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RESEARCH ARTICLE

Does ESG Investment Influence Firm Risk During the COVID-19 Pandemic? Evidence from European Markets

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Abstract
In recent decades, corporate social performance (CSP) has gained in importance. Because of concerns raised by consumers, investors, fund providers, and governmental organizations about sustainability, businesses are motivated to work toward a more sustainable environment. This paper examines the nexus between environmental, social, and governance factors (ESG) and various risk types, including market and accounting-based risk, using a data set comprising 1400 firm-year observations spanning the period from 2015 to 2022 from European countries. It examines both aggregated and disaggregated ESG scores and their associations with accounting-based default risk, measured by Altman's Z'' and Zmijewski's ZM-scores, as well as market risk proxied by beta. To explore the nexus between ESG and risk factors, panel data analysis with both time and unit effects was used and considered with cluster robust standard errors. This study shows that economic cycles have an impact on these relationships, with ESG factors demonstrating a risk-mitigating effect during the COVID-19 pandemic, but no impact before the COVID-19 pandemic. Moreover, this study highlights the comparative informativeness of measuring systematic beta risk compared with traditional accounting-based risk assessments.

Keywords: Corporate Social Performance, COVID-19, Firm risk, Stakeholder Theory, Agency Theory

Introduction

The COVID-19 pandemic outbreak in China's Wuhan province has triggered a challenging economic recession since World War II and, emerged as a key milestone for sustainable investment (Morgan, 2020). The pandemic destroyed commodity and equity markets, as documented by several studies (Phan & Narayan, 2020; Padhan & Prabheesh, 2021; Li et al., 2022; Harjoto et al., 2021; Hu & Zhang, 2021). As COVID-19 spreads, investors began placing greater emphasis on environmental, social, and governance stocks. As an example, stock markets emphasizing ESG factors generally outperform their counterparts (Rubbaniy et al., 2022). Investors have recognized that it is reasonable to invest in ESG- led funds during the COVID-19 pandemic (Mooney, 2020). In light of this HSBC (2020) indicated that investments in sustainable portfolios have been rising and that the majority of investors (49%)

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prefer sustainable portfolios because they believe the returns will be higher and risks will decrease. During the COVID-19 pandemic the environment was severely impacted by the usage of pesticides, soaps ,detergents, and disposable masks (Ankit et al., 2021). Furthermore, the plastic demand has increased because of the packaging and medical uses (Patrício Silva et al., 2021). Therefore, during this time, investors began to demand funds with low ESG risk, especially those with low environmental risk rather than governance and social risks (Ferriani & Natoli, 2020;2).

The potential of ESG investments as a risk-mitigating factor is a topic of debate in the academic literature. A good ESG performance can be attributed as a sign of transparency and risk mitigation, but it can also be used as a disguise measure to deflect shareholders' attention (Lueg et al., 2019).

According to the literature, two distinct perspectives exist regarding the nexus between ESG performance and firm risk: the risk mitigation perspective and the overinvestment perspective. The risk mitigation perspective asserts that ESG investments act as a protective measure for firms during crises, enhance their cash flows, and serve as a risk management tool (Bouslah et al., 2018: 644). Based on stakeholder theory, this view posits that ESG is inversely related to firm risk (Lueg et al., 2019). Investing in ESG reduces reduced risks, according to stakeholder theory.Specifically, lower ESG scores correlate with a higher likelihood of encountering lawsuits and incurring legal fines, whereas substantial ESG investments can cultivate more favorable relationships with government entities and broader financial institutions (McGuire et al., 1988).

Conversely, the overinvestment view suggests that allocating resources to ESG activities is an inefficient use of resources, which can undermine the firm's stability and result in poorer cash flow performance (Goss & Roberts, 2011). Notably, this perspective aligns with shareholder and agency theories, where excessive corporate social performance investments may serve as a smokescreen for opportunistic behavior and divert attention away from shareholders' interests.

In this research, we investigate how ESG investments affect accounting-related risks, as assessed using Altman's Z''-score and Zmijewski's ZM-score, as well as systematic risk (beta). Our investigation spans 2015 to 2022 and encompasses a sample of 172 non-financial companies operating across European countries, including Austria, Belgium, Germany, Denmark, Luxembourg, the Netherlands, and Switzerland. We selected these countries because of their strong commitment to ESG reporting and the availability of relevant data. Europe, in particular, has been at the forefront of addressing environmental concerns within industries, and companies in this region began disclosing their ESG-related practices earlier than in other parts of the world, as noted by (Zahid et al., 2022; 201). Moreover, several European Union directives have been enacted to promote Corporate Social Performance (CSP)

among European companies (European Commission, 2013). To explore the moderating role of COVID-19 on the relationship between company risk and ESG investment, we divided our sample into two sections: the years between 2015-2019 and 2020-2022 constitute pre -and during the COVID-19 periods, respectively. The ESG–firm risk link will be further explored by taking a closer look at the three components; the environmental, social, and governance performance. Following this, we incorporated both account-based default risk and systematic risk into the model.

The first contribution of this study is its examination of both account-based and market-based risk indicators. Most previous studies have neglected to include account-based risk indicators and instead have focused on market-based risk indicators (Oikonomou et al., 2012; Albuquerque et al., 2019; Shahrour et al., 2021; Aevoae et al., 2023). In accordance with Orlitzky and Benjamin (2001), CSP and financial risk are mutually causal, with CSP having a stronger correlation with systematic risk than accounting-based risk. To compare account-based and market-based risk indicators, we included both indicators.

Second, this study uses multiple countries as a sample and focuses on the total and different sub- components of ESG investment. A number of previous studies have examined the relationship between CSP and risk using a single country (Broadstock et al., 2021; Korinth & Lueg, 2022; Zhou & Zhou, 2022; Habermann & Fischer, 2023; Zhang et al., 2023). Other studies that focused on multiple countries (Bitencourt et al., 2020; Hizarci-Payne et al., 2021; Saidane & Abdallah, 2021) did not consider general CSP measures and their subcomponents together.

Third, this study contributes to the literature by demonstrating the moderating effects of the COVID-19 pandemic. Firms may face greater challenges during periods of economic turbulence than during economic upswings. Therefore, it is important to examine the moderation role of crises like COVID-19 when assessing firm risk and CSP performance. Moreover, adverse macroeconomic conditions serve as a natural laboratory to investigate the relationship between firm risk and CSP, as noted by (Bouslah et al., 2018). In this way, the main motivation of CSP investments can be better revealed by considering both the risk mitigation and overinvestment perspectives.

Related Literature

There has been a large amount of literature examining the nexus between corporate financial performance (CFP) and ESG, and the results have been diverse (Singal, 2014; Velte, 2017; Taliento et al., 2019; Duque-Grisales & Aguilera-Caracuel, 2021; Shaikh, 2021; Al Amosh et al., 2022; Saygili et al., 2022). Nevertheless, there is limited research available on the relationship between ESG factors and firm risk, unlike the extensive examination of the

connection between ESG and Corporate Financial Performance (CFP) (Meles et al., 2023). Studies provide contentious results depending on the dataset,country, CSP, and risk measurements. These factors contribute to contentious results, and their importance is highlighted.

Habermann and Fischer (2023) stated that the economic cycle of the selected timeline significantly influences the ESG and firm risk link. They examined the nexus between corporate social performance and bankruptcy likelihood, which was measured using Eikon ESG scores and Altman Z scores, respectively. The 6696 firm-year observations from US firms between 2007 and 2019 constitute the study sample. This study subdivided the sample into two sections covering 2007-2009 and 2010-2019 and the results have been compared with one another. ESG performance decreases firm risk during economic crises but, not during economic upswings. In this manner, Zhou and Zhou (2022) explored the risk associated with stock price fluctuations and ESG performance in the context of the COVID-19 pandemic. Because of good ESG performance, the COVID-19 period can be mitigated to a certain extent. Consistent with these findings, Lööf et al. (2022) revealed that better ESG performance decreases tail risk but returns less reward during the pandemic for 10 different countries. Similarly, Broadstock et al. (2021) investigated the influence of ESG performance in China during the COVID-19 pandemic. Their research revealed that ESG performance helps reduce financial risk during the COVID-19 pandemic, but its impact is less pronounced during non-crisis periods. To build on this, Korinth and Lueg (2022) explored the same relation for German firms between 2012 and 2019. The choice of 2012 as the starting point was motivated by the aim to disregard the impact of the 2008 subprime mortgage crisis and its subsequent impacts. In this study, both aggregated and disaggregated ESG ratings were used to investigate ESG and firm risk link. As a result, it has been found an U-shaped relation between ESG performance and that relation is firm risk and attributed to the level of investment. In contrast, Zhang et al. (2023) found that ESG performance is strongly correlated with firm risk, which exhibited some weakening in the middle of the COVID-19 pandemic. Additionally, the locus of research has a significant impact on determining the relationship. Since more sustainable countries have already explored many opportunities, ESG investment is not helpful to decrease firm risk as much as it does in other countries. Therefore, executives should invest in ESG activities only up to a certain point and terminate them at the appropriate level. Investment in CSP initially decreases firm risk, but overinvestment in these activities can subsequently increase firm risk. Engström and Martinsson (2020) delved into the intricate relationship between total risk, systematic risk, and idiosyncratic risk alongside the ESG performance of Swedish companies. In this regard, we conclude that there is a positive link between ESG performance and firm risk. In addition, Lueg et al.(2019) provided further insights into this association. They explored the bidirectional relationship between firm risk and ESG investment in 59 South African companies between 2012 and 2016. As a result of this study, South African firms tend to increase their investments in ESG activities and engage in window dressing when their ove-

rall firm risk is elevated. For African firms, Corporate Social Responsibility (CSR) could be linked to insolvency risk, as suggested by (Saidane & Abdallah, 2021). They demonstrate that better environmental performance leads to a less stable firm. To extend this line of thinking, Bitencourt et al. (2020) analyzed 71 studies and revealed that the eco-innovation and corporate performance association is more potent in countries with a lower human development index. Consistent with these findings, Do (2022) investigated this identical association using an extensive dataset of companies spanning 36 countries. Using Merton's (1974) model, the study finds that the influence of CSR is greater over extended timeframes and in nations with less robust capital markets and legal systems. Additionally, Hizarci-Payne et al. (2021) conducted a comprehensive review covering 70 studies and concluded that environmental innovation can contribute to firms' performance, with an even greater contribution observed in developing countries than in developed countries.

Because of the different calculation methodologies for ESG ratings, the outcomes of the studies may differ, as noted by (Korinth and Lueg, 2022). In this way, the Eikon ESG ratings (Thomson Reuters) database (e.g., Habermann & Fischer, 2023; Barth et al., 2022; Korinth & Lueg, 2022; Engström and Martinsson 2020; Sassen et al., 2016) and Kinder, Lydenberg, and Domini (KLD) database (see also, Bouslah et al., 2013; Oikonomou et al. 2012; Jo & Na, 2012; Goss & Roberts, 2011) are widely used sources. Despite the fact that many studies have demonstrated a negative relationship between aggregated ESG and firm risk, the individual ESG measure has been less clear. A recent study published by Cohen (2022) showed that the ESG factors and risk associations are determined differently regarding the subcotegories of ESG. Utilizing S&P500 stock data spanning 2019 to 2021, this study determined that corporate risk, as assessed by Altman's Z-score, is inversely impacted by E and S factors but, not by G factors. Bouslah et al. (2013) also used the S&P500 dataset and found that different domains of CSP determine associations in distinct ways. Moreover, Assous (2022) conducted an analysis to evaluate the influence of ESG factors on the risk associated with Saudi banks, gauged through the fluctuations in stock returns. The findings indicate that E scores exhibit a noteworthy positive impact on the stock return fluctuation of Saudi banks, whereas the S score exerts a negative influence on this volatility. In another study, Eratalay & Ángel (2022) investigated the association between ESG and firm systematic risk over the period January 2016–September 2020 for firms listed on the S&P Europe 350. Based on their research outcomes, companies with elevated ESG ratings tend to have reduced exposure to systematic risk. Specifically, during the COVID-19 period, only the S and G scores have a notable and significant influence on systematic risk.

Turning our attention to risk measurement, it becomes evident that various risk metrics are employed. Systematic risk is commonly employed as the primary indicator of risk among market-based risk measures (Sassen et al., 2016). An analysis of a panel of S&P 500 companies was concluded between 1992 and 2009 by Oikonomou et al. (2012). They find that

social responsibility exhibits a weak negative association with systematic risk, whereas irresponsibility had a strong positive association with systematic risk. Albuquerque et al. (2019) introduced an industry equilibrium model, along with empirical findings. In their study, they analyzed a dataset consisting of U.S. companies from 2003 to 2015, and their results demonstrated that firms with elevated levels of CSP experience reduced systematic risk. A recent study conducted by Aevoae et al. (2023) demonstrated that the combined ESG and G scores have a favorable effect on the systematic risk of banks. This conclusion is drawn from an analysis of data from 47 publicly listed banks across various countries during 2007–2020. Additionally, Merton's (1974) model is employed by several authors to measure market risk. This model measures the credit risk of a firm and estimates its default probability based on this. In accordance with this model, a company files for bankruptcy if its assets fall below its nominal debt value. In their study, Shahrour et al. (2021) focused on two distinct risk metrics: accounting-related risk, represented by the Z score, and market-based risk, assessed using Merton's (1974) model. Their research revealed that ESG scores play a mitigating role in reducing firms' default risk in the Eurozone, particularly during financial crisies. A similar result was obtained by Meles et al. (2023) using Z, ZM scores, and Bharath and Shumway's (2008) model to measure accounting-based and market-based risks for European firms. Market-based risk measurement is used for the firm's sensitivity to market and economic conditions, whereas accounting-based risk measurements are used to evaluate the firm's financial performance, health, and vulnerability through financial ratios and metrics. Furthermore, they use green innovation as a proxy for CSP. Their findings imply that in countries with market-oriented financial systems, green innovation has a stronger effect in mitigating default risk than in those bank-oriented financial systems. In their extensive study, Lin and Dong (2018) measured firms' distress level using Altman Z-scores and explored the same relation for the US sample. They discovered that firms with a history of CSR engagement had a lower likelihood of bankruptcy. In a similar vein, Boubaker et al. (2020) examined the same relation for US- listed firms from 1991 to 2012. They use Altman's (1968) Z-score, Ohlson's (1980) O-score, and Zmijewski's (1984) ZM-score to assess firm risk. They reach the same conclusion: CSR engagement reduces firm risk. Unlike other studies, Cooper and Uzun (2019) included defaulted and non-defaulted US companies in their study for the years between 2007 and 2014. As a result, their study concluded that firms with elevated CSR levels exhibit reduced susceptibility to bankruptcy, assuming all other factors remain constant.

Theoretical Framework and Hypothesis Development

Firm risk includes various risks, including systematic, idiosyncratic, legal, and credit risks. Firms can reduce their various risks by improving financing conditions through ESG/CSR ratings (Meles et al., 2023). Investment in ESG activities reduces firm risk because they increase social awareness and managers' motivation. Moreover, motivated employees act

more loyal and innovative when dealing with firm risk (Vishwanathan et al., 2020). The main source of firm risk might be either internal factors (i.e.,bad management) or economic factors such as the worldwide economic downturn or COVID-19 pandemic. Regarding economic circumstances or cycles, fewer firms face risk during periods of economic prosperity. It is common, however, for firms to experience problems associated with external factors during economic crises (Habermann & Fischer, 2023). Although a firm cannot prevent external factors, it can reduce the possibility of being in a distress position at an early stage with sound management mechanisms (Whitaker, 1999). Thus, from the risk mitigation perspective, ESG investments provide firms with a greater level of capital and relational wealth, which improves their transparency and reduces doubt about their future cash flow. On the basis of the risk mitigation view, it can be said that ESG investments function as a type of insurance for a company (Bouslah et al., 2018). Furthermore, a socially responsible investor makes decisions in light of both financial and non-financial factors. When examining theoretical models depicting the relationship between ESG factors and expected returns, it is crucial to highlight that socially responsible assets are highly valued and typically associated with lower risk, irrespective of their return potential. Conversely, assets linked to irresponsibility are often undervalued and tend to entail higher levels of risk (Fama & French, 2007).

In contrast to the aforementioned view, the overinvestment view assumes that firm risk and ESG are positively related. Investment in ESG activities is considered a waste of scarce resources, resulting in more volatile cash flow for the firm (Goss & Roberts, 2011). Moreover, more investment in ESG activities requires permanent maintenance with stakeholders and thus leads to an increase in fixed costs (Perez-Batres et al., 2012). Overall, value-destroying ESG investment activities lead to firm risk. Although philanthropic activities on behalf of shareholders may seem beneficial at first glance for firms, in reality, these activities are more costly than beneficial (Porter & Kramer, 2006). In addition, this view posits (based on agency theory) that managers may invest more in social performance than the potential cost of shareholders to enhance their personal reputation (Barnea & Rubin, 2010) or to attract environmental and climate activists to enhance their existing position in a firm (Cespa & Cestone, 2007).

As a third alternative approach to understanding ESG and firm risk associations, the lens of institutional theory is considered. Several studies of the CSP-CFP relationship have indicated that CSP reduces risk, however, institutional theory suggests that its effect varies based on the length of institutionalization (Brower & Dacin, 2020). In particular, innovative firms lack mature administrations or accounts for their operations and, therefore appear unnecessary or unreliable to acquire resources from other interest groups, increasing their risk exposure (Bansal & Clelland, 2004). Hence, numerous studies have provided evidence that as CSP becomes more deeply ingrained within organizations, it tends to operate in a manner akin to an insurance mechanism (Godfrey et al., 2009; Doh et al., 2010; Mishra & Modi, 2013).

However, regardless of a firm's degree of institutionalization or market structure, they are reluctant to invest in ESG activities during periods of unfavorable business cycles. Hence, during adverse macroeconomic conditions, firms may opt to reduce their investment in ESG activities to utilize resources more efficiently to utilize their resources effectively, or they may decide to invest in these activities to set themselves apart and enhance their differentiation in the market (Branca et al., 2012). As a result, examining ESG and risk associations before and during the COVID-19 period is relevant because adverse macroeconomic conditions provide a natural laboratory for testing the main theories argued in the literature, e.g., the risk mitigation perspective and the overinvestment perspective (Bouslah et al., 2018). As a result, we contend that firms during economic upswings do not depend on stakeholders to assist them in overcoming financial difficulties, as firms in such periods tend to avoid insolvency irrespective of their CSP level. However, those firms benefit from their stakeholders during economic downturn periods to overcome financial difficulties. Consequently, the first hypothesis is developed as follows;

H1: ESG is negatively related to firm risk, particularly during the COVID-19 pandemic

Second we argue in this study that market-based risk measurement reflects firms' actual status more precisely; therefore, systematic risk is more informative than accounting-based risk measurement regarding CSP. There is a greater impact at the firm's image on measures of market risk than on measures of accounting risk. CSP results in risk mitigation primarily through the mediation of factors such as reputation, market risk, and the infusion of fresh capital resources (Orlitzky & Benjamin, 2001). Additionally, as market prices reflect information instantly and unbiasedly, we assume the same is true for firm risk, leading us to propose the following hypothesis.

H2: ESG is more related to systematic risk than accounting-based risk.

Data and Methodology

Sample Selection

The social performance data for European firms from TR Eikon database is widely used by many scholars (e.g.,Habermann & Fischer, 2023; Barth et al., 2022; Korinth & Lueg, 2022; Engström and Martinsson 2020; Sassen et al., 2016). The CSP scores extracted from this database are trained by analysts at 900 evaluation points per firm-year. By doing so, the collected data regarding the dimensions of environment, social, and governance are, verified at multiple levels (Desender & Epure, 2015). Regarding data variability and distribution, this database is considered more anti-biased and relevant than comparable ESG ratings (Habermann & Fischer, 2023). This database draws upon multiple sources, including stock exchan-

ge filings from firms, CSR and annual reports, and websites managed by nongovernmental organizations. These qualitative variables will be transformed into quantitative variables once they have been collected (Ioannou & Serafeim, 2012).

We chose firms from seven European countries as the sample for this study because these countries have stable economic conditions and a strong focus on environmental, social, and governmental factors. Because we access relevant data from the TR Eikon database, we refrain from including the financial sector because of its unique capital characteristics and reporting methods. After this elimination, 565 firms remained, and following that, we removed some firms due to missing values. After winsorizing the Z and ZM scores at the 1st and 99th percentiles, 172 firms remained. We chose the starting period of 2015 because there were not enough data on firms' beta values before this year. Further, this timeline does not include any financial crisis or external shocks until 2020, when the COVID-19 pandemic had a widespread impact on both financial and equity markets.

Methodology

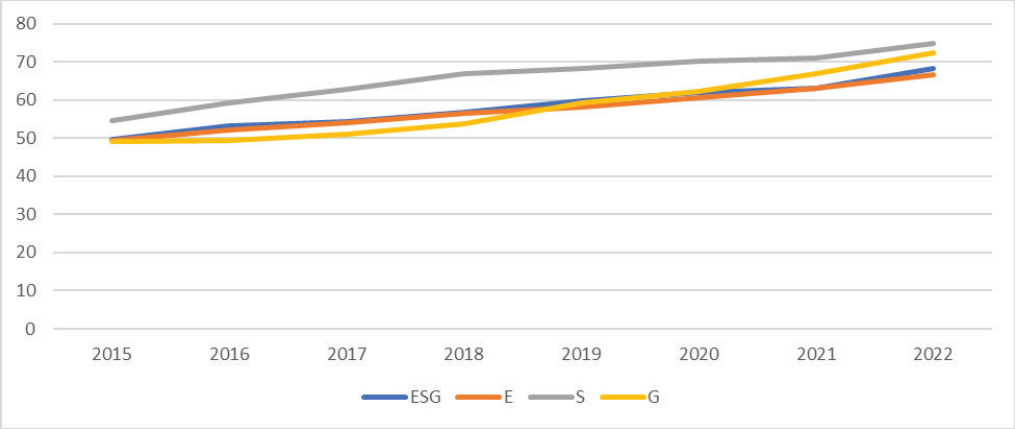
Measurement of CSP

Our study measures firms'CSP performance using Refinitiv ESG scores as an independent variable. By doing so, we use four different CSP metrics namely; overall ESG combined score and its subcategories. The values range from 0 to 100, where 100 represents the highest related score and 0 represents the lowest related score. As indicated, environmental factors include data pertaining to firms' impacts on energy consumption, greenhouse gas emissions, land use, and waste management, while social factors include the percentage of women in the workforce, a company's reputation, customer and society loyalty, and governance factors provide an evaluation of the firm's capability to sustain long-term relationships with shareholders and corporate sustainability strategy performance (Habermann & Fischer, 2023; Lueg et al., 2019; Ioannou & Serafeim, 2012).

Table 1 illustrates the mean values of the ESG combined score, and its subcategory scores across the selected countries from 2015 to 2022.

According to the development of the ESG combined score and, its component scores, the highest improvement was seen in governance performance, followed by the second highest increase in social performance, and the lowest increase was observed in environmental performance among its counterparts. When focusing only on the pandemic period (2020-2022), the highest improvement was again identified in governance performance, followed by environmental performance, and, finally, social performance.

Table 1
Avarage of ESG, E, S, and G scores between 2015 and 2022



Year	ESG Score	Environmental Score	Social Score	Governance Score
2015	49.68179	49.31531	54.77384	49.12334
2016	53.35665	52.22982	59.37203	49.29981
2017	54.44768	54.13355	62.79126	51.19006
2018	56.70036	56.45466	66.93289	53.68624
2019	59.86666	58.29202	68.20227	59.22280
2020	61.91702	60.62448	70.24734	62.28956
2021	63.00271	63.17126	71.08700	67.04291
2022	68.43536	66.78820	74.83673	72.38629

Measuring Firm Risk

Firm risk is defined as the nature of a firm's operations due to any internal or external resources that, in turn, impact firms' rentability. In other words, firm risk represents the combination of business and financial risk. The first category refers to equity risk associated with firms' operating activities, while the latter category refers to an extra risk associated with debt financing (Jo & Na, 2012). To measure firm risk, this study uses both default risk based on accounting measurements and systematic risk (beta) as a dependent variable. In accounting-based models, default risk is predicted using financial statements; however, in market-based models, default risk is predicted using bond market data and option pricing theory.

Accounting Risk

Accounting-based firm risk measurement methods are used in a growing body of literature (Habermann & Fischer, 2023; Meles et al., 2023; Cohen, 2022; Boubaker et al., 2020; Lin &

Dong, 2018). To include only accounting-based information, we measure accounting-based risk using the Z''-score (Altman et al., 1998) and ZM-score (Zmijewski, 1984).

The first risk measurement model Z''-score is computed as follows;

Z''-score = 6.56(WC/TA) + 3.26(RE/TA) + 6.72(EBIT/TA) + 1.05(EQ/TL),

where WC refers to working capital, TA to total assets, RE to retained earnings, EBIT to earnings before interest and tax; EQ to equity book value; TL to liabilities book value.

The Z″-score is computed by considering four factors: liquidity, overall profitability, current operational effectiveness, and capital structure stability. Typically, a decrease in the Z″-score indicates a decrease in the risk of financial distress. An alternative to accounting-based risk measurement is the ZM-score, which is calculated as follows;

ZM -score= -4.336 - 4.513(NI/TA) + 5.679(TL/TA) + 0.004(CA/CL),

where net income is denoted as NI, total assets as TA, total liabilities as TL, current assets as CA, and current liabilities as CL. The ZM-score is assessed using three indicators: profitability, leverage, and liquidity. Moreover, it's important to note that an increase in the ZM-score is linked to a higher risk of financial distress.

Market Risk

In contrast to accounting-based risk measurement methods, systematic or market-based risk (beta) is included in this study to evaluate a firm's risk and its CSP. Systematic risk is macroeconomic by nature. Systematic risks include shocks to economic growth, interest rates, oil prices, and inflation rates (Gregory et al., 2014). Since the COVID-19 pandemic devastated most financial and equity markets, it can be considered systematic risk; thus we anticipate a strong association between firms' systematic risk and their CSP, especially during the COVID-19 pandemic.

We use "beta" value to measure systematic risk retrieved from the TR Eikon database. A least squares linear regression line is employed to calculate how each firm's stock price fluctuation aligns with its market price fluctuation for a given year.

Empirical Strategy

This study uses panel regression to analyze the relationship between firm risk and CSP performance. Panel regression is particularly well-suited for this research because it combines cross-sectional and time-series data, enabling us to control for inter-firm differences and intra-firm variations across years.

The fixed-effect model was applied to conclude the empirical analysis because it imposes fewer restrictions than the random-effects model. In addition, the *Hausman* test also confirmed the preferences of the fixed-effect model. To control for any changes within a specific firm across years, we include the firm-fixed effect. This approach allows us to account for all time-invariant effects among firms, such as management, sector, location, and capital market (Meles et al., 2023; Barth et al., 2022; Do, 2022). Similarly, to control for any changes in a given year across firms, we employ the year-fixed effect. This enables us to also account for variations in economic conditions that may affect firm risk. The Breusch–Pagan test was used to determine the presence of heteroskedasticity. Clustered standard errors were then employed, and the tested relationship was represented as follows;

$$firmrisk_{it} = \beta 0 + \beta 1\ ESG_{it} + \beta 2\ ROA_{it} + \beta 3\ LEV_{it} + \beta 4\ SIZE_{it} + \beta 5\ MTB_{it} + \beta 6\ LIQ_{it} + FE_i + FE_t + \varepsilon_{it} \quad (1)$$

Furthermore, several firm characteristics are added, consistent with previous studies (Meles et al., 2023; Habermann & Fischer, 2023; Korinth & Lueg, 2022). The data for these firms characteristics were obtained from the TR Eikon database. The firm characteristics used in this study are comprehensively outlined in Table 2. European firms were chosen as a locus of research and their distribution and percentage are presented in Table 3.

Table 2
Definition of variables

Variables	Definition
BETA	market risk of a firm where, value indicates a higher level of risk, where lower value indicates a reduced risk level
Z''-Score	the business risk of a firm, where a higher value indicates a reduced risk level and a lower value indicates a higher risk level
ZM-Score	the business risk of a firm, where a higher value indicates a higher risk level, whereas a lower value indicates a reduced risk level
ESG-Score	combined environmental, social, and governance pillar scores ranging between 0 and 100, and high values represent high commitment to these activities.
E-Score	environmental pillar scores ranging between 0 and 100, and high values represent high commitment to environmental activities.
S-Score	social pillar scores ranging between 0 and 100, and high values represent high commitment to social activities.
G-Score	governance pillar scores ranging between 0 and 100, and high values represent high commitment to governance activities.
ROA	profitability ratio computed as net income deflated by total assets
SIZE	natural log of total assets
LEV	net leverage ratio is determined by subtracting cash and marketable securities from long-term liabilities and deflating by the market value of equity
MTB	Market-to-book ratio is calculated by dividing the market value of a firm by its book value
LIQ	cash and short-term assets are deflated by total assets

Table 3
Sample Composition

Country	Number	Percentage
Austria	10	5.7
Belgium	16	9.1
Denmark	16	9.1
Germany	52	29.7
Luxembourg	8	4.5
Netherlands	28	16
Switzerland	45	25.7
Total	175	100

Results

Correlations and Descriptive Statistics

Table 4 provides descriptive statistics for social performance metrics, firm risk measures, and firm characteristics. Using beta as a market risk indicator, the average firm in this study has a beta of 0.926, ranging from -0.9 to 2.8. The Z''-score, a measure of business risk, has a mean value of 4 and ranges from -7.5 to 135 points. The ZM-score, another business risk indicator, has a mean value of -1.23 and ranges from -5 to 16. The combined ESG scores, representing social performance, have a mean value of 58, with, a range of 18 to 94. Among the ESG components, the environmental pillar has the lowest mean value at 57.4, ranging from 0 to 98. The social performance score has the highest mean value of 66, ranging from 0.6 to 98, while the governance performance score has a mean value of 58, ranging from 6 to 98. The standard values of firm characteristics are reasonable. For instance, the average ROA was 0.37, ranging from -3 to 0.4. The SIZE ranged from 6 to 18, with an average value of 10. The LEV has an average value of 0.50, ranging from -0.45 to 21.6. The mean MTB value was 3.5, ranging from -158 to 168. Finally, LIQ had a mean value of 0.47, ranging from -0.7 to 1.2.

Table 4
Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
BETA	.9262857	.4590124	-.9075083	2.804779
Z''-Score	4.079628	8.814808	-7.5063	135.4045
ZM -Score	-1.236404	1.386678	-5.288278	16.02722
ESG-Score	58.26158	18.35178	3.909928	94.25075
E-Score	57.46171	25.08903	0	98.20076
S-Score	65.91089	22.05926	.6271777	98.20207
G -Score	57.71435	22.37887	6.088693	97.76803

Variables	Mean	Standard Deviation	Minimum	Maximum
ROA	.0379326	.1497221	-3.292467	.3994034
SIZE	9.902354	.6821107	6.218404	11.78328
LEV	.5046848	1.030138	-.4592628	21.60505
MTB	3.520607	9.216814	-158.5088	168.3729
LIQ	.4773746	.2144396	-.7188494	1.193019

Additionally, Table 5 presents the average values of social performance and firm risk both after and during the crisis. Throughout the COVID-19 period, social performance and firm risk have increased. In terms of social performance, the greatest increase is observed with governance activities, followed by social activities, and the smallest increase is observed with environmental activities. Based on firms' risk performance both market and business risks, have increased. The beta and ZM-scores have shown differ significantly before and during the pandemic. However, it is worth noting that the increase in business risk, as measured by the Z''-Score, did not demonstrate a statistically significant difference between these two periods.

Table 5
Risk And Social Performance Before And During COVID-19

	Social Performance			
	ESG-Score	**E-Score**	**S-Score**	**G-Score**
Pre-crisis	54.80229	54.06282	62.43278	52.48293
Amid-crisis	64.39881	63.49179	72.0815	66.99555
p value (difference)	0.0000	0.0000	0.0000	0.0000
	Risk Performance			
	BETA	**Z''-Score**	**ZM -Score**	
Pre-crisis	.8485577	4.138135	-1.283948	
Amid-crisis	1.064185	3.975454	-1.152056	
p value (difference)	0.0000	0.6272	0.0466	

Table 6
Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)ESG	1											
(2)E	0.73*	1										
(3)S	0.80*	0.68*	1									
(4)G	0.67*	0.43*	0.51*	1								
(5)BETA	0.13*	0.13*	0.15*	0.22*	1							
(6)Z''-Score	-0.25*	-0.24*	-0.24*	-0.16*	0.09*	1						
(7)ZM -Score	0.14*	0.16*	0.14*	0.15*	0.08*	-0.45*	1					
(8)SIZE	0.30*	0.54*	0.39*	0.33*	0.07*	-0.05*	0.12*	1				
(9)MTB	0.12*	0.06*	0.12*	0.04	0.02	0.01	-0.07*	-0.02	1			

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(10)ROA	0.05*	0.05*	0.06*	-0.01	-0.02	0.12*	-0.54*	0.11*	0.09*	1		
(11)LEV	-0.02	0.04	0.01	0.04	0.03	-0.15*	0.45 *	0.16*	-0.11*	-0.38*	1	
(12)LIQ	0.04	-0.04	0.04	0.01	0.20*	0.06*	-0.08*	-0.27*	0.16*	0.11*	-0.18*	1

** statistical significance at the %5 level*

To address the computational problems associated with multicollinearity, Pearson correlation coefficients were computed and are demonstrated. The correlations among all variables were computed and demonstrated in Table 6. In general, no correlation exists between variables that exceed 0.54 (correlation between SIZE and E and between ROA and ZM scores) that would preclude the regression analysis, except for the correlation between ESG components, which is why it is not possible to combine any ESG component with the combined ESG variables. In view of the correlation between SIZE and ESG components, it should be noted that larger organizations strive to achieve high social performance scores, particularly regarding environmental activities. These firms are prone to investing in these activities because they receive more attention and have more resources to allocate. The same negative correlation between ROA and ZM-score suggests that firms with a high profitability ratio are less likely to be in an endangered position in terms of business risk.

Regression Results

The link between CSP and firm risk is examined using model (1), as discussed in the section on "Empirical Strategy". Based on this equation, Table 7 presents an overview of the association between market risk (beta) and ESG before and during the COVID-19 pandemic. ESG does not appear to exert a positive influence on market risk during economic upswings. However, the combination of ESG and E scores has a negative impact during the COVID-19 pandemic. Altough the coefficients of S and G scores are also negative, they do not yield a significant effect on market risk during this period. The E score exhibits a more pronounced role in mitigating market risk than the S and G scores. This implies that firms with stronger environmental performance are better equipped to navigate changing conditions and regulations, thereby enhancing their ability to absorb market risk during a downturn.

Due to the size of firms, there is a difference between large and small firms during the pandemic period. A large firm's market risk is higher during a pandemic than a small firm's. However, during periods of economic prosperity, size does not affect bearing market risk. With a more complex structure, large firms may have a more difficult time regulating their supply chains during crisis periods, which may lead to greater market risk. In addition, small firms respond quicker to market crises than large firms (Zhang & Fang, 2022). It appears that before COVID-19, firms' profitability ratio had a negative effect on market risk, whereas during COVID-19, its impact was deemed insignificant. Although highly profitable firms seem far from being to be exposed to market risk before the pandemic, all firms are exposed to market

risk during the pandemic regardless of their rentability level. We also included firm financial ratios following Bouslah et al. (2018). It appears to expose firms to market risks during economic upswings; however, its impact seems insignificant during economic downturn. Firm liquidity seems to serve as insurance-like protection against market risk before the pandemic, but it has an insignificant impact during the pandemic. Furthermore, it should be highlighted that firms' liquity is deteriorated during adverse economic states. A firm's liquidity appears to act as a form of protection against market risk before a pandemic, but it becomes insignificant during a pandemic. Furthermore, it should be noted that during periods of economic hardship, all firms' liquidity is adversely affected (Baig et al., 2021).

Table 7
ESG And Market Risk

Dependent Variable: BETA								
Panel A: before COVID-19					**Panel B: COVID-19**			
	ESG	**E**	**S**	**G**	**ESG**	**E**	**S**	**G**
ESG	.0015				-.0016*			
	(.0010)				(.0008)			
E		.0019				-.0049*		
		(.0012)				(.0025)		
S			.0009				-.0001	
			(.0011)				(.0019)	
G				.00165				-.0007
				(.0010)				(.0010)
SIZE	.0808	.0846	.0918	.0666	.7095***	.7079***	.7220***	.7212***
	(.1107)	(.1106)	(.1110)	(.1095)	(.1735)	(.1747)	(.1750)	(.1706)
MTB	.0002	.0002	.0003	.0004	-.0025	-.0025	-.0026	-.0026
	(.0009)	(.0008)	(.0009)	(.0008)	(.0017)	(.0017)	(.0016)	.0016
ROA	-.0927*	-.0944*	-.0951*	-.0899*	-.1903	-.1992	-.1943	-.1937
	(.0504)	(.0495)	(.0501)	(.0498)	(.2384)	(.2425)	(.2417)	(.2374)
LEV	.0227**	.0222**	.0229**	.0220**	-.0039	-.0042	-.0037	-.0037
	(.0106)	(.0101)	(.0105)	(.0103)	(.0186)	(.0184)	(.0179)	(.0182)
LIQ	-.1902*	-.1833*	-.1966*	-.1757	.0379	.0354	.0454	.0393
	(.1097)	(.1091)	(.1107)	(.1120)	(.1762)	(.1767)	(.1753)	(.1769)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	875	875	875	875	525	525	525	525
R-squared	0.1990	0.1935	0.2963	0.1646	0.1063	0.1108	0.1130	0.2851
Number of Firms	175	175	175	175	175	175	175	175

*Standard errors of clustered and heteroscedasticity robust models are provided in parentheses. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.*

As with market risk, business risk is calculated using both the Z'' and ZM scores, and its relationship with CSP is illustrated in Tables 8 and 9. As can be seen, ESG has no impact of on business risk before and during the pandemic period. Altough the findings from the market risk analysis support H1's hypothesis that ESG is negatively correlated with firm risk, this hypothesis cannot hold true when considering business risk. Therefore, H1 is partially supported based on these analysis results. On the other hand, the H2 hypothesis can be accepted because, it holds

that ESG is more closely related to market risks than to business risks derived from accounting data.

Based on firm size, it can be concluded that large firms are more exposed to business risk before and during the pandemic. Because of large firms' greater susceptibility to recessionary risk, they are more susceptible to default risk (Denis & Denis, 1995; Lang & Stulz, 1992). Similar patterns are observed in terms of profitability ratios when comparing these two periods. During both periods profitable firms are not exposed to going bankrupt. The book-to-market ratio is aimed at detecting differences between value and growth companies (Sassen et al., 2016). Although the market-to-book ratio has no impact on market risk, its impact is observed on business risk during economic prosperity. This implies that value companies were less vulnerable to business risk before the pandemic. Additionally, financial leverage negatively impacts market risk during periods of economic upswing and negatively impacts, business risk during COVID-19.

Table 8
ESG And Business Risk (Based On Z"-Score)

Dependent Variable: Z" Score								
Panel A: before COVID-19					**Panel B: COVID-19**			
	ESG	**E**	**S**	**G**	**ESG**	**E**	**S**	**G**
ESG	-.0190 (.0162)				-.0139 (.0126)			
E		-.0338 (.0338)				.0330 (.0224)		
S			-.01542 (.0168)				.0588 (.0454)	
G				-.0013 (.0077)				-.1237 (.0920)
SIZE	-4.3241* (2.496)	-4.339* (2.438)	-4.4631* (2.447)	-4.4242* (2.476)	-13.214 (15.630)	-12.931 (15.551)	-12.917 (15.447)	-13.319 (15.505)
MTB	-.0032 (.0059)	-.0017 (.0060)	-.0036 (.0059)	-.0042 (.0061)	-.0166 (.01824)	-.0166 (.01840)	-.0200 (.0196)	-.0168 (.0187)
ROA	5.5019** (2.2873)	5.5296** (2.2974)	5.5397** (2.2936)	5.5036** (2.2931)	26.633* (13.844)	26.777* (13.890)	26.566* (13.800)	26.725* (13.384)
LEV	.0285 (.04018)	.0378 (.0420)	.0254 (.0407)	.0285 (.0418)	.2997 (.2757)	.2985 (.2827)	.2625 (.2783)	.3070 (.2449)
LIQ	-.4075 (2.4024)	-.5574 (2.4249)	-.3081 (2.3620)	-.3530 (2.3768)	.2208 (4.4340)	.4651 (4.4233)	-.0112 (4.3853)	-.6439 (4.228)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	875	875	875	875	525	525	525	525
R-squared	0.1975	0.1942	0.2960	0.1577	0.2688	0.2683	0.2686	0.2765
Number of Firms	175	175	175	175	175	175	175	175

*Standard errors of clustered and heteroscedasticity robust models are provided in parentheses. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.*

Table 9
ESG and business risk (based on ZM -Score)

Dependent Variable: ZM score								
Panel A: before COVID-19					**Panel B: COVID-19**			
	ESG	**E**	**S**	**G**	**ESG**	**E**	**S**	**G**
ESG	.0002				-.00015			
	(.0016)				(.0013)			
E		-.0033				.00043		
		(.0021)				(.0017)		
S			-.0009				-.00004	
			(.0018)				(.0028)	
G				.0010				-.0019
				(.0011)				(.0019)
SIZE	1.3175***	1.3292***	1.3178***	1.3043***	1.8694***	1.8728***	1.8704***	1.8671***
	(.3403)	(.3410)	(.3415)	(.3409)	(.3854)	(.3835)	(.3854)	(.3865)
MTB	-.0067***	-.0064***	-.0066***	-.0066***	.0098	.0098	.0098	.0098
	(.0020)	(.0020)	(.0020)	(.0021)	(.0060)	(.0060)	(.0060)	(.0060)
ROA	-5.222***	-5.222***	-5.220***	-5.220***	-6.169***	-6.1671***	-6.1694***	-6.1674***
	(.1224)	(.1225)	(.1230)	(.1225)	(.4292)	(.42871)	(.4294)	(.4266)
LEV	.0448	.0449	.0447	.0443	.0967**	.0967**	.0967**	.0968**
	(.0338)	(.0335)	(.0336)	(.0337)	(.0384)	(.0385)	.0390	.0381
LIQ	.2507	.2435	.2504	.2623	-.3478	-.3448	-.3470	-.3620
	(.3591)	(.3580)	(.3593)	(.3582)	(.2650)	(.2651)	(.2688)	(.2631)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	875	875	875	875	525	525	525	525
R-squared	0.1954	0.1930	0.2951	0.1582	0.2047	0.2056	0.2047	0.2069
Number of Firms	175	175	175	175	175	175	175	175

*Standard errors of clustered and heteroscedasticity robust models are provided in parentheses. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.*

Conclusion

In this study, we examine whether and how ESG and its components impact firm risk during the COVID-19 pandemic. The empirical strategy used fixed-effect regression with a sample of 1400 firm-year observations from European countries. To avoid multicollinearity and potential endogeneity problems, each ESG component and risk measurements were separately analyzed. In contrast to other studies (Habermann & Fischer 2023; Zhang et al., 2023; Lueg et al., 2019), we use both business and market risk to determine reactions to firms' ESG performance. In addition, many studies used a sample that included financial crises, which does not provide a true reflection of the impact of CSP on firm risk. Due to this problem, the samples before and during COVID-19 is separated and compared. According to the findings of this study, CSP is more strongly linked to market risk than business risk. Furthermore, it is concluded that CSP mitigates market risk during the COVID-19 economic downturn period. It is difficult to observe the potential contribution of ESG to risk elimination during the

economic upswing because, each firm is capable of overcoming potential risks through credit or ensuring greater demand for goods and services. Consequently, it can be concluded that investment in CSP during periods of economic prosperity agress with agency theory because investment under these conditions wastes resources and disburses firms' cash. However, during at financial crisis, investments in CSP activities will prove beneficial, as can be seen from the viewpoint of stakeholder theory. Based on prior research (Habermann & Fischer 2023; Broadstock et al., 2021; Bouslah et al., 2018) and the results of this study it can be inferred that there exists a positive influence of CSP particularly during periods of economic adversity. Thus, the main conclusions of this study support the risk mitigation view.

As provided in the "Data and Methodology" section , since 2015, the most increase was observed in the governance pillar score and the least increase was observed in the enviromental pillar score. Considering the pandemic period, the improvement order has changed, and environmental performance is ranked second. Further combined ESG and each of its components showed improvement before and during the pandemic period. Business and market risk also increased during the same period. Accordingly, when considering ESG components, environmental performance is the main driver of risk mitigation during the pandemic. As a result, firms with high environmental pillar scores are perceived as offering investors refuge during the COVID-19 pandemic. Due to the increasing importance of resource use and environmental stability during the COVID-19 pandemic, firms began investing more in eco-friendly technologies; therefore, the environment was more prominent for investors than social and governance issues. Because each economic crisis has different reasons and consequences the importance of the ESG subcategories may vary depending on the type of crisis. Considering this, we recommend that further studies to investigate how ESG and its components impact firm risk, together with gross domestic product (GDP) as a moderating factor.

The findings of this study also show that market risk is closely related to CSP whereas there is no association between business risk and CSP. The COVID-19 pandemic directly affects both the economy and financial markets; thus, its effect on market risk is more significant than its impact on business risk. Therefore, other studies are also recommended to focus more on market-based risk measurement models (i.e, Bharath and Shumway, 2008; Merton, 1974) or actual financial failure (Cooper and Uzun, 2019) to provide more accurate results.

Nevertheless, some caveats should be considered when interpreting the results of this study. The first limitation of this study is that, it is based solely on one market risk indicator. However, beta is also widely used in the literature as a market risk indicator, apart from idiosyncratic and tail risks. This study also included firms from countries with higher gross domestic product per capita and a higher human development index. These countries already have developed capital markets and legal systems; thus, it is difficult to observe the positive effects of CSP on firm risk, particularly during economic growth periods. Consequently, the

conclusions drawn from this study may not be readily applicable to emerging economies or to markets characterized by less robust capital markets and legal systems, where localized financial crises are more likely to occur and have a more significant adverse impact. Finally, this study measured firms' CSP performance using firms' ESG performance obtained from the TR Eikon database. Although this database is widely used in the literature and involves numerous ESG metrics, it is doubtful to consider it as a fully CSP performance reflective mechanism.

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