The relationship between corporate social responsibility and firm risk during periods of high volatility in Europe

Abstract

This paper examines the link between a firm's corporate social performance based on Thomson Reuters ESG (environmental, social and governance) scores and its overall risk (total, idiosyncratic, and systematic risk including downside risk measures), drawing on an extensive panel data sample of STOXX Euro 600 constituents from 2002 to 2018. I found that firm risk (both total and systematic risk) among STOXX Euro 600 members was negatively associated with ESG score, and in particular with social pillar score. This link was stronger during periods of high volatility.

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1 Introduction

Corporate social responsibility (CSR) and responsible investing have been hotly debated in recent decades, with disagreement over whether such initiatives hurt or benefit firms from a financial perspective. However, in the second half of 2010s, responsible investing has become a mainstream investment strategy. Even reluctant asset managers are taking initial steps forward in responsible and environmental, social and governance (ESG) rating-based investing to meet demand from asset-holders and mitigate regulatory and climate-related risks (including both physical risks and risks related to the transition to carbon-neutral economy).

The Global Sustainable Investment Review reported that global sustainable investment grew by 34% between 2016 and 2018 and reached US$30.7 trillion at the beginning of 2018 (GSIA 2018). Europe led this growth, investing about US$14 trillion in 2018, up 11% from 2016. Recently, BlackRock, the world's largest asset manager with nearly US$7 trillion under management, sent letters to CEOs of the firms and its clients informing them of its intention to place sustainability at the centre of its investment approach (BlackRock 2020).

Europe remains the locus of socially responsible investing, and responsible investment practices have been adopted by European institutional investors, especially insurance companies and pension funds. The EU is a strong supporter of the transition to "a low-carbon, more resource-efficient and sustainable economy" (EU 2020) and played a significant role in the negotiation of the Paris Agreement. The European Commission (EC) has taken a leadership role by implementing necessary steps towards alignment with the Agreement, and the EC's Action Plan on Financing Sustainable Growth, which supports the realisation of this goal, was adopted in 2018. Recently, the EU's Technical Expert Group on Sustainable Finance (TEG) finalised their taxonomy report, which sought to establish a comprehensive classification system for sustainable activities in the EU. Subsequently, Taxonomy Regulation is adopted by European Parliament on 18th of June 2020.

The relationship between a firm's social responsibility and its financial performance remains a matter of interest for scholars. However, there are many different approaches and manners to explore the link between corporate social performance (CSP) and corporate financial performance (CFP).

According to the principle of risk mitigation in the stakeholder theory framework, corporate social investments might provide benevolence and public weal among stakeholders, which brings insurance-like protection that curtails risk exposure of a firm. Thus, higher CSP preserves, rather than improves, CFP (Godfrey 2005 and 2009). In this research, I analysed the back-door mechanism between CSP and CFP by investigating the wealth-protective association rather than the wealth-enhancing which are captured by stock market valuations. It is necessary for investors and corporate managers to clearly understand the association between CSP and CFP, and to take it into account in their decision-making.

I examined the relationship between a firm's CSP, using Thomson Reuters ESG scores, and its risk (i.e., total, idiosyncratic, and systematic risk, including downside risk measures) using an extensive panel data sample which consisted of 9,996 firm-year observations from 588 European firms from 2002 to 2018. I conducted fixed effects regressions with cluster-robust standard errors at the firm level and included many control variables. I added unconventional risk measures and found that conventional Beta and downside Betas (Beta_BL and Beta_HR) lead to similar conclusions, adding convergent validity to my empirical analysis.

My findings showed that the higher the aggregated ESG score, the lower the systematic (Beta) and total risk. When I investigated the three pillar scores of environmental, social performance and corporate governance, my results showed that social performance is negatively associated with Beta and Beta_BL.

My analysis expanded on elements of the methodology used by Sassen et al. (2016). In addition to the main part of my study, I also investigated the link between CSP and firm risk during periods of financial distress (i.e., the dot-com bubble collapse, the global financial crisis, the European debt crisis, the Greek debt default and the Brexit referendum). I split my data sample into two subsamples based on levels of volatility and found further evidence of the insurance-like protection enjoyed by corporations undertaking socially responsible activities.

My results showed that in times of high-moderate volatility, socially responsible firms are identified by lower levels of firm risk (particularly total and systematic risk). Socially irresponsible firms have higher levels of firm risk during adverse economic shocks.

I implemented the two-stage least squares method (2SLS) for potential endogeneity problem. In the 2SLS regressions, ESG score is replaced by a predicted value, which is estimated by regressing ESG score on an instrumental variable. Instrumental variable is the country-level data from Germanwatch website which is called Climate Change Performance Index. In this index, 17 European countries are assessed in terms of their climate change performance in four pillars. Emissions of the greenhouse gases have 40% weighting in the overall score. Each of the climate policy, energy use and renewable energy pillars has 20% weightings in the assessment (Germanwatch 2020). However, I report Stock-Yogo F test to assess the validity of the instrument and I found out that Germanwatch country score is a weak instrumental variable.

In this paper, theoretical background and empirical evidences are included in section 2 which leads to the hypotheses. Section 3 describes the sample construction process, and Section 4 contains descriptive statistics on the sample, explains the methodology and describes the results. Section 5 concludes the paper and considers the implications of my findings. Section 6 includes limitation of my research and further research ideas.

2 Theoretical Framework

2.1 Theoretical background

This section summarises the main theories on the relationship between financial performance (including risk) and corporate social and environmental responsibility.

The first is the theory of strict constructionism, which considers that more responsible corporate behaviour leads to additional operating costs and may also require sacrifices such as eliminating certain product lines, taking environmental protection measures or promoting community development plans. Thus, this theory argues that improving CSP increases risk and results in economic disadvantage.

The second is the theory of environmental responsibility, which claims that despite the potential costs of responsible corporate behaviour, such behaviour either causes revenues to increase or other costs to decrease. Companies may also reduce their costs due to reduced energy consumption or increased efficiency, reduced materials waste or the prevention of environmental crises, penalties and spills through efforts to minimise the environmental impact of their products and processes. On the revenue side, companies with stronger social and environmental performance may broaden their investor base (Cox et al. 2004), decrease their capital costs (Cheng et al. 2013), expand their markets, attract customers and displace competitors that fail to operate in a socially and environmentally responsible manner (Klassen et al. 1996). According to this theory, socially responsible behaviours also decrease a firm's market risk, resulting in more reliable cash flow projections (Orlitzky et al. 2001).

2.1.1 Stakeholder theory

Freeman's (1984) stakeholder theory provides that every company has explicit and implicit relationships with a variety of stakeholders who have power over and/or an interest in its actions and outputs and, therefore, are critical in determining its success or failure (Jensen et al. 1976; Wijnberg 2000). Thus, firm managers have a duty to balance competing stakeholder claims to preserve the welfare of the company (Evan et al. 1993).

Stakeholder theory helped to define new external stakeholders that need to be taken into account by firms, beyond the traditional parties such as suppliers, employees, customers and shareholders, leading to a new form of managerial comprehension and activity (Jonker et al. 2002). According to stakeholder theory, firms must responsibly manage an extended web of stakeholder interests and recognise a duty of care to both conventional interest groups and hidden stakeholders, for instance the environment and local communities (Simmons 2004).

Theoretically, if firms that do not operate in a socially and environmentally responsible manner and fail to satisfy the claims of their implicit stakeholders, they may be considered a risky investment, because of the likelihood of costly explicit claims such as fines, lawsuits or other regulatory interventions which compel firms to acknowledge these claims. Failing to consider implicit and explicit stakeholder claims is evidence of poor management, which may lead to constraints on obtaining capital at consistent rates (McGuire et al. 1988).

2.1.2 Risk mitigation view

According to the capital asset pricing model, a profit-maximising manager does not invest in risk management in perfect capital markets (Markowitz 1952; Sharpe 1964). Theoretically, additional expenditure to reduce idiosyncratic risk decreases the value of the firm and does not offer any additional risk reduction beyond that which can be attained by holding a diversified portfolio of securities. Nevertheless, Smith et al. (1985) and Stultz (2002) showed that, in the real world, risk reduction adds value to shareholders notwithstanding the cost of such investments.

According to the principle of risk mitigation in the stakeholder theory framework, corporate social investments might provide benevolence and public weal among stakeholders, which brings insurance-like protection that curtails risk exposure of a firm. Thus, higher CSP preserves, rather than improves, CFP (Godfrey 2005 and 2009). In other words, if a firm has high moral capital, less severe sanctions will be imposed by stakeholders during negative events. Bansal et al. (2004) argued that higher CSP helps to reduce the impact of negative shocks, protect a firm's reputation, alleviate regulatory constraints, and defend the company against surveillance (Luo et al. 2009).

The risk-reductive effects of CSP make socially responsible investing more attractive especially for some kind of institutional investors like pension funds, which have a certain long term liability structure (Ryan et al. 2002).

2.1.3 Over-investment view

The principle of managerial opportunism, which is based on agency theory, argues that managers overinvest shareholders' money for perceived social good and exploit their reputation as good social citizens for their own self-interest (Barnea et al. 2010). Therefore, managerial opportunism predicts a positive association between firm risk and CSP. For instance, Surroca et al. (2008) found that a firm's CSP might serve as a part of a manager's own strategy.

2.2 Empirical evidence

This section considers existing literature on the relevance of CSP to CFP or firm risk. The first section focuses on determinants of CFP, while the second focuses on risk measures.

2.2.1 The relationship between CSP and CFP

One of the most comprehensive papers in the ESG investment is written by Friede et al. (2015) and the authors combined the findings of more than 2000 empirical studies conducted since the 1970s and concluded that there is an empirically proven business case for responsible investing. Around 90% of studies found a nonnegative relationship between ESG and CFP. The authors underlined that most studies report positive findings and the relationship is stable over time and across region and asset classes.

Researchers not only used ESG ratings but also other firm characteristics to examine the CSP. For instance, with regard to environmental impact of the firms, Liesen et al. (2017) examined the performance of 433 European companies from 2005 to 2009 and considered the relevance of environmental disclosures and performance (in terms of greenhouse gas [GHG] efficiency) to asset prices. They also investigated whether such information was priced appropriately and found that investors managed to gain abnormal risk-adjusted returns of up to 13.05% annually by taking advantage of the price inefficiency resulting from the positive impact of environmental performance and GHG emissions disclosure.

Socially responsible firms should address not only the needs of their customers but also their employees. Edmans (2011) examined the association between the stock returns in the long term and employee satisfaction. He found that a value-weighted portfolio of the "Fortune 100 Best Companies to Work for in America" earned 2.1% above industry benchmarks from 1984 to 2009.

Gompers et al. (2013) constructed a governance index to investigate the impact of shareholder rights on equity prices and showed that a strategy which invested firms in the lowest decile of the governance index (i.e., with strongest shareholder rights) and sold firms in the highest decile of the index would have gained abnormal returns of 8.5% per year in 1990s. After comparing these two subsamples, the authors also concluded that companies with stronger shareholder rights had higher sales growth, higher profits and firm value, made fewer acquisitions, and lower capital expenditures.

Cost of capital is a crucial factor for investment and corporate finance decisions. Therefore, Dhaliwal et al. (2011) investigated whether voluntary disclosures of CSR activities are associated with a positive impact on the cost of equity capital. The authors' main finding was that firms with high equity capital costs in the preceding year are more likely to begin disclosure of CSR activities in the following year, and those firms, which have improved CSP, earn a consequent drop in the cost of equity capital. Moreover, voluntary disclosures of CSR activities broaden a firm's investor base, particularly among dedicated institutional investors. Furthermore, Cheng et al. (2013) showed that firms with stronger CSP face significantly lower capital constraints, due to both transparency and stakeholder management. The relationship between capital constraints and CSP is stronger and more significant for the most capital-constrained firms, which is inconsistent with the argument that CSR is a luxury good. The authors also found that the link between capital constraints and CSP is driven by both the environmental and social dimensions of CSP.

As one of the early studies in 2000s, Cox et al. (2004) found that long-term institutional investment is positively related to CSP, based on a sample of over 500 UK firms in 2001 and 2002. Moreover, Lee et al. (2009) analysed two mutually exclusive leading and lagging Dow Jones global corporate sustainability portfolios and found that while lagging sustainability firms outperformed the market, leading sustainability firms did not underperform the market.

Increased number of engagements by institutional investors with the firms where they invest has been a major change in Western countries since 1980s and these engagements has become common for environmental, social and governance issues as well starting from late 1990s. Dimson et al. (2015) examined CSR engagements related to governance, social and environmental concerns by US public companies from 1999 to 2009 and found that successful engagements were followed by positive abnormal returns and vice versa. The probability of success was higher if the firm had a poor reputation and a higher capacity to implement changes. Following successful engagements, particularly on environmental and social causes, firms increased their institutional ownership and improved their accounting performance.

2.2.2 The relationship between CSP and firm risk

As one of the most comprehensive studies, Orlitzky et al. (2001) performed a meta-analysis using data from 1980s and 1990s and found that risk is negatively associated with CSP. Among all risk measures, high CSP is most negatively correlated with total market risk. When the measures of market risk and accounting risk are compared, CSP is more strongly associated with market risk.

Godfrey et al. (2008) examined 178 negative legal and regulatory actions against firms between 1993 and 2003 and used event-study methods to show that participation in CSR activities seems to yield insurance-like protection for many firms. This paper contributed to the growing research stream on the CFP-preserving impact of CSR. The authors also found that participation in institutional CSR activities (including both community and diversity dimensions) grants an insurance-like positive impact. However, presence in technical CSR activities (including governance improvements and employee and product relations) did not generate a similar kind of benefit.

Luo et al. (2009) went beyond existing CSR research and considered the role of two marketing levers (R&D and advertising) in explaining the variability of the relationship between CSP and risk among different firms. They found that superior CSP relative to competitors can boost shareholder wealth by lowering the volatility of a firm's stock prices. Furthermore, firms with higher advertising intensity extract more risk reduction benefit from CSP than firm with lower advertising intensity. However, the simultaneous pursuit of CSP, R&D and advertising has an adverse financial impact due to increased stock risk.

Salama et al. (2011) found evidence of a negative link between the Community and Environmental Responsibility (CER) scores of UK firms between 1994 and 2006 and market risk (firm beta).

US firms are analysed more due to the availability of the KLD data in 1990s. Oikonomou et al. (2012) investigated the wealth-protective, rather than wealth-enhancing, impacts of socially responsible firm behaviour by analysing the relationship between CSP and systematic firm risk for S&P 500 members between 1992 and 2009. They found that the relationship between CSR (i.e., the strength components of KLD data (now known as MSCI ESG), including community, diversity, employment, product safety and quality) and beta is a weak negative, while corporate irresponsibility (i.e., majority of the concern factors, including environment, employment and community) is strongly positively associated with systematic risk. Both conventional and downside risk measures gave similar results. Moreover, the authors found that in the presence of high-moderate volatility, socially irresponsible firms are linked to higher levels of market risk. Bouslah et al. (2013) examined the effect of the individual aspects of social performance on firm risk among US firms between 1991 and 2007 using the MSCI ESG Ratings from the KLD database. They showed that corporate governance, diversity and employee issues have positive impact on firm risk for S&P500 members, whereas employee concerns and diversity strengths affect firm risk positively for non-S&P500 members.

Sassen et al. (2016) used a large European panel dataset of 8,752 firm-year observations from 2002 to 2014 to assess the impact of CSP on market risk measures. CSP was measured by ESG scores obtained from the Thomson Reuter Asset4 database. The authors applied three risk measures: total risk, idiosyncratic risk and systematic risk (Beta). They showed that firm risk is significantly and negatively affected by CSP. Environmental performance of a firm generally curtails idiosyncratic risk; however, this applies only in environmentally sensitive industries for systematic and total risk. The authors did not identify a significant link between corporate governance performance and firm risk.

Lastly, Bouslah et al. (2018) examined the effect of the global financial crisis (2008–2009) on the association between firm risk and social performance focusing non-financial U.S. companies from 1991 to 2012. They found that the relationship is time-varying and depends on market conditions. During crisis periods, CSP significantly reduces volatility. The results of the study were mainly

driven by the strength components of social performance in the MSCI ESG data, suggesting an asymmetrical relationship between CSP and firm risk.

2.3 Regulatory background: The EU's Sustainable Finance Strategy

The EU is the strongest supporter of the transition to "a low-carbon, more resource-efficient and sustainable economy", and it has been a prime mover of the international attempts to build a financial system that supports sustainable growth (EU 2020). The EU played a significant role in the negotiation of the Paris Agreement and has adopted a leadership role by taking steps towards alignment with the Agreement.

Before the end of 2050, the EU is planning to produce net-zero GHG emissions and ultimately being a climate-neutral union. In 2018, the EU enacted the necessary regulation to support the realisation of this aim through its Action Plan on Financing Sustainable Growth. The main objectives of the Action Plan are to strengthen the transparency of companies' ESG policies, develop a clear and detailed EU classification system (i.e., a taxonomy) for sustainable activities, establish EU labels for green financial products, incorporate climate risks into banks' risk management policies and introduce sustainability benchmarks to make the duties of asset managers clear (EU 2020).

As stipulated in the Action Plan, the EU taxonomy is intended to act as a guideline on ESG activities for all market participants in the EU. In December 2019, the EU's Taxonomy Regulation (TR) was agreed upon at the political level by the European Council and Parliament. Recently, the EU's independent Technical Expert Group on Sustainable Finance finalised its taxonomy report and consequently the Taxonomy Regulation is adopted by European Parliament on 18 June 2020. (KKS Advisors 2020). Thus, new EU Directive on sustainable finance would have a considerable impact on the investors' choices and firms' decisions on their economic activities in the EU from 2020 onwards.

2.4 Development of hypotheses

In this study, I focused on the association between CSP and firm risk for my sample of European firms, in order to be able to compare my results with those of the benchmark paper (Sassen et al. 2016) and other existing studies. Furthermore, according to the risk mitigation principle drawn

from stakeholder theory, corporate social investments might provide benevolence and public weal among stakeholders, which brings insurance-like protection that curtails risk exposure of a firm. Thus, higher CSP preserves rather than provides CFP. Risk can be measured by the fluctuation of CFP with respect to stock prices over time or by internal accounting returns (Orlitzky et al. 2001). In this study, following Sassen et al. (2016) and Oikonomou et al. (2012), I used market-based risk measures instead of accounting risk measures.

In previous literature, total market risk has been defined as the degree of volatility for a company over time, which is measured by the variance or standard deviation of the stock returns (Jo et al. 2012 and Orlitzky et al. 2001). According to financial theory, total market risk can be divided into systematic and idiosyncratic risk (Jo et al. 2012; Sassen et al. 2016). The idiosyncratic risk (i.e., the unsystematic risk) is a firm-specific risk and is not linked to market movements (Luo et al. 2009; Sassen et al. 2016). Systematic risk represents a firm's vulnerability to changes impacting the entire market (Luo et al. 2009).

As stated above, the risk mitigation principle argues that there is a negative association between CSP and firm risk. In this study, in line with Sassen et al. (2016), I assumed that ESG factors negatively impact market-based risk measures (including total, systematic, and idiosyncratic risk). Sassen et al. (2016) investigated the relationship between CSP, as measured by ESG factors, and firm risk in Europe and found that:

- "the higher the aggregated ESG score, the lower the total and idiosyncratic risk";
- "social performance decreases total, systematic, and idiosyncratic risk"; and
- "environmental performance generally decreases idiosyncratic risk, whereas total risk and systematic risk are only negatively affected in environmentally sensitive industries."

My research used the first two stages of the authors' hypothesis and extended their research by studying this relationship during periods of financial distress:

Hypothesis 1*: There is a negative association between overall CSP, as measured by aggregated ESG score, and financial risk.*

The three pillars of ESG can have varying impacts on firms' financial or risk metrics because of the concerns of different types of stakeholders (Girerd-Potin et al. 2014; Godfrey et al. 2009; Sassen et al. 2016). Investors may weigh the materiality and relevance of the ESG categories separately, causing different market reactions to ESG activities.

Hypothesis 2*: Environmental, social, and corporate governance performances are associated with a firm's total, systematic, and idiosyncratic risk.*

During crises, investors' risk aversion rises, and they direct more attention to the risk evasion rather than to achieving high returns. In such circumstances, the wealth-protective effects of high CSP make socially responsible firms a highly desirable investment.

Oikonomou et al. (2012) argued that in times of high volatility, socially and environmentally irresponsible firms are linked to higher levels of financial risk. In line with the above analysis, I assumed that the impact of the ESG dimensions (social, governance and environmental) on company risk would vary according to the level of market volatility.

Hypothesis 3*: On the existence of high-moderate market volatility, the association between CSP and firm risk is stronger.*

3 Data

3.1 Sample construction

I chose European public firms as the sample of my thesis. Despite the increased interest in responsible investing and ESG integration in the European financial industry, to the best of my knowledge, there has been no recent in-depth research on the association between ESG and firm risk for specifically European stocks. The most recent and comprehensive study is that of Sassen et al. (2016), which examined the performance of European firms from 2002 to 2014.

The STOXX Europe 600 Index involves most large-, mid- and small-cap companies in 17 European countries: the United Kingdom, Germany, France, Switzerland, Sweden, Austria, the Netherlands, Norway, Belgium, Denmark, Finland, Luxembourg, Ireland, Italy, Portugal, Poland, and Spain (STOXX, 2020). It is considered to be a benchmark for European stock markets (Sassen et al. 2016; Horvath et al. 2013)

I retrieved the Europe STOXX 600 Index constituents and their identifiers as of October 2019 from the Thomson Reuters Eikon database (Datastream). I then used these identifiers to gather data on stock prices in Euros between 2002 and 2018 from the Eikon database. Twelve firms were excluded, primarily due to non-matching firm identifiers. The total sample consisted of 9,996 firm-year observations for regression analysis, from a total of 588 European firms. The number of observations may have been lower due to missing values in several variables and the model's specification of the risk measures. I performed my quantitative analysis using STATA.

3.2 Risk measures

Previous studies have identified different ways to capture financial risk. For this research, I estimated firm risk using five different risk measures: total risk, Beta, two separate downsize Betas (Beta_BL and Beta_HR) and idiosyncratic risk.

Total risk is a measure of a stock's volatility and is calculated using the annualised standard deviation of daily stock returns over the previous 12 months. Beta (systematic risk) shows the sensitivity of a firm to market return changes and is also considered as a part of total risk. I calculated Beta using a standard Capital Asset Pricing Model (CAPM). I regressed daily realised

returns of the firms' shares on daily market returns over the same 12-month period. I used the observed returns of Euro STOXX 600 as a market proxy. I drew the Beta_BL values from Bawa and Lindenberg (1977), who used the risk-free rate (German government bonds in this thesis) as their target return. Following Harlow and Rao (1989), I used mean market return as a threshold for Beta_HR. Idiosyncratic risk is the residual risk which cannot be explained by Beta and market movements, and it depends on more firm-specific characteristics. In this study, idiosyncratic risk was estimated by calculating the annualised standard deviation of residuals from the Fama–French Three-Factor Model using daily returns over the year. All risk measures are winsorized at the 1st and 99th percentiles.

3.3 ESG scores

Consistent with the prior literature (e.g., Eccles et al. 2015; Ioannou et al. 2012; Sassen et al. 2016), I used ESG data obtained from the Thomson Reuters-Refinitiv ESG database as a measure of CSP. The ASSET4 Equal Weighted Ratings (EWR) database was replaced by the enhanced Thomson Reuters-Refinitiv ESG database (Refinitiv 2019). One of the key enhancements was the new percentile rank scoring methodology, replacing 0 to 1 scoring. The other important improvement was the implementation of industry and data benchmarks within the data point scoring, to enable comparisons between peer groups. Besides the three main pillars of ESG scoring (i.e., environmental, social and governance), the ESG controversy score was also added to measure the impact of controversies on firms' overall ESG Combined Score. However, I excluded ESG Controversies and ESG Combined Score from my analysis.

The Refinitiv database covers over 7,000 companies globally, representing more than 70% of global market cap, with more than 400 data points, ratios and analytics on the basis of reported data in the public sector. Firms' ESG performance is measured through 10 main themes. These are resource usage, innovation of green product, emissions, workforce, community, human rights, responsibility of product, shareholders, management and CSR strategy (Refinitiv 2019). The overall ESG score is calculated according to the weighted scores across three pillars: environmental (34%), social (35.5%) and governance (30.5%).

The environmental pillar score (ENS) measures a firm's reduction in its use of resources (including water, land, and air). It also depicts the firm's pledge to reducing environmental emissions resulting from its processes and reflects its capacity to decrease environmental costs and burdens for its stakeholders by developing innovative solutions (Refinitiv 2019). ENS considers factors such as the volume of waste, water usage, environmental R&D expenditure and CO2 emissions.

The social pillar score (SOS) captures diverse determinants mainly a company's effectiveness towards job satisfaction, health and safety of the workplace, maintaining diversity and equality in the workplace, effectiveness towards respecting the fundamental human rights conventions, commitment in terms of being a good citizen, public health protection and respecting business ethics, integrity and data privacy (Refinitiv 2019). SOS considers factors such as trade union representation, the use of child labour, injury rate, and compliance with fair-trade principles.

The governance pillar score (CGS) represents a firm's commitment to following best-practice corporate governance principles and processes. Such practices should ensure the equal treatment of long-term shareholders of the company and the promotion of their interests and should also include the use of anti-takeover devices. CGS captures the link between a firm's strategy and its practices, including how such practices are integrated into day-to-day decision-making processes (Refinitiv 2019). CGS considers factors such as the effectiveness of board functions, establishment of board committees, board composition and board compensation policies.

The Thomson Reuters-Refinitiv ESG database provides broad ESG data coverage for the STOXX Europe 600 Index from 2002 to the present. The MSCI (KLD) database does not offer ESG data for my sample, except for the part of 2010s. My main analysis used aggregated ESG scores, but individual pillar scores are also discussed in the detailed analysis. I divided all ESG scores in my sample by 100 to ensure comparability with previous studies.

3.4 Control variables

Following previous studies on CSR and financial risk (Oikonomou et al. 2012; Sassen et al. 2016), I introduced many firm characteristics as control variables. I gathered all financial data for my control variables from the Thomson Reuters Eikon (Datastream) database. All control variables were winsorized at the 1st and 99th percentiles.

Firm size (SIZE) was measured as the log of total assets in Euros to account for the impact of size on firm risk. To capture the impact of firms' capital structures on firm risk, leverage (LEV) was calculated as the ratio of long-term debt to total assets (Sassen et al. 2016). I retrieved the market-to-book value ratio (MTB) from Datastream to measure the different risk characteristics of growth and value stocks (Oikonomou et al. 2012). I controlled stock market liquidity (LIQ), measured as the turnover by volume divided by the number of shares outstanding, to capture its possible impact on market risk. The current ratio (CURA), which is an indicator of the firm's ability to remain solvent in the short run and related to liquidity risk, was calculated by dividing the book value of a firm's current assets by its current liabilities. I calculated research and development intensity (R_D) using the ratio of R&D expenditure to total sales. Previous studies have found that R_D is positively correlated with CSP, and that exclusion of this variable may cause an omitted variable bias (Oikonomou et al. 2012).

Table 1 summarises the variables used in my analysis. Current values for all variables were employed. Some firm-year observations were lost in the regression analyses, due to missing data in some control variables (especially in R_D and CURA). Table 2 shows the number of my observations.

Table 1: Definition of variables

Risk Measures	
Total Risk	Total risk (i.e., total stock volatility) measured by annualized standard deviation of daily stock returns over the year
Idio. Risk	Idiosyncratic risk—unsystematic risk that cannot be explained by broad market movements, measured by annualized standard deviation of the residuals from the Fama-French3-factor model using the daily excess returns of the year
Beta	Systematic risk (i.e., sensitivity to changes in market returns) measured based on standard CAPM model using the daily excess returns of the year
Beta_BL	Downside beta comes from the work of Bawa and Lindenberg (1977), who use the risk-free rate as the target return
Beta_HR	Downside beta comes from the Harlow and Rao (1989) who use the mean market return as a threshold
ESG scores	
ESG	ESG score obtained from Thomson Reuters ESG scores, measured as the weighted average of pillar scores ENS (%34), SOS (%35.5), and CGS (%30.5)
ENS	Environmental pillar score obtained from Thomson Reuters ESG scores, measured as the weighted average of category scores ENER (%12), ENPI (%11), and ENRR (%11)
SOS	Social pillar score obtained from Thomson Reuters ESG scores, measured as the weighted average of category scores SOWO (%16), SOCO (%8), SOPR (%7), and SOHR (%4.5)
CGS	Governance pillar score obtained from Thomson Reuters ESG scores, measured as the weighted average of category scores SOWO (%16), SOCO (%8), SOPR (%7), and SOHR (%4.5)
Control variables	
SIZE	Company size measured as natural logarithm of total assets in Euro
LEV	Leverage measured as Long-term debt/Total assets
MTB	Market to book ratio obtained from Datastream
CURA	Current ratio measured as current total assets to current total liabilities
R_D	Research&Development expenditure/Total sales
LIQ	Stock liquidity measured as Turnover by volume/Number of shares

4 Empirical Analysis

4.1 Descriptive statistics

Panels A, B and C in Table 2 show the descriptive statistics, including the mean, median, standard deviation, min, max, skewness and kurtosis, for the independent and dependent variables in the core models of my thesis. The variables are grouped into risk measures (Panel A), ESG scores (Panel B) and firm characteristics-control variables (Panel C). In this section, I will describe the results of my analysis, substantiate the findings, and compare my results to those of related studies by Sassen et al. (2016) and Oikonomou et al. (2012).

4.1.1 Risk measures

As shown in Table 2 Panel A, the mean and median total risks were 0.30 and 0.27, respectively. The mean and median idiosyncratic risks were 0.26 and 0.23, whereas the mean and median systematic risks (Beta) were 0.92 and 0.90. Further, in relation to other downsize systematic risk measures, the mean and median for Bawa and Lindenberg Beta (Beta_BL) were 0.93 and 0.91. The mean and median for Harlow and Rao Beta (Beta_HR) were 0.97 and 0.94. The mean and median values of my risk measures were parallel to prior research on firm risk (e.g., Bouslah et al. 2013; Sassen et al.2016). The means of the risk figures of Sassen et al. (2016) for STOXX firms from 2002 to 2014 were as follows: total risk, 0.32; idiosyncratic risk, 0.30; and Beta, 0.78.

4.1.2 Corporate social performance (ESG)

Since I divided ESG scores by 100, the range was between 0 and 1, which is consistent with previous studies (Sassen et al. 2016). A high score indicated strong performance in the category. The mean and median scores for my sample of STOXX firms from 2002 to 2018 were 0.62 and 0.64 for ESG, 0.72 and 0.85 for ENS, 0.73 and 0.84 for SOS and 0.60 and 0.64 for CGS. The summary statistics of my sample were consistent with the previous literature. The means of the ESG scores calculated by Sassen et al. (2016) for STOXX firms were as follows: ESG, 0.67; ENS, 0.70; SOS, 0.72; and CGS, 0.59.

Table 2: Descriptive Statistics

Variable	Mean	Median	Standard Deviation	Min	Max	Skewness	Kurtosis	N
Panel A: Risk measures								
Total Risk	0.30	0.27	0.11	0.14	0.73	1.24	4.36	8504
Idio. Risk	0.26	0.23	0.11	0.11	0.77	1.57	5.98	8669
Beta	0.92	0.90	0.38	0.00	1.99	0.18	2.83	8707
Beta_BL	0.93	0.91	0.39	0.05	2.11	0.28	2.86	8668
Beta_HR	0.97	0.94	0.42	0.01	2.33	0.38	3.03	8668
Panel B: ESG scores								
ESG	0.62	0.64	0.16	0.09	0.96	-0.42	2.62	7442
ENS	0.72	0.85	0.26	0.08	0.97	-1.08	2.80	7463
SOS	0.73	0.84	0.26	0.04	0.99	-1.13	3.12	7463
CGS	0.60	0.64	0.26	0.02	0.98	-0.45	2.08	7460
Panel C: Control variables								
Size	15.921	15.784	1.889	11.413	20.943	0.27	2.81	8929
Leverage	0.196	0.176	0.143	0.000	0.665	0.70	2.98	8532
Market-to-book	2.616	2.020	2.178	0.050	18.060	2.46	11.60	8106
Current ratio	1.489	1.310	0.776	0.373	5.758	1.83	7.59	6918
R&D	0.045	0.021	0.064	0.000	0.581	3.09	17.22	4123
Stock liquidity	1.361	0.910	1.506	0.023	13.135	3.35	18.02	8258
Germanwatch	59.04	59.45	7.39	38.74	77.76	-0.28	-0.21	186

4.2 The relationship between CSP performance and firm risk

This section focuses on the association between CSP and firm risk. As stipulated in the theoretical framework, acting in a socially and environmentally responsible manner is predominantly negatively related to firm risk (including total risk, idiosyncratic risk and systematic risk). To test Hypothesis 1, I regressed risk measures on a range of ESG scores that capture firms' CSP, a range of controls and a combination of fixed effects. The model is specified in the following equation:

Equation (1): $FIRMRISK_{i,t}=\alpha+\beta_1 ESG_{i,t}+\beta_2 SIZE_{i,t}+\beta_3 MTB_{i,t}+\beta_4 LEV_{i,t}+\beta_5 LIQ_{i,t}+\beta_6 R\_D_{i,t}+\beta_6 CURA_{i,t}+\mu_s+\eta_t+\epsilon_{i,t}$

I ran fixed effects regressions using the 'reghdfe' command in STATA to estimate the parameters of the above equation. Using ESG score as an indicator of CSP, I predicted a negative coefficient for the ESG score variable.

To test Hypothesis 2, instead of overall ESG score, I used firms' weighted pillar scores (ENS, SOS, CGS) to investigate the impact of different ESG factors.

Following Sassen et al. (2016) and Oikonomou et al. (2012), I used firm size, MTB ratio, current ratio, research and development intensity, leverage and stock liquidity as my control variables. These controls were not included in all my model specifications; instead, I ran the same regressions consecutively for different sets of control variables. Initially, I included size, MTB ratio and current ratio, then included all firm characteristics to capture the effects of all other variables on the dependent variable in the model.

In my equations, the symbols μ and η respectively indicate to the firm and year fixed effects. Firm and year fixed effects are incorporated in model specifications of this paper. The fixed effects control for unobserved developments with regards to a specific firm and changes in the macroeconomic environment, which influence the dependent and independent variables synchronously. For instance, in my sample, I aimed to capture the impact of the global financial crisis and European debt crisis. The model estimated a parameter for each cross-sectional unit, and any covariation caused by years or firms having unusual characteristics was captured within the model. My explanatory variables were time-variant, so they were not affected by the imperfections of the fixed effects model (the impossibility of including time-constant variables).

Another important issue when analysing panel data is the estimation of robust standard errors. Thus, I calculated the t-statistics for the regression coefficients based on robust standard errors clustered at the firm level. Adoption of clustered standard errors makes it more challenging to get significant results, as standard errors are becoming larger in general.

Additionally, to minimise the threat of heteroscedasticity, I based the t-statistics for the regression coefficients on robust standard errors, which are consistent under heteroscedasticity. There is no downside to using robust standard errors since they are appropriate even when heteroscedasticity is not apparent. Robust standard errors are similar to regular standard errors in the absence of heteroscedasticity but diverge otherwise (White, 1980).

4.2.1 Total risk

Table 3 shows the regression results for total risk as a function of ESG, providing the initial evidence of the link between CSP and firm risk. As shown in column 1, I naively regressed the volatility of stock prices on an indicator for CSP without controls. I found an insignificantly negative coefficient on the aggregated ESG score. Further, after controlling for several firm characteristics, the results (as seen in column 2 and 3) showed that the relationship between firm risk and ESG became significantly negative, in line with Hypothesis 1 and consistent with Sassen et al. (2016). The ESG coefficient of 0.062 on total risk shows that an increase in a firm's ESG performance by one standard deviation 0.16 was associated with a relative decrease in total risk of 3.3% in relation to the mean risk of 0.30.

As shown in columns 4, 5 and 6, I next began to address Hypothesis 2 and investigate the relationship between total risk and the pillar scores (ENS, SOS and CGS), rather than using the aggregated ESG score. Consistent with Sassen et al. (2016), I found an insignificantly positive relationship between ENS and total risk. The coefficient of CGS was close to zero and insignificant. However, as shown in column 6, the coefficients of SOS were negative. Although they increased with additional control variables, they remained insignificant, in contrast to Sassen et al. (2016).

Table 3: Total Risk
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Total risk	(1)	(2)	(3)	(4)	(5)	(6)
ESG	-0.028	-0.039*	-0.062**			
	(0.018)	(0.024)	(0.030)			
ENS				0.005	0.015	0.026
				(0.011)	(0.015)	(0.021)
SOS				-0.013	-0.016	-0.026
				(0.011)	(0.014)	(0.020)
CGS				-0.002	-0.001	0.006
				(0.009)	(0.011)	(0.014)
SIZE		0.005	0.010		0.005	0.010
		(0.006)	(0.009)		(0.006)	(0.009)
CURA		-0.001	-0.003		-0.001	-0.003
		(0.004)	(0.005)		(0.004)	(0.005)
MTB		0.001	0.003*		0.001	0.003
		(0.001)	(0.002)		(0.001)	(0.002)
R_D			-0.050			-0.049
			(0.101)			(0.100)
LIQ			-0.003*			-0.003
			(0.002)			(0.002)
LEV			-0.003			0.002
			(0.033)			(0.033)
Observations	6,589	4,084	2,382	6,606	4,096	2,387
R-squared	0.683	0.687	0.672	0.683	0.687	0.671
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

4.2.2 Beta

The patterns in Table 3 (regressions of total risk on ESG) can also be seen in Table 4 (regression of Beta on ESG). The coefficients of Beta, as shown in columns 1 and 2, were significantly negative, supporting Hypothesis 1.

The SOS coefficient of 0.242 on Beta indicates that an increase in a firm's social performance by one standard deviation 0.26 was associated with a relative decrease in systematic risk by 6.8% in relation to the mean risk of 0.92. This indicates that, consistent with previous studies, firms' social

performance scores were relevant to their systematic risk. Further, as shown in columns 4, 5 and 6, the coefficients of ENS and CGS were insignificantly positive, in line with Sassen et al. (2016).

Table 4: Beta
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Beta	(1)	(2)	(3)	(4)	(5)	(6)
ESG	-0.094	-0.151*	-0.242**			
	(0.062)	(0.080)	(0.101)			
ENS				0.063	0.077	0.125
				(0.040)	(0.054)	(0.077)
SOS				-0.086**	-0.129***	-0.145**
				(0.041)	(0.048)	(0.068)
CGS				0.010	0.055	0.061
				(0.031)	(0.041)	(0.058)
SIZE		0.014	0.046*		0.013	0.045*
		(0.017)	(0.026)		(0.017)	(0.026)
CURA		-0.018	-0.023		-0.018	-0.023
		(0.013)	(0.019)		(0.013)	(0.019)
MTB		0.004	0.009		0.003	0.007
		(0.004)	(0.006)		(0.004)	(0.006)
R_D			-0.366			-0.387
			(0.360)			(0.356)
LIQ			-0.001			0.000
			(0.008)			(0.008)
LEV			0.068			0.096
			(0.122)			(0.123)
Observations	6,609	4,089	2,382	6,626	4,101	2,387
R-squared	0.563	0.573	0.590	0.563	0.574	0.589
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

4.2.3 Idiosyncratic risk

Counter to Hypothesis 1, the relationship between ESG and idiosyncratic risk was not statistically significant (Table 5). When I added more control variables, the coefficient decreased -0.040 (column 3). However, the coefficients of ESG (column 3) and SOS (column 6) were negative, in

line with Sassen et al. 2016. Additionally, the coefficients of ENS, SOS and CGS pillar scores were insignificant.

Table 5: Idiosyncratic risk
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

Idiosyncratic risk	(1)	(2)	(3)	(4)	(5)	(6)
ESG	-0.024	-0.034	-0.040			
	(0.017)	(0.022)	(0.028)			
ENS				-0.005	0.004	0.014
				(0.011)	(0.015)	(0.019)
SOS				0.002	-0.001	-0.015
				(0.010)	(0.012)	(0.016)
CGS				-0.009	-0.004	0.003
				(0.009)	(0.010)	(0.014)
SIZE		0.003	0.006		0.003	0.006
		(0.006)	(0.010)		(0.006)	(0.010)
CURA		-0.001	-0.003		-0.001	-0.003
		(0.004)	(0.005)		(0.004)	(0.005)
MTB		0.002*	0.003*		0.002*	0.002
		(0.001)	(0.001)		(0.001)	(0.001)
R_D			-0.038			-0.039
			(0.099)			(0.098)
LIQ			-0.004**			-0.004**
			(0.002)			(0.002)
LEV			0.014			0.016
			(0.032)			(0.032)
Observations	6,590	4,081	2,393	6,607	4,093	2,398
R-squared	0.646	0.638	0.619	0.646	0.637	0.618
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

4.2.4 Endogeneity problem

When the influence of ESG scores on firm risk is analysed, endogeneity could be an issue. The independent variable influences the dependent variable, but also the other way around. When this is the case, one of the assumptions for Ordinary Least Squares (OLS) estimation is violated. The endogenous variable is correlated with the error term, which causes biased regression coefficients

from OLS. I have used Germanwatch country scores as an instrumental variable (IV) to produce predicted values of the ESG score which are uncorrelated with firm risk and thus error term in my model.

In the first stage I regress ESG on the exogenous controls (e.g. SIZE, CURA, R_D, LEV) and the instrument variable (Germanwatch) as specified in equation 2.

Equation (2): $ESG_{i,t}=\alpha+\beta_1 Germanwatch_{i,t}+\beta_2 SIZE_{i,t}+\beta_3 CURA_{i,t}+\beta_4 R\_D_{i,t}+\beta_5 LEV_{i,tt}+\mu_s+\eta_t+\epsilon_{i,t}$

Table 6 presents results from OLS regressions of ESG on Germanwatch country scores. Column 1 and 2 include firm fixed effects. Column 1 and 3 include year fixed effects. I found a significant positive coefficient (0.001) for Germanwatch variable in column 1.

Table 6: ESG
Robust and clustered (by country) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

ESG	(1)	(2)	(3)
Germanwatch	0.001**	0.001	-0.001
	(0.000)	(0.001)	(0.001)
SIZE	-0.008	0.053***	0.012
	(0.009)	(0.012)	(0.008)
CURA	0.002	0.008	0.006
	(0.006)	(0.007)	(0.013)
R_D	-0.160	-0.0135	-0.004
	(0.130)	(0.137)	(0.216)
LEV	-0.026	-0.053	-0.092
	(0.021)	(0.034)	(0.056)
Observations	2,174	2,174	2,189
R-squared	0.847	0.827	0.032
Firm FE	YES	YES	NO
Year FE	YES	NO	YES

Equation (3): $FIRMRISK_{i,t}=\alpha+\beta_1 ESG_{i,t}+\beta_2 SIZE_{i,t}+\beta_3 CURA_{i,t}+\beta_4 MTB_{i,t}+\mu_s+\eta_t+\epsilon_{i,t}$

In the second stage I replace ESG with the predicted value from the first stage and regress firm risk on predicted ESG as specified in equation 3.

Table 7: OLS and SLS on firm risk
Robust and clustered (by country) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

VARIABLES	(1) Total risk	(2) Total risk_IV	(3) Beta	(4) Beta_ IV	(5) Idio_risk	(6) Idio_risk_ IV
ESG	-0.04**	-0.88**	-0.19***	-0.299	-0.035*	-1.28**
	(0.020)	(0.409)	(0.072)	(1.635)	(0.019)	(0.567)
SIZE	0.003	-0.008	0.011	0.010	0.004	-0.012
	(0.005)	(0.007)	(0.017)	(0.032)	(0.004)	(0.008)
CURA	-0.005	-0.006	-0.026**	-0.026	-0.002	-0.004
	(0.003)	(0.004)	(0.012)	(0.019)	(0.003)	(0.005)
MTB	0.001	0.001	0.005	0.005	0.001	0.002
	(0.001)	(0.002)	(0.004)	(0.004)	(0.001)	(0.002)
Observations	3,194	3,184	3,197	3,186	3,193	3,183
R-squared	0.754	-0.653	0.630	0.005	0.700	-1.584
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Stock-Yogo F (test)		7.864		6.008		9.186

Table 7 shows OLS regression results in columns 1, 3 and 5; the 2SLS regression results in column 2,4 and 6. In column 2, coefficient of ESG is significantly negative (-0.88) and larger than the coefficient of ESG (-0.04) in column 1. In column 4, coefficient remains negative as in the OLS regression. However, significance of the ESG coefficient is lost while the coefficient of ESG is greater than column 3. On the other hand, for idiosyncratic risk, coefficient of ESG score is significant at 5% level (column 6) and larger than OLS regression in column 5.

The weak identification test of Stock and Yogo (2005) is established on the bias of the IV estimator relative to corresponding statistics of the OLS. Stock and Yogo (2005) tabulated critical values for the test in their paper. If a model consists of one instrumental and one endogenous variable, then the 10% critical value is 16.38. The null hypothesis of the labelling as a weak instrumental variable can be rejected when the F-statistic goes over the critical limits. However, my regression (Stock and Yogo 2005) F-statistics (column 2,4 and 6) is below the critical value and not significant at any of the conventional significance levels.

On the other hand, Staiger and Stock (1997) recommended arguing IV's to be weak if the F-statistic is less than 10 for a single endogenous regressor. Thus, Germanwatch country scores variable is a weak instrument which can produce biased IV estimators.

4.2.5 Downside risk measures (Beta_BL and Beta_HR)

I expected that, if the distributions of the returns of STOXX Europe 600 members were symmetric, as in a normal distribution, the results would be the same for both standard and downside risk measures. However, when the distributions of returns are asymmetric, downside price fluctuations tend to have a dominating impact (De Fusco et al. 1996). Conventional risk measures may, therefore, underestimate the risk, especially if the distribution of returns is skewed to the left.

Tversky and Kahneman (1991) argued that "losses and disadvantages have a greater impact on preferences than gains and advantages", which is a clear illustration of the higher sensitivity of investors towards downside risk. Oikonomou et al. (2012) claimed that investors, and particularly institutional investors, are likely to demand a significant premium for exposures to assets with downside risk. This is compatible with Godfrey's (2005) argument concerning the insurance-like impact of CSP on CFP. As a result of this reasoning, Oikonomou et al. (2012) defined financial risk as the possibility of a downward movement in the stock prices of socially irresponsible firms, rather than defining it as general instability in stock prices.

In my fixed effects regressions of Beta_BL (Table 6), the coefficients of ESG (using German 10-year government bonds as the target return) were similar to conventional Beta. There was a significant negative relationship between Beta_BL and ESG (as shown in columns 1, 2 and 3) and it was stronger than the conventional Beta not only for ESG but also for SOS. Moreover, the coefficient of ENS was significantly positive (column 6).

Table 6 also shows the results of fixed effects regressions of Beta_HR (using mean market return as a threshold) on ESG and pillar scores. As shown in column 7, the result was significantly negative (0.137) without controls. However, the coefficient on ESG was 0.176 (column 9), which does not indicate statistical significance at any of the conventional significance levels. As shown in columns 9, 10 and 11, the coefficients of SOS were negative but insignificant.

Table 8: Downside risk measures
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Beta_BL	Beta_BL	Beta_BL	Beta_BL	Beta_BL	Beta_BL	Beta_HR	Beta_HR	Beta_HR	Beta_HR	Beta_HR	Beta_HR
ESG	-0.134*	-0.171*	-0.267**				-0.137*	-0.101	-0.176			
	(0.071)	(0.091)	(0.118)				(0.078)	(0.101)	(0.135)			
ENS				0.053	0.087	0.161*				0.019	0.060	0.128
				(0.043)	(0.059)	(0.084)				(0.051)	(0.069)	(0.099)
SOS				-0.100**	-0.134**	-0.154**				-0.077	-0.082	-0.115
				(0.046)	(0.053)	(0.073)				(0.052)	(0.060)	(0.082)
CGS				-0.004	0.042	0.041				0.028	0.091*	0.095
				(0.036)	(0.047)	(0.068)				(0.040)	(0.051)	(0.072)
SIZE		0.001	0.025		-0.001	0.022		-0.006	0.013		-0.006	0.010
		(0.020)	(0.033)		(0.020)	(0.033)		(0.019)	(0.034)		(0.019)	(0.034)
MTB		0.003	0.005		0.003	0.004		0.001	0.005		0.001	0.004
		(0.004)	(0.007)		(0.004)	(0.007)		(0.005)	(0.007)		(0.005)	(0.007)
CURA		-0.036***	-0.045**		-0.036***	-0.044**		-0.032**	-0.033*		-0.032**	-0.033
		(0.013)	(0.018)		(0.013)	(0.019)		(0.014)	(0.020)		(0.014)	(0.021)
LIQ			-0.004			-0.003			0.001			0.002
			(0.008)			(0.009)			(0.010)			(0.011)
R_D			-0.451			-0.466			0.045			0.024
			(0.456)			(0.453)			(0.518)			(0.512)
LEV			0.085			0.115			0.146			0.160
			(0.132)			(0.134)			(0.148)			(0.149)
Observations	6,716	4,164	2,435	6,733	4,176	2,440	6,716	4,164	2,435	6,733	4,176	2,440
R-squared	0.533	0.547	0.567	0.533	0.548	0.567	0.432	0.446	0.454	0.432	0.447	0.455
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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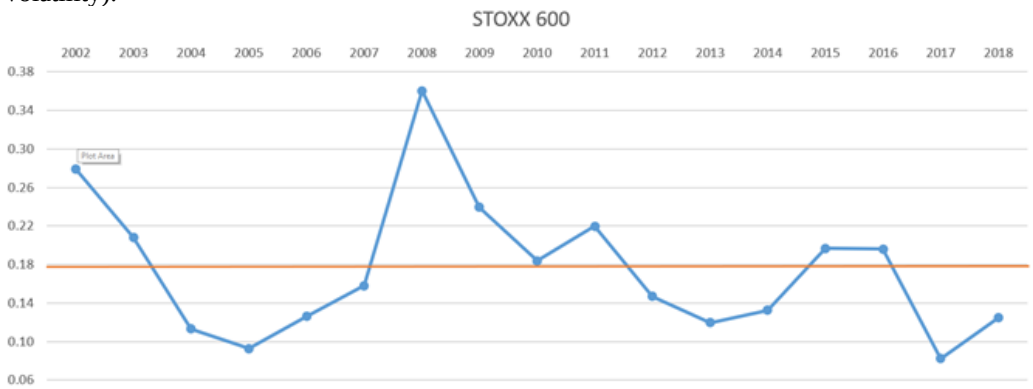
4.3 Effects of volatility conditions

Hypothesis 3 predicted that the overall volatility of the stock market was a meaningful determinant for the link between CSP and firm risk. With the intention of testing this hypothesis, I split my panel data sample into two subsamples: low and high-moderate volatility. Figure 1 clearly shows three periods of high-moderate volatility in Europe: 2002–2003 (the collapse of the dot.com bubble); 2008–2011 (the global financial crisis and European debt crisis); and 2015–2016 (the Greek debt default and the Brexit referendum).

Figure 1: Annualized standard deviation of daily returns for STOXX Europe 600 index between 2002-2018. Two subsamples are created based on market volatility (small or high-medium volatility).



Another remarkable point is that the R-squared values of the models were higher during periods of high-moderate volatility, consistent with Oikonomou et al. (2012). One possible explanation may be the relevance of CSP (and also control variables) increases as a source of market risk during periods of market stress.

In line with the previous literature, I found that the link between market risk and ESG was stronger during volatile periods (Table 7, column 5). During such periods, the coefficient was significantly negative and higher than in low volatility periods. The ESG coefficient of 0.393 on Beta during high volatility periods shows that a rise in a firm's CSP by one standard deviation 0.16 was associated with a relative decline in systematic risk by 7% in relation to the mean risk of 0.92. However, I did not find a similarly significant relationship between the pillar scores (ENS, SOS, CGS) and market risk.

Table 9: Beta during high volatility
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively

VARIABLES	(1) Beta	(2) Beta High Vol	(3) Beta Low Vol	(4) Beta	(5) Beta High Vol	(6) Beta Low Vol
ESG	-0.151*	-0.206	-0.175*	-0.242**	-0.393**	-0.310**
	(0.080)	(0.128)	(0.092)	(0.101)	(0.159)	(0.122)
SIZE	0.014	0.001	0.021	0.046*	0.028	0.069*
	(0.017)	(0.025)	(0.021)	(0.026)	(0.037)	(0.036)
CURA	-0.018	-0.027	-0.010	-0.023	-0.036	-0.002
	(0.013)	(0.018)	(0.017)	(0.019)	(0.023)	(0.025)
MTB	0.004	0.007	0.003	0.009	0.007	0.012
	(0.004)	(0.005)	(0.005)	(0.006)	(0.007)	(0.009)
LIQ				-0.001	-0.028*	0.012
				(0.008)	(0.015)	(0.009)
R_D				-0.366	-0.715	0.027
				(0.360)	(0.441)	(0.525)
LEV				0.068	0.150	-0.010
				(0.122)	(0.209)	(0.151)
Observations	4,089	1,842	2,193	2,382	1,075	1,277
R-squared	0.573	0.648	0.579	0.590	0.679	0.589
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Table 8 shows similar statistically significant results for total risk. During high volatility periods, the coefficient of ESG (column 5) was higher than for the rest of the sample, indicating a stronger link. The coefficient of idiosyncratic risk (column 11) during high volatility periods was also higher than a low volatility period, although it was statistically insignificant.

As shown in Table 9, downside Betas followed a similar pattern (columns 5 and 11) to ordinary Beta. Although I did not find a significant relationship between Beta_HR and ESG in the full sample (column 10), I did find a statistically significant negative coefficient (0.415) in periods of high volatility. For both downside Betas, there were stronger negative coefficients on ESG during highly volatile periods than during low volatility, in both the sub-sample and the full sample.

When these results are considered together, it is clear that, especially in adverse economic conditions, environmental and social corporate issues are captured by the market and then generate a higher level of stock volatility for socially and environmentally irresponsible firms.

Table 10: Total and idiosyncratic risk during high volatility
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses.
***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Total risk	Total risk High_Vol	Total risk Low_Vol	Total risk	Total risk High_Vol	Total risk Low_Vol	Idio. risk	Idio. risk High_Vol	Idio. risk Low_Vol	Idio. risk	Idio. risk High_Vol	Idio. risk Low_Vol
ESG	-0.039*	-0.064	-0.034	-0.062**	-0.102*	-0.052*	-0.034	-0.045	-0.027	-0.040	-0.049	-0.033
	(0.024)	(0.041)	(0.022)	(0.030)	(0.054)	(0.028)	(0.022)	(0.037)	(0.021)	(0.028)	(0.050)	(0.027)
SIZE	0.005	0.002	0.007	0.010	0.011	0.009	0.003	-0.000	0.006	0.006	0.007	0.005
	(0.006)	(0.009)	(0.005)	(0.009)	(0.014)	(0.010)	(0.006)	(0.009)	(0.006)	(0.010)	(0.015)	(0.010)
CURA	-0.001	-0.007	0.007	-0.003	-0.008	0.008	-0.001	-0.008	0.007	-0.003	-0.012	0.008
	(0.004)	(0.007)	(0.005)	(0.005)	(0.009)	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)	(0.008)	(0.005)
MTB	0.001	0.002	0.002*	0.003*	0.003	0.004**	0.002*	0.002	0.002*	0.003*	0.002	0.004**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
LIQ				-0.003*	-0.011***	0.001				-0.004**	-0.011***	0.001
				(0.002)	(0.004)	(0.002)				(0.002)	(0.004)	(0.002)
R_D				-0.050	-0.234*	0.136				-0.038	-0.171	0.127
				(0.101)	(0.127)	(0.144)				(0.099)	(0.151)	(0.127)
LEV				-0.003	0.020	0.011				0.014	0.036	0.014
				(0.033)	(0.058)	(0.036)				(0.032)	(0.054)	(0.037)
Observations	4,084	1,844	2,186	2,382	1,074	1,276	4,081	1,840	2,188	2,393	1,079	1,282
R-squared	0.687	0.710	0.585	0.672	0.698	0.583	0.638	0.679	0.566	0.619	0.657	0.560
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 11: Downside Beta's during high volatility
The variable construction is defined in Table 1. The sample is described in Table 2. Robust and clustered (by firm) standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level respectively

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Beta_BL	Beta_BL High_Vol	Beta_BL Low_Vol	Beta_BL	Beta_BL High_Vol	Beta_BL Low_Vol	Beta_HR	Beta_HR High_Vol	Beta_HR Low_Vol	Beta_HR	Beta_HR High_Vol	Beta_HR Low_Vol
ESG	-0.171*	-0.268*	-0.163	-0.267**	-0.453**	-0.290**	-0.101	-0.277*	-0.057	-0.176	-0.415*	-0.223
	(0.091)	(0.146)	(0.102)	(0.118)	(0.191)	(0.131)	(0.101)	(0.160)	(0.120)	(0.135)	(0.220)	(0.153)
SIZE	0.001	-0.001	0.002	0.025	0.044	0.028	-0.006	-0.009	-0.004	0.013	0.033	0.016
	(0.020)	(0.033)	(0.022)	(0.033)	(0.054)	(0.036)	(0.019)	(0.033)	(0.025)	(0.034)	(0.054)	(0.042)
CURA	-0.036***	-0.044**	-0.027	-0.045**	-0.052**	-0.014	-0.032**	-0.054***	-0.013	-0.033*	-0.048*	0.007
	(0.013)	(0.020)	(0.017)	(0.018)	(0.025)	(0.026)	(0.014)	(0.020)	(0.020)	(0.020)	(0.026)	(0.029)
MTB	0.003	0.004	0.003	0.005	0.002	0.010	0.001	0.002	-0.001	0.005	0.001	0.010
	(0.004)	(0.006)	(0.006)	(0.007)	(0.009)	(0.009)	(0.005)	(0.007)	(0.007)	(0.007)	(0.010)	(0.010)
LIQ				-0.004	-0.038**	0.010				0.001	-0.041**	0.014
				(0.008)	(0.016)	(0.009)				(0.010)	(0.016)	(0.011)
R_D				-0.451	-0.927	0.349				0.045	-0.403	0.947
				(0.456)	(0.571)	(0.648)				(0.518)	(0.515)	(0.818)
LEV				0.085	0.095	0.091				0.146	0.079	0.215
				(0.132)	(0.216)	(0.165)				(0.148)	(0.220)	(0.189)
Observations	4,164	1,884	2,227	2,435	1,107	1,297	4,164	1,884	2,227	2,435	1,107	1,297
R-squared	0.547	0.632	0.548	0.567	0.664	0.571	0.446	0.579	0.439	0.454	0.604	0.459
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

5 Conclusion

This paper examined the link between a firm's CSP, based on ESG scores, and its level of risk (total, systematic and idiosyncratic) using STOXX Euro 600 constituents from 2002 to 2018. I conducted fixed effects regressions with cluster-robust standard errors at the firm level and included many control variables. I found that the higher the aggregated ESG score, the lower the total and systematic (Beta) risk.

Examining the three pillar scores of ENS, SOS and CGS, my results showed that social performance is negatively associated with Beta and Beta_BL. In contrast to Sassen et al. (2016), I did not find a significant link for total and idiosyncratic risk with regards to social performance.

I incorporated unconventional risk measures into my study and found that conventional Beta and downside Betas (Beta_BL and Beta_HR) led to similar conclusions, adding convergent validity to my empirical analysis.

My benchmark paper (Sassen et al. 2016) calculate systematic risk (Beta of a firm) based on the standard CAPM model, using monthly excess returns for the previous 5 years. However, I followed Oikonomou et al. (2012) and calculated conventional and downside Betas based on the standard CAPM model, using daily excess returns for the previous 12 months. This calculation method also enabled me to identify periods of high volatility and compare two sub-sets of data based on volatility levels.

I also investigated the link between CSP and firm risk during periods of financial distress (e.g., the bursting of the dot-com bubble, the global financial crisis, the European debt crisis, the Greek debt default and the Brexit referendum). My results showed that, in times of high-moderate volatility, firms that act in a socially and environmentally responsible manner are identified by lower levels of firm risk (particularly total and systematic risk). Socially irresponsible firms have higher levels of firm risk during adverse systemic shocks.

In line with Oikonomou et al. (2012), I found that a firm's CSP is linked to its ability to weather periods of financial distress. Thus, this relationship should be considered by investors, and particularly by institutional investors such as pension funds and insurance companies, when

making asset allocation or investment decisions. Firm managers should also consider the impact of CSP on firm risk when they make strategic business decisions.

Additionally, I implemented the two-stage least squares method (2SLS) for potential endogeneity problem. Instrumental variable is the country-level data from Germanwatch website (Climate Change Performance Index) which assesses each country's performance in four categories: Emissions of the greenhouse gases have 40% weighting in the overall score. Each of the climate policy, energy use and renewable energy pillars has 20% weightings in the assessment (Germanwatch 2020). However, I found out that Germanwatch country score is a weak instrumental variable.

6 Limitations and further research

Thomson Reuters ESG scores are used to measure CSP of the European firms due to data availability in line with the prior literature. Since the number of ESG data providers are increasing especially for European firms, it would be valuable to compare my results with different datasets.

The present study is limited to STOXX Europe 600 constituents. Thus, it is worth examining the relationship between CSR and firm risk in other settings. For instance, STOXX Global 1800 Index consists of 600 Asia/Pacific and 600 North-American region firms additional to STOXX Europe 600 Index constituents and has substantial difference in terms of sector weightings which might affect the link between CSR and firm risk.

New EU Directive on sustainable finance is expected to impose several requirements on firms and investors including disclosure of the economic activities against the EU Taxonomy. Therefore, it is worth examining the effects of the Taxonomy Regulation on the relationship between CSP and firm risk for European firms.

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