings from developed market cannot simply be implemented on a global scale. Their results showed a negative correlation between ESG scores and corporate performance in the context of emerging markets. They go even further by stating that there are no net financial benefits associated with high ESG ratings. Instead, returns depend heavily on the regions and challenges companies face.

Chapter 3 Data

This chapter outlines the data used to analyze the influence of ESG ratings on the performance of Dutch companies during the COVID-19 recovery period. Two dependent variables are used in this thesis: Total Shareholder Return (TSR) and Share Risk. The financial data was obtained through the Refinitiv Eikon platform and the ESG data was retrieved through the Thomson Reuters *entire universe* database. The dataset was then filtered to include only companies listed on Euronext Amsterdam, resulting in a final sample of 57 companies. Some companies had missing ESG data for several years. The data that were missing were mostly concentrated either at the beginning, or the end of the study period, but not randomly distributed throughout. It is therefore concluded that the missing data most likely stems from periods when ESG data collection was less consistent or did not exist at all. The vast majority of the dataset was still consistent, and the missing data did not exhibit random distribution, so it was decided to keep all companies in the dataset. The period studied ranges from January 2019 to December 2022, with data being collected monthly. This time frame was selected to capture the different phases of market behavior in the COVID-19 pandemic. Data from January 2019 to February 2020 are categorized as the *pre-crash* phase. The *pre-crash* period provides a good baseline for market and ESG performance before the impact of the pandemic. The *crash* phase, February and March 2020, includes the market crash. In March 2020, the AEX index experienced a significant crash due to the COVID-19 pandemic. The first

shock began on February 10, 2020. This decline intensified and led to a sharp drop in the AEX index in early March (Yahoo Finance, 2024). The sudden onset of the COVID-19 pandemic offers crucial insights into the immediate effects of a global crisis on stock performance. In particular, the unprecedented levels of economic uncertainty offer perspectives on corporate performance not previously known (Baker et al., 2020). The phase of *immediate* recovery began in March and ended in April. In late March, central banks and governments implemented extensive monetary and fiscal stimulus measures to stabilize economies (Keliuotyte-Staniuleniene & Kviklis, 2022). The fourth and final phase, *long-term recovery,* started in May 2020. Due to data availability, the *long-term recovery* phase ends in December 2022.

3.1 Dependent variables

The stock performance of Dutch companies is quantitatively assessed through two dependent variables: Total Shareholder Return (TSR) and Share Risk, which is measured through the standard deviation of stock returns.

3.1.1 Stock return

Stock returns are measured through Total Shareholder Return (TSR). TSR measures firm performance by including both capital gains and dividends paid to shareholders. Data to calculate TSR were obtained from Datastream through the Refinitiv Eikon platform. Total Shareholder Return was calculated monthly using the following formula:

$$TSR = \left(\frac{P_{end} - P_{beginning} + D}{P_{beginning}}\right) \times 100$$

Where:

- P_{end}: Adjusted closing price at the end of the month.
- $P_{beginning}$: Adjusted closing price at the end of the previous month.
- D: Dividends paid during the month.

3.1.2 Share risk

To provide a diverse metric of firm performance, a second dependent variable is used. Firm performance is measured through Share Risk. Share Risk provides useful insights into the risk associated with a firm's stock returns. It is calculated using the standard deviation of monthly stock returns. Using the standard deviation of shares is widely used in financial literature to assess investment risk. This is emphasized in fundamental works by Markowitz (1952), Sharpe (1966) and Fama and French (1992). For this thesis, daily closing prices for each company were collected from the Refinitiv Eikon database, for the period from January 2019 to December 2022. The calculation of daily returns was performed in Stata using the formula:

$$R_t = \left(\frac{P_t - P_{t-1}}{P_{t-1}}\right)$$

Where:

- P_t: the adjusted closing price at the end of day t.
- P_{t-1}: the adjusted closing price at the end of the previous day.

Following the calculation of the daily returns, these returns were aggregated to compute the monthly standard deviations in Stata.

3.2 Independent variable: ESG Scores

The independent variable is the firms' *ESG score*. Similar to Friede et al. (2015), the ESG data are obtained through the Thomson Reuters' database. As previously mentioned, Thomson Reuters ESG scores are based on more than 400 metrics, subdivided into ten themes. These themes are distributed across the three ESG pillars. The Environmental (E) pillar includes the themes of Resource Use, Emissions and Innovation. The Social (S) pillar includes Personnel, Human Rights, Community and Product Responsibility. Finally, the Governance (G) pillar includes the themes of Management, Shareholders and CSR Strategy. Thomson Reuters offers two main types of ESG scores, the normal ESG score and the combined ESG score. The normal ESG score evaluates a company's performance in all three pillars. The *combined ESG score* merges the normal ESG score with additional data on ESG controversies (Erasmus Data Service Centre, 2024). Controversies include any negative incidents or disputes related to ESG issues that a company may have faced. By adding this additional rating, a more accurate picture of a company's ESG performance is reflected. This measure allows for verification of firm's actions against ESG commitments. The combined ESG score is scaled from 0 to 100, with a higher score indicating better performance.

3.3 Control variables

In addition to the main variables of interest, several control variables are included to account for other factors that might influence firm performance, beyond the influence of the independent variable of ESG scores. These control variables are firm size, leverage, Return on Assets (ROA), VSTOXX, and industry fixed effects. These set of control variables have been identified in existing literature as potential influences on firm performance.

3.3.1 Firm characteristics

3.3.1.1 Firm size

According to Drempetic et al. (2019), there is a positive correlation between firm size and ESG scores. Larger firms tend to have higher ESG scores because they have more resources and different risk profiles compared to smaller firms. Also, larger firms have better resources to provide ESG data, which possibly gives them an advantage in the way ESG scores are measured. Company size was measured in several ways, some of which were revenue, market capitalization, number of employees and total assets. Bae et al. (2021) used market capitalization as a measure for firm size. For the regressions in this paper, due to

data availability and previous literature, the natural logarithm of market capitalization is used. The natural logarithm is used to normalize the data and reduce skewness.

3.3.1.2 Leverage

Leverage indicates the extent to which a firm uses debt to finance its assets. There is a positive relationship between financial leverage and firm value (Gill & Obradovich, 2012). The effect of financial leverage can vary between industries. Specifically, the manufacturing and service industries. In the manufacturing sector, financial leverage has a positive impact on firm value. In the service sector, this positive impact is even more pronounced. Thus, financial leverage is included as a control variable. Leverage is calculated by dividing total debt by total equity.

3.3.1.3 Return on Assets

Return on Assets (ROA) reflects the ratio between a company's profitability and how its assets are utilized. ROA is a measure for firm performance. As this thesis focuses on TSR and share risk as a measure of firm performance, ROA is included as a control variable. The data for the calculation of ROA was obtained through Datastream. The period studied ranges from January 2029 to December 2022 and data was collected on a monthly basis. ROA is calculated using the following formula:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

As mentioned, ROA can be used as a measure of firm value, so too in the literature. Orlitzky et al. (2003) use ROA in evaluating the financial performance of Corporate Social Responsibility (CSR) initiatives. Adding to this, results from a study conducted by Chakkravarthy et al. (2024) highlight that ROA positively influences firm value and the dividend payout ratio. This thesis focusses specifically on Total Shareholder Return and Share Risk. It is therefore essential to account for other factors that might influence firm performance, and in turn Total Shareholder Return and Share Risk. Hence, this control variable is added to isolate the net effect of TSR and Share Risk on ESG, without the outcome being influenced by the company's ROA.

3.3.2 Market Conditions

The Euro STOXX 50 Volatility Index (VSTOXX) is a measure of the expected volatility in the euro zone. It serves as a in indicator of market uncertainty, with a high VSTOXX signaling high market uncertainty. VSTOXX data was collected through the Eikon Datastream database. Monthly data was collected from January 2019 to December 2022. The literature details the importance of adding the VSTOXX variable when measuring firm performance. A study conducted by Kyaw (2020) shows that companies that score well within environmental practices are associated with having lower risk. Given this thesis' focus on the impact of ESG scores on firm performance, it is important to isolate the effects of VSTOXX. Moreover, a study by Nguyen et al. (2022) examined the relationship between firm performance and market volatility during the COVID-19 crisis. The study sheds light on how a period

of unprecedented market volatility affected the performance of firms in Vietnam. The findings showed that the pandemic negatively impacted stock market returns and volatility, leading to financial turmoil within the companies. Market volatility can thus affect both stock returns and overall firm performance. Given the specific focus of this thesis on the COVID-19 crisis, and the findings of Nguyen et al. (2022) and Kyaw (2020), it is essential to include VSTOXX as a control variable in the regressions. This allows for the effect of ESG on firm performance to be clearly isolated from the effect of VSTOXX.

3.3.3 Industry Effects

The influence of industry-specific factors on firm performance has been widely documented in existing literature (McGahan & Porter, 1997; Garcia et al., 2017; Qureshi et al., 2020). Industry effects can influence how firms respond to various internal and external factors. Market conditions, regulations and financial leverage are all pertinent to a specific industry. As mentioned earlier, sensitive sectors often exhibit different ESG performance patterns due to greater regulatory scrutiny and pressure (Garcia et al., 2017; Qureshi et al., 2020). This thesis categorizes firms according to the Industry Classification Benchmark (ICB) standards. The ICB classification includes a total of 11 industries. The industries present in this dataset are Technology, Financial, Industrial, Basic Materials, Consumer Goods, Consumer Services, Healthcare, Telecommunications and Energy. Given the limitation of the dataset to 57 companies, which means that some industries are barely represented, it was necessary to merge certain industries to ensure a sufficient sample size. Industries with similar operational characteristics, market conditions and regulations were merged. The combined industries are Technology (merging Technology and Telecommunications), Industry (merging Industrial and Basic Materials), Finance (merging Finance and Real Estate), and Consumer (merging Consumer Goods and Consumer Services), with Health Care and Energy remaining separate. Firstly, Technology and Telecommunications both operate in fast-paced, innovation-driven environments and face similar regulatory challenges. Similarly, Manufacturing and Basic Materials are both involved in production and manufacturing processes. Both sectors have similar environmental issues and supply chain challenges. Financials and Real Estate are grouped together due to their mutual dependence on financial markets and similar governance regulations. Both sectors are highly sensitive to economic cycles, interest rates and financial regulations. Consumer Goods and Consumer Services both supply directly to end users. Fluctuations in market demand and trends in consumer behavior can significantly impact both sectors. Due to their unique operating environments and ESG challenges, Healthcare and Energy were kept separate. The sectors were added to the regression models as fixed effects. In addition, the interaction effects of the sectors are measured on recovery rates and ESG scores.

3.4 Descriptive Statistics

The dataset contains 57 companies and 2,592 observations for the independent variable, the ESG combined score. The mean ESG Combined score within this sample is 58.085, with a standard deviation of 15.695. This means there are significant differences in ESG performance within the analyzed firms.

The ESG practices have a wide range, with scores spanning from a minimum of 20.9 to a maximum of 92. Total Shareholder Return has a mean of 4.102 and a standard deviation of 11.741. The range of TSR is substantial, starting at -52.16 and going up to 64.67. The skewness is 0.204 and kurtosis 5.632, which suggests that the distribution has a few extreme values. Overall, TSR shows a diverse performance across firms. Leverage, ROA, and VSTOXX are winsorized at the 1st and 99th percentile for the regression analysis. The descriptive statistics depict the non-winsorized variables. The Share Risk mean is 2.131 with a standard deviation of 1.079. The values range from 0.68 to 6.448, showing varying levels of risk across firms. The skewness of 1.615 and the kurtosis of 6.284 indicate a right-skewed distribution, where most firms have lower risk, but there are a few firms present in the dataset with much higher Share Risk. The average logarithm of market capitalization is 8.303 with a standard deviation of 1.64. The sample shows a diverse group of firm sizes with values ranging from 5.006 to 12.621. Looking at the skewness of 0.282 and kurtosis of 2.312, firm size has a distribution close to normal. The leverage mean is 1.231 and has a standard deviation of 1.412. The values range from 0.009 to 6.547. The skewness of 2.084 and kurtosis of 7.035 show a distribution with significant outliers, but these have been mitigated by the winsorizing process. The industry dummy variables show the distribution of companies across different sectors: industrial industry (33.3%), consumer industry (19.3%), energy industry (5.3%), financial industry (24.6%), healthcare industry (5.3%), and technology industry (12.3%). In the regression analysis, the Industrial industry was taken as the base industry. This industry has the most observations out of the dataset and therefore makes for a more stable and comprehensive benchmark than the other industries.

Table 1: Summary of the Statistics

Variables	N	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
Independent Variable							
ESG Combined Score	2592	58.085	15.695	20.9	92	-.082	2.395
Dependent Variables							
Total Shareholder Return	2597	4.102	11.741	-52.16	64.67	.204	5.632
Share Risk	2602	2.131	1.079	.68	6.448	1.615	6.284
Control Variables							
ln MV	2597	8.303	1.64	5.006	12.621	.282	2.312
Leverage	2724	1.231	1.412	.009	6.547	2.084	7.035
ROA	2700	5.268	8.096	-22.46	34.06	.417	5.992
VSTOXX	2737	22.867	5.259	14.129	31.581	-.202	1.623
Industrial Industry	2736	.333	.471	0	1	.707	1.5
Consumer Industry	2736	.193	.395	0	1	1.556	3.421
Energy Industry	2736	.053	.223	0	1	4.007	17.056
Financial Industry	2736	.246	.431	0	1	1.182	2.397
Healthcare Industry	2736	.053	.223	0	1	4.007	17.056
Technology Industry	2736	.123	.328	0	1	2.298	6.283

Note: This table shows the summary of the statistics for the ESG Combined score, the dependent variables TSR and Share Risk, and the control variables. No variables are winsorized.

3.5 Correlation Matrix

The correlation matrix in Table 6 highlights some of the key relationships between the variables. When the coefficient between variables is 1, it is considered a strong relationship. A coefficient of zero is a neutral relationship and a coefficient of -1 is a negative relationship. Most of the effects observed in the matrix are around zero and therefore considered minor. There is a significant correlation of 0.059 between ESG scores and TSR. Thus, firms with better ESG ratings have slightly better shareholder returns than firms with low ESG ratings. The correlation between ESG scores and Share Risk is not significant. No conclusion can be drawn on the effect between the two variables. The correlation between ESG scores and Market Value has a coefficient of 0.331, meaning that firms with higher ESG ratings tend to be larger. Similarly, ESG and Industrial Industry have a positive correlation of 0.245. Firms in the Industrial sector are likely to have higher ESG scores compared to firms in other sectors. The correlations between the industries show how likely the overlap between the two sectors is, with Financial and Industrial having the strongest correlation of -0.403. This shows the clear separation between the Financial and Industry sectors.

Chapter 4 Method

Panel regression is used to examine the impact of ESG on firm performance across various periods of the COVID-19 pandemic. The regression models analyze the impact of ESG performance on Total Shareholder Return (TSR) and Share Risk. The data analysis was conducted using STATA. Before performing the regression analysis, the ESG scores were centered around their mean. First, the mean of the ESG scores was calculated. Then, by subtracting this mean from each ESG score, a new variable is created with a mean of zero. This new variable is the centered ESG score used in the regression analyses. Not only the ESG scores are centered, but also the VSTOXX variable. Centering the VSTOXX variable follows the same method as for the ESG scores. This process of centering variables is in line with previous research papers. Aiken et al. (1991) and Jaccard et al. (1990) emphasize the importance of centering variables for accurate interpretation of the interaction terms as it can also reduce multicollinearity.

The independent variable is the centred ESG score (*c.ESG*). The two recovery phases (*immediate recovery* and *long-term recovery*) were combined into a single dummy variable (*dRecovery*). This variable indicates whether an observation falls within the recovery period or not. The variable equals one from April 2020 up until December 2022 and zero otherwise. *Industry* is also a dummy variable that takes the value of 1 if a company belongs to a particular industry and zero otherwise. The control variables Market Value (*ln_MV*), Leverage (*LEVERAGE_w*), Return on Assets (*ROA_w*), and the market volatility index (*VSTOXX_c_w*) are included to capture the influence of firm size, financial performance and market conditions. The hypotheses are tested using panel data regression models with interaction terms. Specifically, random effects models are used to account for both within-company and

between-company variations. Robust standard errors are used to solve potential heteroskedasticity and autocorrelation issues.

The first hypothesis measures whether ESG ratings have a positive influence on Total Shareholder Return (TSR) during the post-COVID-19 recovery period. To test hypothesis one, the following regression model is specified:

$$TSR_{it} = \beta_0 + \beta_1 dRecovery_t + \beta_2 c.ESG_{it} + \beta_3 (dRecovery \times c.ESG)_{it} + \beta_4 \ln\_MV_{it} + \beta_5 Leverage\_w_{it} + \beta_6 \mathrm{ROA}_{it} + \beta_7 \mathrm{VSTOXX}_t + \theta_j + \epsilon_{it}$$

Where:

- TSR_{it}: Total Shareholder Return for firm *i* at time *t*
- $dRecovery_t$: Dummy variable for recovery period at time t
- $c.ESG_{it}$: Centered ESG score for firm *i* at time *t*
- $\ln\_MV_{it}$: Natural logarithm of market value for firm *i* at time *t*
- $Leverage\_w_{it}$: Leverage for firm *i* at time *t*
- ROA_{it}: Return on Assets for firm *i* at time *t*
- VSTOXX_t: Market volatility index for the EURO STOXX 50 at time t
- θ_j: Industry fixed effects, with *j* representing the industry

In this regression, the interaction term $\beta_3 (dRecovery \times c.ESG)_{it}$ examines the relationship between ESG scores and TSR changes during the recovery period.

The second hypothesis measures whether high ESG ratings are associated with lower Share Risk during the post-COVID-19 recovery period. This regression is similar to the one used for hypothesis 1, only it has Share Risk as the dependent variable. To test the second hypothesis, the following regression model is employed:

$$share\_risk_{it} = \beta_0 + \beta_1 dRecovery_t + \beta_2 c.ESG_{it} + \beta_3 (dRecovery \times c.ESG)_{it} + \beta_4 \ln\_MV_{it} + \beta_5 Leverage\_w_{it} + \beta_6 \mathrm{ROA}_{it} + \beta_7 \mathrm{VSTOXX}_t + \theta_j + \epsilon_{it}$$

Where:

- $share\_risk_{it}$: Share Risk for firm *i* at time *t*

In this regression, β_1 captures the direct effect of the recovery period on Share Risk. The coefficient β_2 measures the overall impact of ESG performance on Share Risk. The interaction term $\beta_3 (dRecovery \times c.ESG)_{it}$ examines the relationship between ESG scores and Share Risk changes during the recovery period. Mirroring the previous hypothesis, β_4 controls for firm size effect, β_5 for

leverage, β_6 for the return on assets and β_7 controls for market volatility. θ_j represents the industry's fixed effects.

The third hypothesis measures whether the influence of ESG ratings on Total Shareholder Return varies significantly across different industries. The regression model used for this hypothesis is:

$$\begin{aligned} TSR_{it} = {} & \beta_0 + \beta_1 dRecovery_t + \beta_2 c.ESG_{it} + \beta_3 Industry_i + \beta_4 \ln\_MV_{it} + \beta_5 Leverage\_w_{it} \\ & + \beta_6 \mathrm{ROA}_{it} + \beta_7 \mathrm{VSTOXX}_t + \beta_8 (dRecovery \times c.ESG)_{it} \\ & + \beta_9 (dRecovery \times Industry)_i + \beta_{10} (c.ESG \times Industry)_i \\ & + \beta_{11} (dRecovery \times c.ESG \times Industry)_{it} + \epsilon_{it} \end{aligned}$$

In this model, the coefficients of interest are β_6, β_7, β_8, and β_9. The term $\beta_6 (dRecovery \times c.ESG)_{it}$ shows how ESG ratings influence TSR specifically during the recovery phase. The coefficient $\beta_7 (dRecovery \times Industry)_i$ measures the interaction between the recovery period and industry. It shows how firms in different industries perform during the recovery period. The term $\beta_8 (c.ESG \times Industry)_i$ tests the interaction between ESG scores and industry. It shows whether the impact of ESG ratings on TSR varies across industries. Finally, the three-way interaction term $\beta_9 (dRecovery \times c.ESG \times Industry)_{it}$ provides insights into how the combined effects of the recovery period, ESG scores, and industry influence TSR.

The fourth and final hypothesis looks at whether the influence of ESG ratings on Share Risk varies significantly across different industries. The regression model used for this hypothesis is:

$$\begin{aligned} share\_risk_{it} = {} & \beta_0 + \beta_1 dRecovery_t + \beta_2 c.ESG_{it} + \beta_3 Industry_i + \beta_4 \ln\_MV_{it} + \beta_5 Leverage\_w_{it} \\ & + \beta_6 \mathrm{ROA\_w}_{it} + \beta_7 \mathrm{VSTOXX\_c\_w}_t + \beta_8 (dRecovery \times c.ESG)_{it} \\ & + \beta_9 (dRecovery \times Industry)_i + \beta_{10} (c.ESG \times Industry)_i \\ & + \beta_{11} (dRecovery \times c.ESG \times Industry)_{it} + \epsilon_{it} \end{aligned}$$

This regression is similar to the one used for hypothesis 3, only it tests whether the relationship between ESG ratings and Share Risk varies across industries. The coefficients of interest are the same (β_6, β_7, β_8, and β_9) and they examine the same interactions, but in the context of Share Risk instead of TSR.

Chapter 5 Results

5.1 Results for the Hypotheses

H1: High ESG scores positively impact Total Shareholder Return (TSR) during the post-COVID-19 economic recovery compared to firms with lower ESG ratings.

The results for testing hypothesis 1 are presented in Table 2. The analysis shows that the recovery period after COVID-19 has a significant impact on TSR, with a coefficient of 3.690. Higher ESG scores also have a slightly significant positive impact on TSR, with a coefficient of 0.0779. However, the interaction term between the recovery period and ESG scores is not statistically significant. The control variables show that higher market capitalization correlates negatively with TSR, while ROA has a positive influence, although small. Also, higher market uncertainty leads to lower returns. The industry fixed effects show varying results. The energy and technology sectors have significant coefficients of 2.974 and 10.90 respectively. The high coefficient of Technology might be attributed to the fact that this sector has a higher growth potential due to rapid innovation. This was especially true during the COVID-19 pandemic when there was a global shift to remote work and digitalization. On the contrary, firms in the financial sector perform significantly worse with a coefficient of -1.684. Lastly, the adjusted R-squared is 0.0442, meaning that approximately only 4.42% of the variance in TSR is explained by this model. It can therefore be concluded that there is no significant evidence to support that high ESG scores positively impact TSR during the recovery period.

Table 2: Regression results of ESG on TSR

	(1)
Variables	**TSR**
dRecovery = 1	3.690***
	(0.626)
c.ESG	0.0779***
	(0.0267)
dRecovery * c.ESG	0.00543
	(0.0283)
ln_MV	-1.299***
	(0.276)
Leverage_w	0.122
	(0.172)
ROA_w	0.0666**
	(0.0320)
VSTOXX_c_w	-0.299***
	(0.0492)
Constant	-0.253
	(0.826)
Consumer	1.792
	(2.469)
Energy	2.974***

	(0.878)
Financial	-1.684
	(1.221)
Healthcare	1.439
	(1.155)
Technology	10.90***
	(2.367)
Observations	2,498
Number of id	57
Adjusted R^2	0.0442
R^2 within	0.0404
R^2 between	0.250
R^2 overall	0.0500

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*

H2: High ESG ratings are associated with lower Share Risk during the post-COVID-19 economic recovery compared to firms with lower ESG ratings.

The results for testing hypothesis 2 are presented in Table 3. The regression results show that the dummy variable for the recovery period has a significant coefficient of -0.342. Thus, firms experienced lower Share risk during the recovery period. The ESG scores do not have a significant influence and the interaction term between Recovery and ESG do not appear to be significant either. The natural logarithm of market value has a significant effect on Share Risk with a coefficient of -0.188. Lager firms therefore tend to experience lower Share Risk. Leverage has a coefficient of 0.0557. In other words, higher leverage is associated with a slightly higher Share Risk. ROA is not significant, while VSTOXX has a slightly significant influence on Share Risk with a coefficient of 0.0815. The adjusted R-squared is 0.1739. This suggests that 17.39% of the variance in Share Risk is explained by the predictors in this model.

Table 3: Regression results of ESG on Share Risk

	(1)
Variables	**Share Risk Regression Results**
dRecovery = 1	-0.342***
	(0.0495)
c.ESG	0.00492
	(0.00341)
Recovery * c.ESG	-0.00402
	(0.00366)

ln_MV	-0.188***
	(0.0445)
Leverage_w	0.0557*
	(0.0316)
ROA_w	-0.00420
	(0.00397)
VSTOXX_c_w	0.0815***
	(0.00416)
Constant	-0.466***
	(0.154)
Consumer	-0.237
	(0.272)
Energy	-0.381**
	(0.173)
Financial	0.148
	(0.173)
Healthcare	0.287
	(0.267)
Technology	4.048***
	(0.367)
Observations	2,498
Number of id	57
Adjusted R^2	0.1739
R^2 within	0.160
R^2 between	0.241
R^2 overall	0.178

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*

H3: The influence of ESG ratings on Total Shareholder Return varies significantly across different industries.

Table 4 shows the results of the regressions for analyzing the impact of ESG scores on Total Shareholder Return (TSR) during the post-COVID-19 recovery period. The regressions measure the interaction effects between ESG scores, the recovery period (dRecovery), and industry dummies. At first, the effects of ESG scores and the recovery period on TSR are measured. Then, the industry dummy variables are added. Hereafter the control variables market capitalization (ln_MV), leverage (LEVERAGE_w), ROA (*ROA_w*) and market volatility (VSTOXX_c_w) are included. Model 4 introduces the interaction effects and model 5 captures the full three-way interaction of recovery period, ESG scores, and industry variables. The first TSR model focuses on the influence of the recovery period and ESG score on TSR.

The results show that the recovery period has a significant coefficient of 1.987. The coefficient on recovery remains significant in all 5 models. In other words, TSR is significantly higher during the recovery period than compared to the pre-crash period and the crash period. Next, the ESG coefficient is examined. It is not significant in the first model. In the second model, the coefficient becomes positive and significant. Hence, better ESG performance is related to higher TSR. The value and significance increase in the third model. This shows that the positive influence of ESG becomes more evident as more control variables are added. However, in the fourth and fifth models, the coefficient again becomes insignificant. This may indicate that the interaction effects moderate the immediate impact of ESG on TSR. In the second TSR model, the dummy variables for the sector are added. The coefficients for the Consumer, Financial and Healthcare sectors are significant. The Financial sector is the only industry dummy with a significant positive coefficient of 2.412. The Financial sector continues to be positively significant in all models. Thus, firms in the Financial sector have a higher TSR than firms in the Industrial sector, even after controlling for other variables and interaction effects. The Healthcare and Consumer sectors have significant coefficients of -2.871 and -1.413, respectively. As such, firms in these sectors have a lower TSR than firms in the industrial sector. Next, LN Market Value, Leverage, ROA and VSTOXX are added to the model as control variables. LN Market Value is significant with a negative coefficient of -1.283. The LN Market Value coefficient stays significant and negative across all models, thus large firms tend to have lower TSR during the recovery period. Leverage is not significant in any of the models. ROA is only significant in the third model, with a small, but significant positive coefficient of 0.0674. VSTOXX variables are significant across all variables with negative coefficients of -0.299, -0.305 and -0.307. This highlights the negative impact of market uncertainty on shareholder returns. The fourth model introduces the interaction terms. What stands out is that Healthcare now has a significant positive coefficient of 3.499, whereas, in the second model, it had a negative coefficient of -2.871. Moreover, the interaction term between the recovery period and the Healthcare sector is significant with a coefficient of -6.288. Firms in the healthcare sector thus had lower TSR during the recovery period compared to the pre-recovery period. The change in the coefficient from negative to positive in model 4 shows that the negative effect of healthcare firms on TSR is reduced when interaction terms are included. The interaction between dRecovery and Financial is negative and significant in models 4 and 5. Thus, although the Financial sector generally performed well, as shown by the positive coefficients of the Financial sector, the recovery period has been less beneficial for firms in this sector. The interaction term between the recovery period and the Healthcare sector remains significant in Model 5 with a coefficient of -6.288. Hence, firms in the health sector performed less well during the recovery period. Model 5 captures the three-way interaction terms. The interaction between dRecovery, c.ESG and the consumer sector are significant with a coefficient of -0.151. In other words, ESG scores have a negative impact on companies in the consumer sector during the recovery period. The interaction between dRecovery, c.ESG and the healthcare sector are significant with a coefficient of 0.227. Thus, the positive impact of ESG scores during the recovery period is stronger for companies

in the healthcare sector. Lastly, the adjusted R-squared of the model is very low. It increases only slightly when control variables and interaction effects are included. Although the model's complexity increases, it does not substantially improve the fit. The highest adjusted R-squared value is 0.0545, suggesting that a little more than 5% of the variance in TSR is explained in this model.

Table 4: Regression results on TSR with control variables and interaction effects

	(1)	(2)	(3)	(4)	(5)
Variables	**TSR**	**TSR**	**TSR**	**TSR**	**TSR**
dRecovery = 1	1.987***	1.880***	3.683***	4.551***	4.562***
	(0.523)	(0.530)	(0.627)	(0.843)	(0.862)
c.ESG	0.0241	0.0295*	0.0814***	0.0448	0.0482
	(0.0178)	(0.0157)	(0.0189)	(0.0328)	(0.0396)
Industry (Base = Industrial)					
Consumer		-1.413**	-0.269	0.156	0.804
		(0.639)	(0.818)	(1.173)	(0.923)
Energy		0.794	1.772	1.705	1.155
		(1.117)	(2.447)	(2.592)	(1.911)
Financial		2.412***	2.971***	2.284**	2.249**
		(0.871)	(0.880)	(1.050)	(1.039)
Healthcare		-2.871***	-1.693	3.449*	2.551
		(0.795)	(1.207)	(1.848)	(1.909)
Technology		-0.331	1.412	3.487**	3.439**
		(1.162)	(1.146)	(1.388)	(1.393)
Control variables					
ln_MV			-1.283***	-1.204***	-1.136***
			(0.274)	(0.269)	(0.250)
Leverage_w			0.126	0.113	0.100
			(0.174)	(0.177)	(0.176)
ROA_w			0.0674**	0.0397	0.0306
			(0.0315)	(0.0346)	(0.0342)
VSTOXX_c_w			-0.299***	-0.305***	-0.307***
			(0.0492)	(0.0513)	(0.0512)
Interactions					
dRecovery * c.ESG				0.00617	0.00248
				(0.0274)	(0.0402)
dRecovery * Consumer				0.508	1.553
				(1.135)	(1.530)
dRecovery * Energy				0.605	0.640
				(1.139)	(1.205)

dRecovery * Financial				-7.569***	-6.609**
				(2.414)	(2.567)
dRecovery * Healthcare				-3.478***	-3.660***
				(1.206)	(1.190)
dRecovery * Technology				0.0597	0.159***
				(0.0394)	(0.0447)
Consumer * c.ESG				0.0933	0.0194
				(0.148)	(0.117)
Energy * c.ESG				0.0285	-0.0267
				(0.0406)	(0.0533)
Financial * c.ESG				0.0949**	-0.0671
				(0.0384)	(0.0913)
Healthcare * c.ESG				0.131*	0.0987
				(0.0780)	(0.0814)
Technology * c.ESG				0.161**	0.108
				(0.0702)	(0.0795)
dRecovery * Consumer * c.ESG					-0.151***
					(0.0509)
dRecovery * Energy * c.ESG					0.133
					(0.144)
dRecovery * Financial * c.ESG					0.0669
					(0.0741)
dRecovery * Healthcare * c.ESG					0.227**
					(0.104)
dRecovery * Technology * c.ESG					0.0794
					(0.0589)
Constant	2.607***	2.564***	17.61***	16.88***	16.45***
	(0.421)	(0.653)	(2.483)	(2.473)	(2.348)
Observations	2,534	2,534	2,498	2,498	2,498
Number of id	57	57	57	57	57
Adjusted R^2	0.00771	0.0236	0.0473	0.0528	0.0545
R^2 within	0.00713	0.00682	0.0402	0.0440	0.0436
R^2 between	0.00210	0.227	0.251	0.276	0.311
R^2 overall	0.00781	0.0256	0.0501	0.0590	0.0624

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*

H4: The influence of ESG ratings on Share Risk varies significantly across different industries.

The results for answering hypothesis four are shown in Table 5. The analysis of Share Risk mirrors the structure of the TSR analysis. The Recovery dummy variable is significant in all models. In models 1

and 2, the recovery dummy is positive. Hence, the recovery period has a positive effect on Share Risk in these models. On the contrary, as more variables are added, the coefficient of recovery becomes negative. So, after adding the control variables and interaction effects, the recovery period has a negative effect on Share Risk. The ESG score is significant only in Model 4, with a low coefficient of 0.00862. ESG performance, therefore, only has a marginal effect on Share Risk in this model. Next, the industry-fixed effects are added to the model. Only the Consumer and Financial industries show significant coefficients. Both sectors have a consistent negative effect on Share Risk across all models. Being operative as a firm in one of these industries means having a lower Share Risk as compared to firms in the Industrial sector. Model 3 introduces the control variables. The natural logarithm of Market Value is negative and significant in all models. Thus, larger firms generally have lower Share Risk. VSTOXX is positive and significant in all models, even though the coefficient is relatively small. Higher market volatility thus leads to slightly higher Share Risk. Model 4 introduces the interaction effects. The interaction between dRecovery and Healthcare is significant and positive in Models 4 and 5. Thus, the recovery period had a positive impact on equity risk for companies in the healthcare sector. Lastly, model 5 includes the three-way interactions. Noticeably, no three-way interaction is significant for Share Risk. The influence of ESG ratings on Share Risk does not significantly vary across different industries during the recovery period. This means that although industry and ESG scores individually affect Share Risk, their combined influence on the recovery period does not show a significant pattern. Also, the highest adjusted R-squared for this model is 0.18566. This means that 18.57% of the variance in Share Risk is explained by the predictors in this model. Although the relatively higher adjusted R-squared compared to the TSR model highlights a somewhat better fit, a significant portion of the variability is still unexplained.

Table 5: Regression results on Share Risk with control variables and interaction effects

	(1)	(2)	(3)	(4)	(5)
Variables	**Share Risk**	**Share Risk**	**Share Risk**	**Share Risk**	**Share Risk**
dRecovery = 1	0.173***	0.182***	-0.280***	-0.333***	-0.355***
	(0.0473)	(0.0472)	(0.0467)	(0.0918)	(0.100)
c.ESG	0.00453	0.00255	0.00256	0.00862**	0.00672
	(0.00406)	(0.00408)	(0.00303)	(0.00397)	(0.00435)
Industry (Base = Industrial)					
Consumer		-0.522***	-0.442***	-0.480***	-0.475***
		(0.190)	(0.152)	(0.142)	(0.138)
Energy		-0.268	-0.224	-0.0270	-0.0804
		(0.188)	(0.263)	(0.308)	(0.229)
Financial		-0.328**	-0.363**	-0.462***	-0.456***
		(0.158)	(0.169)	(0.150)	(0.148)
Healthcare		0.0542	0.167	0.189	0.160

	(0.257)	(0.168)	(0.180)	(0.175)
Technology	-0.00875	0.310	0.153	0.143
	(0.211)	(0.265)	(0.215)	(0.215)
Control variables				
ln_MV		-0.200***	-0.199***	-0.198***
		(0.0481)	(0.0453)	(0.0450)
Leverage_w		0.0456	0.0509*	0.0486*
		(0.0291)	(0.0298)	(0.0295)
ROA_w		-0.00460	-0.00324	-0.00280
		(0.00355)	(0.00387)	(0.00390)
VSTOXX_c_w		0.0763***	0.0766***	0.0769***
		(0.00360)	(0.00361)	(0.00365)
Interactions				
dRecovery * c.ESG			0.0234	0.0310
			(0.135)	(0.121)
dRecovery * Consumer			-0.211	-0.0668
			(0.354)	(0.362)
dRecovery * Energy			0.160	0.169
			(0.122)	(0.124)
dRecovery * Financial			-0.0550	-0.00931
			(0.180)	(0.147)
dRecovery * Healthcare			0.237*	0.259*
			(0.143)	(0.149)
dRecovery * Technology			0.0234	0.0310
			(0.135)	(0.121)
Consumer * c.ESG			-0.0111	-0.00767
			(0.00701)	(0.00718)
Energy * c.ESG			0.00192	-0.00311
			(0.0215)	(0.0181)
Financial * c.ESG			-0.00190	0.00701
			(0.00670)	(0.00763)
Healthcare * c.ESG			-0.0152***	-0.0168**
			(0.00589)	(0.00752)
Technology * c.ESG			-0.00120	0.000888
			(0.0133)	(0.0124)
dRecovery * Consumer * c.ESG				-0.00642
				(0.00874)
dRecovery * Energy * c.ESG				0.0105
				(0.0181)
dRecovery * Financial * c.ESG				-0.0126

					(0.00860)
dRecovery * Healthcare * c.ESG					0.000822
					(0.00937)
dRecovery * Technology * c.ESG					-0.00456
					(0.0102)
Constant	2.005***	2.191***	2.345***	2.342***	2.336***
	(0.0755)	(0.123)	(0.370)	(0.346)	(0.347)
Observations	2,538	2,538	2,498	2,498	2,498
Number of id	57	57	57	57	57
Adjusted R^2	-0.00074	0.03923	0.17875	0.18566	0.18448
R^2 within	0.00996	0.00927	0.165	0.170	0.172
R^2 between	0.00260	0.176	0.241	0.267	0.267
R^2 overall	0.00263	0.0416	0.182	0.190	0.191

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*

5.2 Additional tests

5.2.1 Breusch-Pagan Lagrangian multiplier test

The Breusch-Pagan Lagrangian multiplier test for random effects was conducted to determine the appropriate regression model. For Total Shareholder Return (TSR) the test results can be found in Table 9, the results for Share Risk are in Table 12. For both TSR and Share Risk, the test yielded significant results. The TSR test results show a chi-squared value of 2.89 with a p-value of 0.0445. For Share Risk, the chi-squared value of 938.07 has a p-value of 0.0000. Thus, both tests confirm the need for a random effects model. Therefore, random effects models are chosen for both TSR and Share Risk to capture unobserved heterogeneity. The random effects model takes into account individual variability, which is essential for this dataset with 57 firms across several industries and time periods.

5.2.2 VIF

Variance Inflation Factor (VIF) was examined to measure the amount of multicollinearity present in the dataset. A VIF of one means that variables are not correlated. A VIF greater than five means that the variables are highly correlated. Any VIF that is between one and five indicates a moderate correlation. A VIF higher than 10 suggests there is significant multicollinearity present. The VIF table can be found in table 7. Some VIF values are above the critical limit of 10. dRecovery and ln_MV have VIFS of 10.43 and 10.57 respectively, indicating significant multicollinearity. This can be troublesome, as high multicollinearity can affect the stability of the regression coefficients, as described by O'Brien (2007). However, this research also cautions against blindly following rules of thumb such as the VIF threshold of 10, as such values do not necessarily undermine the results of the regression analyses. Thus, although two of the VIF values exceed the threshold of 10, it is still possible that the results are still reliable. Given that the models in this thesis also account for robust standard errors, it provides a level of

assurance that the estimated coefficients are stable and reliable, despite the presence of multicollinearity. Nevertheless, conclusions about the results among the variables with high VIF values should be drawn with caution. The other VIF values are below the critical threshold. Hence, the influence of multicollinearity on these variables is limited. The average VIF of 5.02 indicates that although multicollinearity is present, it is mainly caused by some specific variables and is not necessarily problematic for overall modeling.

5.2.3 Omnibus test

An omnibus test assesses whether the model explains a significant portion of the variance in the dependent variable. In this thesis, the omnibus test was conducted to examine the joint significance of the interactions between the recovery period, industry categories, and ESG scores on TSR and Share Risk. The results from the omnibus test on TSR and Share Risk can be found in Tables 8 and 11 respectively. The results for TSR show a significant chi-squared value. This suggests that the interactions between the recovery period, industry categories and ESG scores combined have a substantial impact on TSR. It is therefore of importance to consider these variables simultaneously rather than separately, affirming the relevance of this thesis' model. On the contrary, the omnibus test for Share Risk did not show significant results. This indicates that a three-way interaction may not have a meaningful combined effect on Share Risk.

5.2.4 Robustness test

Robustness tests are performed to ensure that the results of the primary regression analysis hold under different assumptions. The primary regression includes the entire period under study. To perform the robustness checks, the crisis period is excluded from the results and these results are compared with the full sample. This analysis can determine whether the observed relationship between ESG scores, industry impacts and the two dependent variables are consistent when the most volatile period is removed.

The robustness check for TSR can be found in Table 10. In the original model, the recovery dummy shows a significant positive effect on TSR, hinting at a higher TSR during the recovery period compared to the period before. In the robustness check model, the recovery dummy is no longer significant, except in the third model. This suggests that the heightened TSR observed during the recovery period in the main model might have been influenced by the inclusion of the crisis period. The crisis period thus played a substantial role in driving the significant positive impact on TSR during the recovery period. Noticeably, the coefficient for ESG remains significant and positive across all models in the robustness check. This reaffirms the positive influence of ESG scores on TSR. Firms with higher ESG ratings tend to perform better in terms of shareholder returns, regardless of whether the crisis period is excluded. As for the industry variables, the Financial sector shows a significant positive effect on TSR in both the

original and robustness check models. The Healthcare sector in the robustness check is similar to the original model. With no added control variables or interaction effects, the Healthcare sector has a significant effect on TSR of -3.065. This changes to a significant positive effect of 3.321 when control variables and interaction effects are added to the regression. This hints at some instability in the effect of the Healthcare sector on TSR but is similar to the results of the original model. The effects of industry differences are robust to the inclusion, or exclusion, of the crash period. The control variables show similar patterns in both tables. Market value has a consistent negative impact on TSR in both Table 4 and Table 10. In Table 4, the coefficients range from -1.458 to -1.254, while in Table 10, the coefficients are similar. The variable ROA is positively significant in both tables, underpinning the role of profitability in improving TSR. The interaction terms show some differences between the two tables. In Table 4, there are significant negative interactions between the financial sector, the healthcare sector and the recovery phase. In Table 10, these interactions remain significantly negative. Thus, these sectors experienced specific challenges during the recovery phase that are independent of the crash period. The comparisons between Table 4 and Table 10 show that the findings are largely robust to crash period exclusions. ESG scores continue to exert a positive influence on TSR, and sectoral differences remain significant. The negative impact of the recovery phase on certain sectors, such as Financials and Healthcare, also remains consistent.

The robustness check for Share Risk can be found in Table 13. In the original Share Risk model, the ESG score is significant and positive in all models. In this model, higher ESG scores are thus associated with higher Share Risk throughout the entire period, including the crisis. However, in the robustness check, the ESG score is significant only in model 4 and even then it has a very low coefficient. This likely suggests that the positive relationship between ESG scores and Share Risk observed in the original model is largely driven by the crisis period. When the crisis period is excluded, the influence of ESG scores on Share Risk decreases significantly. ESG performance may not have a strong direct impact on Share Risk beyond extreme market conditions. Industry-specific effects remain consistent in the robustness check model. The consumer and financial sectors are consistently significant with negative coefficients. This implies that these sectors experience reduced Share Risk during the recovery period compared to the industrial sector. As this pattern remains consistent in the robustness check model, the sectoral differences are robust to the exclusion of the crisis period. The control variables show similar patterns in both tables. LN Market value has a consistently negative impact on Share Risk in both models. Thus, larger firms have less Share Risk. Similar to the original model, leverage is only positively significant in models 4 and 5. The ROA variable is not significant in either model, while the VSTOXX variable is consistently significantly positive. This highlights the role of market volatility in increasing Share Risk. There are some slight differences in the interaction terms. Whereas the interaction between recovery and the financial sector was still strongly and significantly negative in the original model, this interaction is no longer significant in the robustness model. Only the interaction between recovery and

the healthcare sector remains significant. Finally, no three-way interactions are significant in the robustness model either. While individual effects may exist, the interaction between the three variables does not contribute to the explanatory power of the model during recovery. The comparisons between Table 5 and Table 13 show that the findings are largely robust to crisis period exclusions. This means that although certain interactions are less prominent without the crisis period, the overall conclusions on the influence of ESG scores and industry-specific effects on Share Risk remain consistent.

Chapter 6 Conclusion

This thesis explores the effect of ESG scores on the performance of Dutch companies during the COVID-19 pandemic. The research question states: *How do ESG ratings influence firm performance across various industries in the Dutch market during the post-COVID-19 economic recovery, and does this influence exhibit industry-specific patterns?*

The research question was tested by conducting panel regression analyses with random effects models. Combined ESG scores were taken as the independent variable. To measure firm performance in differing approaches, two dependent variables were examined. Namely, Total Shareholder Return and Share Risk. In addition, several control variables were added, and industry-fixed effects were included to isolate industry differences. The analysis focused on four hypotheses, and robustness tests were conducted in which the crisis period was excluded.

The first hypothesis stated that higher ESG scores would lead to higher TSR during the post-COVID-19 economic recovery period. The results showed that ESG scores had a positive impact on TSR, with firms with higher ESG scores performing better in terms of shareholder returns. The recovery period also had a positive influence on TSR. However, the interaction term between the recovery period and ESG scores was not statistically significant. Thus, the null hypothesis is not rejected. The second hypothesis stated that higher ESG scores would lead to lower Share Risk. The coefficient for ESG did not significantly affect Share Risk. In addition, the results show that the interaction effect between the recovery period and ESG is also not statistically significant. Thus, the null hypothesis is not rejected. The third hypothesis stated that sectoral differences would significantly affect TSR during the recovery period. The three-way interaction between recovery, ESG and the consumer sector was significantly negative. In contrast, the interaction term between recovery, ESG, and the healthcare sector was significantly positive. However, these findings fall away in the robustness analysis. Here, only the three-way interaction between recovery, ESG and the Energy sector is significant at the 10% level. The positive or negative sector interactions that are initially observed do not appear to be robust when the crisis period is excluded. These sectoral differences may be specific to the unique circumstances of the crisis period. Thus, the null hypothesis is not rejected. The last hypothesis stated that sectoral differences significantly affect Share Risk during the recovery period. Here, no significant result was found for any

three-way interaction. Thus, the null hypothesis is not rejected. To conclude, the answer to the research question is that ESG scores had no significant effect on the performance of companies in the Netherlands during the recovery period of COVID-19. Also, no sector-dependent effect was measured.

There are several, possible explanations why no effect was measured in this study. First, the sample size of this study is relatively small, with only 57 companies. There are currently 133 Dutch companies listed on the Euronext. Of these firms, ESG data is available for only 57. This limited number of companies reduces the statistical power of the analysis and limits the generalizability of the findings. In addition, data were missing for some companies, which further affected the completeness of the analysis. Due to the small sample size, there was limited sectoral differentiation. Some sectors were underrepresented, making it difficult to draw detailed conclusions about sectoral differences. A larger and more diversified sample could provide more insight into how ESG scores affect different sectors. In addition, data availability limited this study to December 2022 as a "long recovery period." This means the analysis was limited to a relatively short time period after the initial COVID-19 crisis. A longer time frame could provide a more complete picture of the long-term effects of ESG scores on firm performance. The impact of ESG scores on TSR and Share Risk can differ in a longer recovery period when companies have more time to adjust to changing economic conditions.

In this study, ESG scores were considered static. They were not adjusted for changes in ESG performance over time. However, ESG scores fluctuate based on corporate strategies and external factors. Using static scores can influence the true impact of ESG on company performance. Given the growing importance of ESG ratings, firms actively working to improve their ESG rankings are not accurately represented by static scores. Future research should use dynamic ESG scores that reflect these changes over time, which also provide more detailed insights for investors. Integrating dynamic ESG scores can support ongoing improvements in corporate ESG practices.

One possible explanation for the lack of a significant effect in this study is reverse causation. This means that ESG scores are not only affected by firm performance, but firm performance also influences companies' ESG scores. Companies that perform well financially may have more resources to invest in better ESG practices, which improves their ESG scores. This makes it difficult to determine the direction of causality. Granger causality tests should be conducted to detect reverse causality and help understand how ESG performance and firm performance mutually influence each other.

Future research can also benefit from including unlisted companies, in addition to the listed companies examined in this study's dataset. By extending the analysis to private companies, the sample size will be significantly increased. Private companies can offer valuable insights that are not always visible in

listed companies. It offers a broader picture of how ESG scores affect business outcomes in differing corporate environments and ownership structures.

This thesis offers a relevant contribution to the current academic literature by examining the impact of ESG scores on the performance of Dutch companies during the post-COVID-19 recovery period. While many studies have already been conducted on the impact of ESG performance on firm performance in the United States, little research has been conducted on how ESG scores affect Dutch companies, especially in the context of an economic crisis and recovery period. By focusing on the Dutch market, this thesis fills an important gap in the literature and offers new insights relevant to European and Dutch policymakers, investors and companies. The findings can serve as guidelines for further studies and help improve ESG strategies and policies in the Netherlands and Europe.

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Appendix A

Table 6: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) TSR	1.000												
(2) Share Risk	-0.066***	1.000											
(3) ESG	0.059***	-0.017	1.000										
(4) Market Value	-0.089***	-0.152***	0.331***	1.000									
(5) Leverage	0.035*	0.038*	0.017	-0.052***	1.000								
(6) ROA	0.026	-0.101***	0.009	0.255***	-0.203***	1.000							
(7) VSTOXX	-0.051***	0.324***	0.069***	0.008	0.040**	-0.100***	1.000						
(8) Industrial	-0.003	0.115***	0.245***	-0.123***	-0.068***	0.065***	0.000	1.000					
(9) Consumer	-0.070***	-0.153***	-0.193***	0.036*	0.095***	-0.050**	0.000	-0.346***	1.000				
(10) Energy	0.006	-0.024	-0.143***	0.013	0.015	-0.049**	0.000	-0.167***	-0.115***	1.000			
(11) Financial	0.119***	-0.077***	-0.029	-0.109***	0.154***	-0.152***	0.000	-0.403***	-0.279***	-0.134***	1.000		
(12) Healthcare	-0.066***	0.052***	-0.048**	0.024	-0.137***	-0.005	0.000	-0.167***	-0.115***	-0.056***	-0.134***	1.000	
(13) Technology	-0.025	0.094***	0.049**	0.249***	-0.135***	0.198***	0.000	-0.265***	-0.183***	-0.088***	-0.213***	-0.088***	1.000

*Note: Significance levels are *** p<0.01, ** p<0.05, * p<0.1*

Table 7: Variance Inflation Factor

Variables	VIF	1/VIF
1.dRecovery	10.43	0.095914
c.ESG	7.11	0.140594
dRecovery#c.ESG	7.69	0.129964
Industry		
Consumer	5.96	0.167684
Energy	4.19	0.238584
Financial	5.47	0.182741
Healthcare	4.71	0.212350
Technology	4.63	0.216166
dRecovery#Industry		
Industry	5.79	0.172683
Consumer	4.66	0.214411
Energy	5.78	0.173124
Financial	4.46	0.224056
Healthcare	4.59	0.218064
Industry#c.cESG		
Consumer	4.48	0.223426
Energy	4.28	0.233765
Financial	5.85	0.171008
Healthcare	4.09	0.244368
Technology	2.95	0.338865
dRecovery#Industry#c.cESG		
Industry	4.34	0.230263
Consumer	4.80	0.208257
Energy	6.16	0.162420
Financial	3.81	0.262308
Healthcare	3.16	0.316592
Ln_MV	10.57	0.094634
Leverage_w	1.99	0.502860
ROA_w	2.21	0.452173
VSTOXX_c_w	1.48	0.674203
Mean VIF	5.02	

Note: This table presents the Variance Inflation Factors for all regression variables and interaction effects to assess multicollinearity.

Appendix B: Total Shareholder Returns

Table 8: Chi-Square Test Results for TSR Regression

(1) 1.dRecovery#Consumer#c.ESG = 0
(2) 1.dRecovery#Energy#c.ESG = 0
(3) 1.dRecovery#Financial#c.ESG = 0
(4) 1.dRecovery#Healthcare#c.ESG = 0
(5) 1.dRecovery#Technology#c.ESG = 0
chi2(5) = 29.42
Prob > chi2 = 0.0000

Note: Three-way interaction terms between the recovery period, the industry sectors and the centered ESG scores.

Table 9: TSR Breusch and Pagan Lagrangian multiplier test for random effects

$TSR\ [id,t] = Xb + u[id] + e\ [id,t]$

Estimated results:

	Var	SD = sqrt (Var)
TSR	136.6448	11.68952
e	114.6684	10.70833
u	.8025993	.8958791

Test**:** Var (u) = 0

Chibar2(01) = 2.89
Prob > chibar2 = 0.0445

Note: Breusch and Pagan Lagrangian Multiplier test for random effects in the TSR model, indicating the presence of significant random effects.

Table 10: TSR regression results for robustness check

	(1)	(2)	(3)	(4)	(5)
Variables	**TSR**	**TSR**	**TSR**	**TSR**	**TSR**
dRecovery = 1	-0.439	-0.525	-1.189*	-0.775	-0.656
	(0.513)	(0.517)	(0.662)	(0.789)	(0.794)
c.ESG	0.0434**	0.0444***	0.0935***	0.0761***	0.0932***
	(0.0185)	(0.0164)	(0.0199)	(0.0276)	(0.0296)
Industry (Base = Industrial)					
Consumer		-1.484**	-0.297	-0.412	-0.0805
		(0.616)	(0.823)	(0.965)	(0.860)
Energy		0.846	1.858	1.022	0.278
		(1.025)	(2.665)	(2.853)	(2.005)
Financial		2.410***	2.879***	1.791*	1.785*
		(0.914)	(0.901)	(1.044)	(1.021)
Healthcare		-3.065***	-1.868	3.321**	2.439
		(0.880)	(1.243)	(1.686)	(2.001)
Technology		-0.497	1.445	3.121*	3.115**
		(1.149)	(1.164)	(1.595)	(1.565)
Control variables					
ln_MV			-1.458***	-1.308***	-1.254***
			(0.290)	(0.278)	(0.260)
Leverage_w			0.135	0.119	0.110
			(0.204)	(0.215)	(0.212)
ROA_w			0.0679**	0.0399	0.0298
			(0.0269)	(0.0333)	(0.0355)
VSTOXX_c_w			0.0843	0.0801	0.0782
			(0.0548)	(0.0567)	(0.0566)
Interactions					
dRecovery * c.ESG				-0.148	-0.694
				(0.805)	(0.759)
dRecovery * Consumer				1.365	2.832*
				(1.158)	(1.639)
dRecovery * Energy				1.179	1.095
				(1.033)	(1.050)
dRecovery * Financial				-7.310***	-6.526**
				(2.304)	(2.943)
dRecovery * Healthcare				-2.847*	-3.125**
				(1.545)	(1.405)
dRecovery * Technology				-0.148	-0.694
				(0.805)	(0.759)

Consumer * c.ESG				0.0373	0.0698*
				(0.0362)	(0.0375)
Energy * c.ESG				0.0670	-0.0690
				(0.154)	(0.111)
Financial * c.ESG				0.00747	-0.0474
				(0.0427)	(0.0402)
Healthcare * c.ESG				0.0751*	-0.0684
				(0.0436)	(0.186)
Technology * c.ESG				0.128	0.0726
				(0.0798)	(0.0808)
dRecovery * Consumer * c.ESG					-0.0431
					(0.0464)
dRecovery * Energy * c.ESG					0.236*
					(0.132)
dRecovery * Financial * c.ESG					0.0722
					(0.0502)
dRecovery * Healthcare * c.ESG					0.176
					(0.182)
dRecovery * Technology * c.ESG					0.114
					(0.0785)
Constant	4.997***	4.979***	14.44***	13.37***	13.01***
	(0.415)	(0.647)	(2.551)	(2.474)	(2.357)
Observations	2,432	2,432	2,398	2,398	2,398
Number of id	57	57	57	57	57
Adjusted R^2	0.00501	0.0244	0.0379	0.0478	0.0473
R^2 within	2.19e-05	2.35e-05	0.0391	0.0333	0.0312
R^2 between	0.0912	0.298	0.306	0.337	0.366
R^2 overall	0.00510	0.0261	0.0430	0.0527	0.0552

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*

Appendix C: Share Risk

Table 11: Chi-Square test results for Share Risk regression

(1) 1.dRecovery#Consumer#c.ESG = 0
(2) 1.dRecovery#Energy#c.ESG = 0
(3) 1.dRecovery#Financial#c.ESG = 0
(4) 1.dRecovery#Healthcare#c.ESG = 0
(5) 1.dRecovery#Technology#c.ESG = 0
chi2(5) = 3.95
Prob > chi2 = 0.5563

Note: Three-way interaction terms between the recovery period, the industry sectors and the centered ESG scores.

Table 12: Share Risk Breusch and Pagan Lagrangian multiplier test for random effects

$share\_risk\ [id, t] = Xb + u[id] + e\ [id, t]$

Estimated results:

	Var	SD = sqrt (Var)
share_r~k	1.263255	1.123946
e	.860318	.9275333
u	.1720042	.4147339

Test**:** Var (u) = 0

chibar2(01) = 938.07
Prob > chibar2 = 0.000

Note: Breusch and Pagan Lagrangian Multiplier test for random effects in the Share Risk model, indicating the presence of significant random effects.

Table 13: Share Risk regression results for robustness check

	(1)	(2)	(3)	(4)	(5)
Variables	**Share Risk**	**Share Risk**	**Share Risk**	**Share Risk**	**Share Risk**
dRecovery = 1	0.509***	0.517***	0.206***	0.141	0.121
	(0.0516)	(0.0520)	(0.0511)	(0.0890)	(0.0957)
c.ESG	-0.00179	-0.00330	0.000123	0.00378	0.00200
	(0.00339)	(0.00343)	(0.00315)	(0.00484)	(0.00574)
Industry (Base = Industrial)					
Consumer		-0.574***	-0.439***	-0.475***	-0.452***
		(0.170)	(0.157)	(0.160)	(0.153)
Energy		-0.376**	-0.283	-0.0448	-0.0663
		(0.163)	(0.290)	(0.359)	(0.290)
Financial		-0.390**	-0.396**	-0.553***	-0.545***
		(0.158)	(0.182)	(0.156)	(0.155)
Healthcare		0.00723	0.167	0.214	0.0583
		(0.236)	(0.161)	(0.142)	(0.184)
Technology		-0.0427	0.355	0.142	0.139
		(0.203)	(0.281)	(0.208)	(0.209)
Control variables					
ln_MV			-0.237***	-0.233***	-0.233***
			(0.0516)	(0.0488)	(0.0493)
Leverage_w			0.0502	0.0595*	0.0569*
			(0.0318)	(0.0318)	(0.0319)
ROA_w			-0.00507	-0.00349	-0.00354
			(0.00428)	(0.00472)	(0.00457)
VSTOXX_c_w			0.0396***	0.0399***	0.0402***
			(0.00361)	(0.00355)	(0.00358)
Interactions					
dRecovery * c.ESG				-0.00265	0.00107
				(0.00414)	(0.00662)
dRecovery * Consumer				-0.00158	-0.0155
				(0.150)	(0.129)
dRecovery * Energy				-0.134	-0.0603
				(0.348)	(0.344)
dRecovery * Financial				0.227*	0.231*
				(0.126)	(0.127)
dRecovery * Healthcare				-0.0805	0.0935
				(0.177)	(0.113)
dRecovery * Technology				0.295**	0.307**
				(0.150)	(0.153)

Consumer * c.ESG				-0.0112	-0.00580
				(0.00805)	(0.00901)
Energy * c.ESG				0.0140	0.0128
				(0.0194)	(0.0151)
Financial * c.ESG				0.00145	0.00909
				(0.00714)	(0.00798)
Healthcare * c.ESG				-0.00939	-0.0285***
				(0.00671)	(0.0107)
Technology * c.ESG				-0.00472	-0.00382
				(0.0121)	(0.0107)
dRecovery * Consumer * c.ESG					-0.00892
					(0.00963)
dRecovery * Energy * c.ESG					0.00305
					(0.0236)
dRecovery * Financial * c.ESG					-0.0107
					(0.00878)
dRecovery * Healthcare * c.ESG					0.0204*
					(0.0118)
dRecovery * Technology * c.ESG					-0.00157
					(0.0121)
Constant	1.676***	1.901***	3.084***	3.067***	3.072***
	(0.0730)	(0.120)	(0.403)	(0.380)	(0.389)
Observations	2,436	2,436	2,398	2,398	2,398
Number of id	57	57	57	57	57
Adjusted R^2	0.0588	0.115	0.162	0.172	0.1699
R^2 within	0.0722	0.0720	0.151	0.160	0.162
R^2 between	0.0414	0.261	0.228	0.255	0.254
R^2 overall	0.0600	0.117	0.166	0.177	0.178

*Note: The robust standard errors are in parentheses; significance levels are *** p<0.01, ** p<0.05, * p<0.1*