Doing Safe by Doing Good: Risk and Return of ESG Investing in the U.S. and Europe

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Abstract

We examine the profitability of investing along environmental, social and governance (ESG) criteria. A four-factor model shows that a long-short portfolio in stocks with the highest respectively lowest ESG scores yields a significantly negative alpha, hinting at an insurance-like character of corporate social responsibility. Indeed, we demonstrate that ESG activity reduces firm risk, with a positively moderating role of market volatility. ESG-inactive firms are nevertheless shown to deliver the highest contemporaneous return per unit of risk. Corporate social responsibility rather reveals its benefit only gradually: Value-increasing effects significantly lag ESG scores by several years.

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1 Introduction

Over the past few years, non-financial activities such as those concerning environmental, social and governance (ESG) issues have become increasingly important for corporate managers. The latest UN Global Compact-Accenture CEO study in 2016 reports that 95 percent of the more than 1,000 participating CEOs from all over the world see it as a personal responsibility to ensure that their company has a core purpose and role in society (United Nations, 2016). This development has been paralleled by an increasing interest of financial market participants to invest sustainably: According to the 2018 Global Sustainable Investment Review, the amount of assets invested along ESG criteria reached $30.7 trillion globally; sustainable investment in the U.S. makes up 25.7% of total managed assets, in Europe the proportion is even higher at 48.8% (USSIF, 2019).

Despite this tremendous interest in corporate social responsibility (CSR) and socially-responsible investing, empirical research has struggled to establish a clear relation between firms' CSR activities[1] and their financial performance. Depending on the type of financial performance measured, the methodology and data used, both positive, null and negative relations have been derived (Margolis, Elfenbein and Walsh, 2009; Christensen, Hail and Leutz, 2018; Brooks and Oikonomou, 2018). Consistently positive effects tend to be obtained from only a limited set of performance measures that refer predominantly to ex-ante, i.e. implicit, measures of capital costs (cf. Dhaliwal et al., 2011; Ghoul et al., 2011). With regard to realized returns on investments in ESG-active firms, in contrast, the empirical results are rather inconclusive (Renneboog, Horst, and Zhang, 2008b). Some studies report that investing based on social-responsibility screens leads to higher returns than conventional investments (cf. Kempf and Osthoff, 2007; Statman and Glushkov, 2009; Edmans, 2011). Others show that this investment style is financially costly as so-called "sin-stocks" deliver superior returns (Fabozzi et al, 2008; Hong and Kacperczyk, 2009; Luo and Balvers, 2017) and

[1] In the following, we will refer to corporate actions aimed at sustainability as CSR or ESG activitiy interchangeably.

that financial markets react negatively to increases in ESG activity (Krüger, 2015). Recent research by Riedl and Smeets (2017) even demonstrates that socially responsible investors "are willing to forgo financial performance in order to invest in accordance with their social preferences".

The observed disparity in empirical results may be caused by different factors. Prime among them is the question of how to best measure corporate social responsibility. The established investment practice assigns companies to either a responsible or a non-responsible group according to negative or norms-based screens (Renneboog, Horst, and Zhang, 2008a). Analyses on the portfolio level that are based on such a dichotomous treatment of corporate social responsibility hence disregard the multifaceted nature of ESG activities which may be captured more comprehensively via so-called ESG ratings that have sprung up in recent years. Some of the early studies on the corporate level furthermore appear to have been plagued by methodological problems (Margolis and Walsh, 2001). Omitted variables and reverse causality easily trigger endogeneity in this context, which, unless appropriately dealt with, may lead to biased estimates. Among the omitted variables, the legal environment in which companies operate seems to play a particularly important role. This is because it determines the disclosure requirements of firms, as such affecting the basis for any ESG measurement. In addition, the legal and institutional context is related to the shareholder vs. stakeholder orientation of companies (cf. Shleifer and Vishny, 1997; Bottenberg et al., 2016), which may influence the perception of corporate social responsibility by investors and, thus, determine its effects on cost of capital and firm value (Dhaliwal, Li, Tsang, and Yang, 2014).

Against this background, our objective is to paint a comprehensive and robust picture of the profitability of socially responsible investing by addressing these issues conjointly. To this end, we combine results from portfolio-level and firm-level analyses in order to draw detailed conclusions regarding the risk-return tradeoff induced by corporate social responsibility. We employ one of the broadest and longest databases of ESG scores to capture

maximal heterogeneity in firms' CSR activities. By collecting separate, unbalanced panels of companies headquartered in the U.S. and in Europe that received ESG ratings over the time period 2003 to 2017, we account for the legal and institutional environment of a company. In the analyses on the firm level, a system GMM estimator addresses further endogeneity concerns regarding the ESG measure and accounts for potential autoregressive memory in the respective dependent variable (risk or performance). Reverse causality issues are moreover addressed via additional cross-sectional analyses.

We derive four sets of results. First, a Carhart (1997) four-factor analysis shows that holding a portfolio that is long in stocks of the quintile of firms with the strongest ESG scores and short in the quintile of firms with the weakest ESG scores yields a negative abnormal return ("alpha") of -27.8 basis points per month in the U.S. portfolio and of -30.5 basis points for the European portfolio. Digging deeper into the data, we find that this negative abnormal return is not driven by a negative return from investing in ESG-active firms but rather by an extremely strong positive return from investing in firms that unfold only weak ESG activity. Seen as a risk premium, this observation suggests that corporate social responsibility policies offer an insurance-like protection against negative firm events as originally proposed by Godfrey (2005) and Godfrey, Merrill, and Hansen (2009).

Our second set of results confirms the insurance hypothesis on the firm level. We consider both standard risk measures and proxies for tail risk on equity markets and find that, apart from idiosyncratic risk, all other risk measures are significantly reduced when ESG scores increase, though the effects are stronger for the U.S. sample than for the European firm sample. The risk-reducing effect of ESG activity can also be confirmed for risk measures based on debt market information and is robust against further consideration of reverse causality. Higher corporate social responsibility hence leads financial market participants to perceive lower firm risk. Splitting the composite ESG score into its three constituent parts, we find that the risk-reducing effect is predominantly driven by the environmental component for U.S. firms, whereas the social component plays the main role for European firms. As

behavioral finance studies have furthermore repeatedly shown that the market setting tends to affect investors' perceptions, particularly regarding risk (Tversky and Kahneman, 1981), we also test whether the general market volatility plays a role for the risk-reducing effect of ESG activity. Indeed, we find this to be the case: At least for U.S. firms, the negative impact of the ESG score on firm risk is strongly driven by the general volatility on financial markets. The insurance-like feature of corporate social responsibility may hence be appreciated more or less strongly by investors, depending on the general market environment.

Incorporating these firm-level results into the earlier portfolio-level analysis, our third set of results examines whether the risk-reduction caused by higher corporate social responsibility is sufficiently strong to make up for the lower return. We therefore construct ratios of return per unit of risk for each quintile portfolio of firms ordered according to their ESG scores. Our analysis shows that the return-to-risk ratio is higher for firms with weak ESG activity than for those with strong ESG activity. This result holds for both abnormal returns and realized excess returns and is robust across different risk measures. It demonstrates that despite the risk-reducing effect of corporate social responsibility, the return delivered per unit of risk remains higher for firms that engage in only little ESG activity.

Given that ESG-inactive firms hence appear to be preferrable investment targets, the question arises whether investors in socially responsible firms nevertheless derive a financial advantage at some point. To see the distinctive quality of this issue, it has to be noted that the analyses so far relate firms' ESG ratings with their contemporaneous performance on financial markets: We find that market participants discount the current stock prices of ESG-inactive firms more strongly, relative to their perceived risk, than they increase the stock prices of ESG-active firms, translating into immediately higher returns per unit of risk for the former compared to the latter. For the insurance function inherent in ESG activities to become truly effective, however, it may take several months or even years. We therefore conduct a final analysis that examines the time-lagged effect of ESG activity on firm value. Our fourth set of results shows that there is indeed a positive impact of corporate social

responsibility on firm value (measured via Tobin's Q) for both U.S. and European firms that stretches over up to four years. Higher ESG scores hence do not translate immediately into higher firm value to their full extent. Financial markets rather take several years to appreciate their valuable effect.

Our findings may be taken as an indication that corporate social responsibility indeed offers an insurance-like protection that is recognized by financial market participants: Doing good via sustainable corporate policies dampens firm risk. In this respect, our work puts related results by Diemont, Moore, and Soppe (2015) and Monti, Pattitoni, Petracci, and Randl (2018) on a comprehensive footing as we consider an extensive set of risk measures from both equity and debt markets and examine also the individual ESG components' risk effects. Furthermore, we show that the perception of CSR policies as an insurance becomes stronger in more volatile markets, particularly for U.S. firms, thus enhancing earlier findings by Diemont, Moore, and Soppe (2015). While the risk-reducing feature of corporate social responsibility may hence make ESG-active firms particularly attractive investment opportunities in phases of high market volatility, we demonstrate that this does not outweigh their lower return in general: Abnormal and realized excess returns per unit of risk remain larger for firms that engage in only little ESG activity. Financial markets rather seem to underestimate the beneficial effect of corporate social responsibility in the short term and take several years to incorporate the value-increasing effect of ESG activity.

To the best of our knowledge, this combination of portfolio- and firm-level results delivers a novel perspective on ESG investing with several implications for managers, investors and policy makers. First, our results suggest that managers who do not follow the trend of engaging in sustainability will pay a price. Particularly high-volatility market phases make this policy costly to sustain as investors on U.S markets will demand a higher premium for the lack of an ESG insurance, which translates into immediately lower valuations for these firms. Second, the persistently higher risk-adjusted returns of ESG-inactive firms moreover imply that investors who are willing to forego the moral imperative of social responsibility

may indeed reap superior returns. Socially-responsible investors, in contrast, need stamina: Though their portfolios are less risky, they need to hold on to their investments for several years in order to fully reap the beneficial insurance effect. Either way, taking CSR criteria into account in the investment process allows for ample pickings.

The remainder of this paper is structured as follows. Hypotheses are derived in Section 2. Section 3 presents the data and delineates the variables construction. Section 4 outlines the econometric methodology and presents the empirical results and Section 5 concludes.

2 Literature and hypotheses derivation

Ever since Friedman (1970)'s argument that corporate social responsibility constitutes a misappropriation of valuable firm resources due to high implementation costs that outweigh any tangible benefits, both scientists and practitioners have pondered the relationship between sustainable corporate policies and the ensuing financial performance. While CSR should not be able to increase firm value in an Arrow-Debreu complete markets economy, both incomplete markets, incomplete contracting between firms and stakeholders or the existence of pro-social shareholders may ascribe a profitable role to socially responsible corporate strategies (Bénabou and Tirole, 2010; Hart and Zingales, 2017).

Early research on the profitability of socially responsible investing has mainly compared the return from responsibly screened portfolios with matched conventional portfolios. While the majority of papers conclude that there is no significant return difference in general (cf. Renneboog et al., 2008; Revelli and Viviani, 2014; Brooks and Oikonomou, 2018), there seems to be a geographical divide: Socially responsible investment funds in the U.S. indeed do not show different risk-adjusted returns compared to conventional funds (Bauer, Koedijk, and Otten, 2005), but Continental European and Asian funds seem to underperform their benchmarks (Renneboog, Horst, and Zhang, 2008a). Though the reason for this is unclear, the stronger environmental regulation and stakeholder orientation of firms in Europe may play

a role. German corporate governance, for instance, assigns legally defined control rights to employee representatives on corporate boards (Fauver and Fuerst, 2006). As this represents a higher "natural level" of CSR activity for European firms, any additional efforts may therefore be seen as less beneficial compared to U.S. firms. Given these differences in the shareholder vs. stakeholder perspective, any study of the profitability of ESG investing needs to account for the legal and institutional environment. Our analysis therefore differentiates between U.S. and European data in the following.

Studying the profitability of socially responsible investment furthermore needs to address the way CSR measurement translates into portfolio allocation. Industry practice still employs positive or negative screens on a limited number of CSR components, for instance the use of renewable energy or community involvement. Screening therefore cannot account for firms' social responsibility efforts in the same way that investment along ESG ratings can, as these ratings consider different CSR dimensions at the same time and allow for a highly granular view on the aggregate activities. The fact that the universe of ESG-rated firms has only recently expanded globally explains why so few studies yet examine the link between ESG scores and portfolio returns[2]. This leads us to posit our first hypothesis:

H1: Equity portfolios display abnormal returns that are dependent on the portfolio firms' ESG ratings.

Among the arguments for why firms should engage in corporate social responsibility, Godfrey (2005) is one of the first to claim that CSR activities allow companies to preserve their ability to generate financial wealth. By creating "moral capital", socially responsible corporate behavior cushions stakeholders' sanctions in case of negative events, as such acting as an insurance (Godfrey, Merrill, and Hansen, 2009). In a similar vein, Albuquerque, Koskinen, and Zhang (2018) argue that CSR represents a product differentiation strategy that allows firms to reduce their profit elasticity to aggregate shocks. Correspondingly, they show

[2]One of the earliest studies that examines this relation is by Kempf and Osthoff (2007). They use KLD ratings that combine a granular rating approach, based on various criteria for which strengths and concerns are collected, with a negative screening.

that CSR-active firms display lower systematic risk and have higher value. Jagannathan, Ravikumar, and Sammon (2017) point out that ESG-related issues, for instance environmental crises caused by pollution, may cause severe changes in consumer tastes or regulations that can lead to large swings in asset prices. As these negative events are rare, difficult to diversify and may have devastating effects on the affected companies, they should be reflected predominantly in measures of downside or extreme risk.

Individual aspects of the purportedly negative relation between corporate social responsibility and firm risk have been tested and confirmed: Jo and Na (2012) show that CSR activities of firms in controversial industries, i.e. alcohol, tobacco or gambling, reduce total firm risk. Monti, Pattitoni, Petracci, and Randl (2018) consider both total and tail risks on equity markets and find a negative relation with environmentally and socially responsible activity of firms. This is supported by Hoepner, Oikonomou, Sautner, Starks, and Zhou (2018) who examine engagement by an activist investor with respect to social and governance strategies in a proprietary dataset. In contrast to these analyses on equity markets, there is only limited evidence of a negative relation between ESG activity and risk measured on debt markets: Oikonomou, Brooks, and Pavelin (2014) show that stronger environmental and social corporate activity reduces firms' credit spreads and Jiraporn, Jiraporn, Boeprasert, and Chang (2014) report higher credit ratings following stronger CSR activity. Based on the earlier evidence, we reconsider the ESG-risk relationship on a comprehensive basis by considering both standard risk measures (such as stock volatility and idiosyncratic risk) and proxies for tail risk (such as (conditional) value at risk and lower partial moments) calculated from companies' stock prices and debt-based risk measures:

H2: ESG ratings have a negative relation with firm risk.

As the employed risk proxies are predominantly based on the market participants' perceptions regarding the firms' securities valuations, it may be reasonable to question whether factors that are known to influence perceptions moderate the risk-reducing effect of corporate social responsibility. Indeed, Lins, Servaes, and Tamayo (2017) and Monti, Pattitoni, Pe-

tracci, and Randl (2018) show that corporate investment in social capital is perceived more beneficially in crisis periods, when trust is generally low. In a similar vein, Nofsinger and Varma (2014) demonstrate that socially-responsible mutual funds deliver superior returns by reducing downside risks in crisis phases, and Diemont, Moore, and Soppe (2015) report a significant relation between certain types of corporate social responsibility and tail risks only in extreme market conditions. In contrast to these studies, which essentially focus on extreme situations such as financial crises, we question the more general influence of the market volatility as a moderating factor and posit the following hypothesis:

H3: The negative relation between ESG ratings and firm risk is moderated by the market volatility.

Against the backdrop of a significant relation between CSR activity and firm risk, a simple consideration of abnormal portfolio returns based on ESG activity does not fully answer the question regarding the preferableness of such an investment strategy. Rather, both return and risk need to be considered at the same time. Particularly if ESG activity indeed allows to reduce risk, it is not clear at the outset whether the risk-reducing effect is sufficiently strong to outweigh the lower reward for risk that is inherent in the corresponding premium for ESG risk. We therefore study the return per unit of risk in the portfolio analysis in order to answer this question comprehensively and state:

H4: Equity portfolios display return-to-risk ratios that are dependent on the portfolio firms' ESG ratings.

The contemporaneous relation between ESG ratings on the one hand and return and risk on the other helps to understand why ESG-inactive firms trade at lower values that translate into immediately higher return premia for the risk of a lacking CSR-insurance. The question remains, however, whether ESG-active firms are able to turn the insurance-linked characteristic of corporate social responsibility into higher firm value over time. Following the arguments in Eccles, Ioannou, and Serafeim (2014), a certain time period should be allowed to pass between the reported ESG activities and any potential performance or value effects.

To consider just two examples, it may reasonably take some months or even years for higher workplace safety to increase employees' productivity or for stronger product responsibility to reduce profit volatility. Governance-related strategies may likewise be expected to take some time before becoming effective. Similarly to Servaes and Tamayo (2013), Hawn and Ioannou (2016) and Albuquerque, Koskinen, and Zhang (2018), we examine the effect of corporate social responsibility on Tobin's Q as a comprehensive measure of firm value. In contrast to the earlier studies, however, we consider time lags of between 1 and 4 years and frame the final hypothesis:

H5: ESG ratings have a positive lagged relation with firm value.

3 Data

3.1 Sample construction

Our sample consists of all publicly listed companies in the U.S. and in Europe that have received ESG scores from Thomson Reuters over the time period 2003 to 2017. Coverage of the Thomson Reuters-Refinitiv ESG database, an enhancement and replacement of the earlier ASSET4 database that started publishing ESG scores in 2002, has evolved over time: Irrespective of whether the firms communicate their CSR activities, the constituents of ever more stock-market indices have been covered by the rating process. Due to these rigorous inclusion rules, the Thomson Reuters database has been shown to exhibit minimal selection bias as compared to the providers of other ESG ratings (Desender and Epure, 2015). Table 1 reports the annual development of the number of firms with an ESG score from Thomson Reuters in our sample.[3] Our final dataset consists of 10,324 firm-year observations in the

[3]It should be noted that there is a drop in the number of rated firms from 2016 to 2017 that is particularly strong in the U.S. sample. As we downloaded the data in late 2018, we believe that there might be belated additional entries for 2017 that we were, unfortunately, unable to consider in our analysis. As we see no structural reasons, we remain confident that our results will not be biased because of this smaller number of observations in the most recent year of out data collection.

U.S. sample and 11,971 firm-year observations in the European sample.

Table 1: Firm sample distribution per year

U.S.			Europe		
Year	N	%	Year	N	%
2003	290	2.81%	2003	337	2.82%
2004	406	3.93%	2004	534	4.46%
2005	465	4.50%	2005	640	5.35%
2006	472	4.57%	2006	657	5.49%
2007	507	4.91%	2007	716	5.98%
2008	654	6.33%	2008	768	6.42%
2009	734	7.11%	2009	809	6.76%
2010	779	7.55%	2010	846	7.07%
2011	794	7.69%	2011	884	7.38%
2012	794	7.69%	2012	895	7.48%
2013	793	7.68%	2013	903	7.54%
2014	795	7.70%	2014	949	7.93%
2015	968	9.38%	2015	1071	8.95%
2016	1210	11.72%	2016	1090	9.11%
2017	663	6.42%	2017	872	7.28%

Table 2 shows the sample breakdown according to country, Table 3 according to industry. As can be seen, the largest number of firms in the European sample is headquartered in the UK, followed by France, Germany, Switzerland and Sweden.[4] Regarding the industry breakdown, both the U.S. and the European sample feature the largest number of firms in the financial, industrial and cyclical consumer goods and services industry. The U.S. sample, however, shows a larger fraction of firms in technology, the European sample a larger fraction in basic materials and telecommunications services.

[4]In additional analyses, we test whether our results still hold if we drop the UK firms from the European sample, as capital markets in the United Kingdom tend to subscribe more to shareholder rather than stakeholder value maximization principles (Shleifer and Vishny, 1997). Indeed, our results are robust against this issue.

Table 2: Firm sample distribution per country

U.S.			Europe (cont'd)		
Country	N	%	Country	N	%
United States of America	10324	100.00%	Isle of Man	7	0.06%
			Italy	535	4.47%
Europe			Jersey	44	0.37%
Country	N	%	Luxembourg	89	0.74%
Austria	211	1.76%	Malta	9	0.08%
Belgium	322	2.69%	Monaco	7	0.06%
Cyprus	31	0.26%	Netherlands	468	3.91%
Czech Republic	41	0.34%	Norway	232	1.94%
Denmark	335	2.80%	Poland	223	1.86%
Finland	347	2.90%	Portugal	100	0.84%
France	1139	9.51%	Romania	2	0.02%
Germany	1047	8.75%	Russia	336	2.81%
Gibraltar	2	0.02%	Spain	559	4.67%
Greece	222	1.85%	Sweden	704	5.88%
Guernsey	30	0.25%	Switzerland	916	7.65%
Hungary	37	0.31%	Ukraine	8	0.07%
Ireland; Republic of	367	3.07%	United Kingdom	3601	30.08%
			Europe (Total)	11971	

Table 3: Firm sample distribution per industry

U.S.			Europe		
Industry	N	%	Industry	N	%
Energy	765	7.41%	Energy	874	7.30%
Basic materials	702	6.80%	Basic materials	1211	10.12%
Industrials	1424	13.79%	Industrials	2265	18.92%
Cyclical consumer goods & Services	1704	16.51%	Cyclical consumer goods & Services	1882	15.72%
Non-cyclical consumer goods & Services	647	6.27%	Non-cyclical consumer goods & Services	811	6.77%
Financials	2300	22.28%	Financials	2703	22.58%
Healthcare	880	8.52%	Healthcare	691	5.77%
Technology	1260	12.20%	Technology	566	4.73%
Telecommunications services	112	1.08%	Telecommunications services	458	3.83%
Utilities	492	4.77%	Utilities	510	4.26%
No assigned industry	38	0.37%			

3.2 Variables description

In the following, we will describe the variables that enter our firm-level analysis. We start by considering the dependent variables, risk measures and firm value, before describing the ESG score and its three individual components afterwards and the control variables at the

end. Descriptive statistics of the variables are presented in Table 4.

3.2.1 Dependent variables

The firm-level analyses use measures of firm risk (Section 4.2) and value (Section 4.4) as dependent variables. With regard to risk measures, we differentiate between equity-based and credit risks. Among equity-based risk measures, we consider the stock volatility σ and the idiosyncratic risk σ_ϵ as standard risk variables. Annual stock volatility is calculated from daily stock returns that we obtain from Datastream. Idiosyncratic risk of company i in year t is derived as the volatility of the stock return that is not explained by the company's β according to the capital asset pricing model

$$R_{i,t} = r_f + \beta_i * RMRF_t + \epsilon_{i,t} \; . \tag{1}$$

We therefore first estimate each company's β, where the S&P 500 and the Stoxx Europe 600 are used as the market indices for U.S. and European firms, respectively. The risk-free rate is approximated by the corresponding one-month government bond rate. Idiosyncratic risk σ_ϵ is then calculated as $\sqrt{Var(\epsilon_{i,t})}$.

In addition to these two standard equity-risk measures, our analysis aims at recognizing that ESG-related risks may be extreme in nature, i.e. rare and large. We therefore also try to capture the risks of these extreme events in the form of value at risk (VaR) and expected shortfall or conditional value at risk ($CVaR$). Value at risk measures the predicted maximum loss over a given horizon within a specific confidence interval (Jorion, 2007). We calculate it as the 5%-quantile based on the empirical daily stock return distribution for every year. Conditional value at risk corresponds to the mean value of returns below the VaR-threshold. Both VaR and CVaR are reported in absolute values, so that higher numerical values reflect higher risk. We capture further downside risks via lower partial moments ($LPMs$) of the second and third order $LPM(0,2)$ and $LPM(0,3)$. We calculate these as the square and cube

root of the semi-variance below the 0%-return-threshold (Bawa, 1975; Fishburn, 1977). This allows us to compare our results metrically.

Downside risks also arise on the credit side, if a firm is unable to pay its obligations and therefore faces bankruptcy. In order to capture this default risk, we analyze a company's one and five-year credit default swap (CDS) spread as well as its distance-to-default (DTD). As approximation of the CDS spread we use the CRI (2019) "actuarial spread" which is constructed without upfront fee. This spread measures the costs of an insurance against a default of the company over a one, respectively five, year period. The DTD is calculated using volatility-adjusted leverage based on the Merton (1974) model. It measures the distance between the default point and the expected value of a firm's assets. A higher distance-to-default hence implies a lower probability of default. Both the CDS spreads and the distance-to-default measures are obtained from the Risk Management Institute at the National University of Singapore (CRI, 2019). As they reflect market-based perceptions of risk we extend the analysis by including also corporate *credit ratings* provided by Standard & Poor's. These credit ratings portray an external perspective on a firm's creditworthiness that is explicitly independent of the current position in the firm's business cycle (i.e. rating-through-the-cycle methodology, cf. Löffler, 2004; Kiff et al., 2013). We convert the letter combination of credit ratings into an ordinal scale following Klock, Mansi, and Maxwell (2005), where a triple-A rating is assigned a value of twenty-two and a D-rating a value of one. Higher rating values hence represent lower default risk.

Finally, we employ *Tobin's Q* to assess the effect of ESG activities on firm value. Tobin's Q is an established measure to study the value effect of corporate governance activities since Demsetz and Lehn (1985), Morck, Shleifer, and Vishny (1990) and Gompers, Ishii, and Metrick (2003). It is generally defined as the market value of a firm divided by its replacement costs. We follow Chung and Pruitt (1994) and calculate Q as the sum of the market capitalization of common stock, the liquidating value of the preferred stock and the book value of debt divided by total assets.

As can be seen from Table 4, Panel A, the U.S. and the European firm sample do not differ much with respect to equity-based risk measures. The European firms do seem to represent a lower credit risk, however. This shows both in the much lower CDS spreads and the higher average credit rating.[5] Tobin's Q, in contrast, appears to be slightly higher for U.S. firms on average.

3.2.2 ESG scores

We follow recent work (cf. Ioannou and Sefarim, 2012; Cheng et al., 2013; Hawn and Ioannou, 2016, Monti et al., 2018) and employ the *ESG score* provided by the Thomson Reuters Eikon database as our main explanatory variable. The Thomson Reuters ESG score is one of the most comprehensive reflections of a company's corporate social responsibility and comprises an environmental, social and governance pillar. Based on more than 400 measures collected annually from companies' public disclosures, the environmental component considers issues such as resource use, emissions, and innovation, the social component focuses on the workforce, human rights, community and product responsibility while the governance component is concerned with management issues, shareholder relations and CSR strategy. As percentile rank scores, all environmental and social categories are benchmarked against Thomson Reuters Business Classifications Industry Group, while the governance categories are benchmarked against the respective Country Group (Thomson Reuters, 2019). Our main analyses employ the comprehensive ESG score per firm as main explanatory variable, but we also consider the individual pillars' scores in additional analyses.

With regard to the distribution of ESG scores in our sample (see Table 4, Panel B), we find the average ESG total score to be lower for the U.S. sample (at 50.8) than for the European sample (56.7). This is also mirrored in the scores for the individual components: The mean scores are higher for the European sample with respect to the environmental (61.1 vs. 47.8) and the social pillar (59.1 vs. 52.1). Only the governance pillar takes approximately

[5]It should be noted, however, that the number of rated firms in Europe is much smaller.

the same average score value in the two geographies.

3.2.3 Control variables

We employ standard firm characteristics as controls in the analyses on the firm level (Tittmann and Wessels, 1988; Capon et al., 1990; Brailsdorf et al., 2002). These include *Leverage* (calculated as the ratio of total assets to total liabilites), *Size* (defined as the natural logarithm of total assets), *Profitability* (approximated by operating income divided by total assets), *Growth* perspectives (proxied as the growth rate of total sales) as well as *Efficiency* (calculated as total revenues divided by total assets). When investigating the relationship between ESG and firm risk, we add risk-specific control variables following Hoepner, Oikonomou, Sautner, Starks, and Zhou (2018) such as the *Dividend Yield*.

Similarly to Monti, Pattitoni, Petracci, and Randl (2018) we winsorize the control variables at 1% in order to limit the influence of outliers. As can be seen from Table 4, Panel C, the distribution of control variables is very similar in the U.S. and the European sample. The only difference concerns the dividend yield, which is on average higher for European than for U.S. firms.

Table 4: Descriptive statistics

	U.S.			Europe		
	Firm-year obs.	Mean	Std. dev.	Firm-year obs.	Mean	Std. dev.
Panel A: Risk measures and firm value						
σ	10054	2.05191	1.158586	11846	2.047147	1.030153
σ_ϵ	10054	0.8790474	0.6244586	11846	1.074047	0.7685565
VaR	10042	3.207559	1.835301	11840	3.224098	1.628767
CVaR	10042	4.549415	2.593998	11840	4.530653	2.348906
LPM (0,2)	10054	2.014898	1.08571	11845	2.026559	1.012953
LPM (0,3)	10054	2.605577	1.480867	11845	2.601389	1.422893
CDS1Y spread	9883	12.43814	35.96619	10445	11.69023	18.96858
CDS5Y spread	9883	25.16677	35.52201	10445	17.50044	15.01912
DTD	9881	6.376737	3.413092	10546	5.475579	3.239699
Credit rating	7231	13.85797	2.77509	4504	14.67651	2.82252
Tobin's Q	8019	2.101022	1.359688	9344	1.778112	1.287574
Panel B: ESG variables						
ESG score	10324	50.78279	16.75922	11971	56.72254	16.25569
Environmental pillar score	7524	47.80097	22.21441	9511	61.13985	21.28115
Social pillar score	7524	52.14256	19.53416	9511	59.12456	20.90271
Governance pillar score	7524	50.90215	21.31767	9511	50.68008	20.5814
Panel C: Control variables						
Leverage	10223	0.6084854	0.2174105	11927	0.6130684	0.2201798
Growth	10194	0.0874486	0.2101158	11884	0.0793336	0.245467
Profitability	10221	0.0915869	0.0836727	11911	0.0794521	0.0781677
Efficiency	10224	0.778956	0.6802555	11927	0.7519308	0.6042375
Size	10224	16.03221	1.438818	11927	16.02434	2.080782
Dividend yield	10066	1.697217	1.812576	11846	2.779078	2.38761

4 Empirical analysis

4.1 Socially responsible investment returns

The question whether socially responsible investment allows for abnormal returns will in the following be studied via employment of a Carhart (1997) four-factor estimation model. The analysis of differences in stock returns has a long history in financial research. Fama and French (1993) identified three main risk factors (market, size and value) that drive stock returns. Carhart (1997) later introduced momentum as a fourth factor. In order to investigate the impact that ESG-related risks may have on stock returns, we follow these methodologies and control for the respective market, size, value and momentum factors. If

socially responsible firms set themselves apart with regard to these risk factors, our model will reflect this via different factor loadings. In order to run the estimation, we first rank the companies in the U.S. respectively European sample according to their ESG scores in every year, similarly to Gompers, Ishii, and Metrick (2003) who study the impact of governance-based risks on stock returns. Subsequently, we dissect each sample into quintiles, where Q1 denotes the 20% of firms with the lowest ESG ratings and Q5 the portfolio of 20% of firms with the highest ESG ratings. Each of these equally-weighted portfolios is annually reallocated according to the firms' (potentially changed) ESG scores. We then run the following regression for each quintile portfolio using monthly portfolio returns:

$$R_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i} * RMRF_t + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} Mom_t + \epsilon_{i,t} \, . \tag{2}$$

$R_{i,t}$ denotes the monthly portfolio return of the respective quintile portfolio. $r_{f,t}$ is the monthly risk-free rate and $RMRF$ represents the CAPM or market factor, where the risk-free rate is subtracted from the market return. SMB_t, HML_t and Mom_t represent the size, book-to-market and momentum factors taken from Kenneth French's data. The regression intercept α_i is our variable of interest, as it can be interpreted as the abnormal return due to ESG activity in excess of the return from a passive investment into the four risk factors. Equation (2) is estimated for each quintile individually.

In addition to estimating alphas for each of these ESG quintile portfolios, we also construct a difference portfolio that amounts to a long position in the highest ESG quintile (Q5) and a short position in the lowest ESG quintile (Q1). It is again re-allocated according to the companies' ESG scores every year. In this model, R_t denotes the return difference of the high ESG-rated portfolio and the low ESG-rated portfolio. The intercept alpha in this regression can then be interpreted as the abnormal return of investing in a portfolio of high ESG-rated

companies and going short in a portfolio with low ESG-rated companies:

$$R_t = \alpha + \beta_1 * RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 Mom_t + \epsilon_t \ . \tag{3}$$

Tables 5 and 6 present the portfolio performance results for the U.S. and European sample, respectively.[6] For the U.S. case, we find that investing into the most ESG-active companies, i.e. the top 20 percent, yields no significant abnormal return. Investing into the four quintiles of firms with lower ESG scores, in contrast, delivers a significantly positive alpha. Interestingly, alpha can be seen to increase with decreasing ESG-activity so that the portfolio of firms with the lowest ESG ratings yields the largest abnormal return. As a consequence, we find that the difference portfolio that is long in the 20% most ESG-active firms and short in the 20% most ESG-inactive firms yields a highly significant negative alpha of -27.8 basis points per month for the U.S. sample.

In addition to the increase in alpha along with lower ESG scores, we find that also the sensitivity towards the size factor varies along with the ESG score. More precisely, the two quintile portfolios of the least ESG-active firms show the strongest loadings of this factor, while the portfolio of the most ESG-active firms displays the weakest loading. As a consequence, the size-factor loading of the long-short portfolio is highly significant and negative. This may be taken as an indication that the significant alpha in this long-short portfolio is not driven by simple size differences of the companies involved but rather captures a truly ESG-specific effect.

The results for the European sample are very similar. Here, the monthly abnormal return from the long-short portfolio is even more strongly negative at -30.5 basis points. Again, this result is driven by the particularly strong positive abnormal return from the portfolios with low ESG scores. These portfolios' abnormal returns are even larger than for the U.S. sample. A similar effect as in the U.S. case is also observed regarding the decreasing

[6]The results do not change qualitatively if we employ value-weighted portfolios instead of equally weighted portfolios. The corresponding results are available from the authors upon request.

Table 5: Four-factor model, U.S. sample

This table presents the four-factor regressions of equally-weighted monthly returns from firm portfolios sorted by their respective ESG score in the U.S. Subdivided into quintiles, Q5 represents the companies with the highest ESG scores (top 20%) while Q1 comprises the companies with the lowest ESG scores (lowest 20%). Portfolios are reallocated annually. The difference portfolio represents a portfolio that buys Q5 companies and sells short Q1 companies. Coefficients are estimated using a standard OLS regression. Explanatory variables are *RMRF*, *SMB*, *HML* and *Mom*. The intercept (α) measures the abnormal return of the respective portfolio. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	α	RMRF	SMB	HML	Mom	Obs.	Adjust. R^2
Difference PF	-0.278***	-0.0222	-0.290***	0.0515	0.0335	180	0.227
(Q5-Q1)	(0.0967)	(0.0274)	(0.0444)	(0.0418)	(0.0313)		
Q5	0.0803	1.042***	0.0592**	0.0752***	-0.116***	180	0.972
	(0.0571)	(0.0162)	(0.0263)	(0.0247)	(0.0185)		
Q4	0.211**	1.091***	0.251***	0.122***	-0.215***	180	0.928
	(0.106)	(0.0301)	(0.0489)	(0.0460)	(0.0344)		
Q3	0.250***	1.091***	0.349***	0.101***	-0.188***	180	0.952
	(0.0870)	(0.0246)	(0.0400)	(0.0376)	(0.0281)		
Q2	0.289***	1.108***	0.409***	0.0439	-0.169***	180	0.947
	(0.0927)	(0.0262)	(0.0426)	(0.0401)	(0.0300)		
Q1	0.359***	1.064***	0.349***	0.0237	-0.150***	180	0.934
	(0.0975)	(0.0276)	(0.0448)	(0.0422)	(0.0315)		

sensitivity towards the size factor with increasing ESG levels. As a consequence, we see a highly significant negative loading of this factor in the long-short portfolio that is even larger in absolute size than for the U.S. sample.

Table 6: Four-factor model, European sample

This table presents the four-factor regressions of equally-weighted monthly returns for firm portfolios sorted by their respective ESG score in Europe. Subdivided into quintiles, Q5 represents the companies with the highest ESG scores (top 20%) while Q1 comprises the companies with the lowest ESG scores (lowest 20%). Portfolios are reallocated annually. The difference portfolio represents a portfolio that buys Q5 companies and sells short Q1 companies. Coefficients are estimated using a standard OLS regression. Explanatory variables are *RMRF*, *SMB*, *HML* and *Mom*. The intercept (α) measures the abnormal return of the respective portfolio. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	α	RMRF	SMB	HML	Mom	Obs.	Adjust. R^2
Difference PF	-0.305***	-0.0252	-0.649***	0.0494	0.0516*	180	0.461
(Q5-Q1)	(0.101)	(0.0220)	(0.0527)	(0.0543)	(0.0294)		
Q5	0.200	0.675***	-0.0959	0.195**	-0.171***	180	0.787
	(0.169)	(0.0367)	(0.0879)	(0.0906)	(0.0490)		
Q4	0.339**	0.707***	0.149*	0.177*	-0.235***	180	0.804
	(0.171)	(0.0371)	(0.0890)	(0.0917)	(0.0496)		
Q3	0.341*	0.728***	0.393***	0.0623	-0.224***	180	0.779
	(0.183)	(0.0397)	(0.0953)	(0.0982)	(0.0531)		
Q2	0.567***	0.741***	0.473***	0.0684	-0.199***	180	0.786
	(0.181)	(0.0393)	(0.0943)	(0.0972)	(0.0526)		
Q1	0.505***	0.700***	0.553***	0.146	-0.222***	180	0.786
	(0.180)	(0.0390)	(0.0936)	(0.0965)	(0.0522)		

According to these portfolio-level results, firms with lower ESG activity offer higher abnormal returns after controlling for the four risk factors market, size, value and momentum than firms with stronger ESG activity, both in the U.S. and in Europe. Interpreted as a compensation for risk, these higher returns suggest that market participants associate lower corporate social responsibility with higher risk. In order to test this indication, we need to examine the relation between ESG activity and risk on the corporate level. In the following, we will therefore conduct firm-level analyses that consider both standard risk measures and proxies for downside risk as dependent variables. The latter are particularly suitable to

capture extreme risks that corporate social responsibility might help to insure against.

4.2 ESG effects on firm risk

Even though the relation between corporate social responsibility and risk may be less prone to endogeneity problems than the relation between CSR and firm value (Cheng, Ioannou, and Serafeim, 2013), we nevertheless cannot exclude that biases may result from simple panel regressions. In order to deal with these concerns, we resort to dynamic panel regressions that are estimated with a system GMM approach following Arellano and Bover (1995) and Blundell and Bond (1998). As the lagged dependent variable is included as an additional regressor in these models, both autoregressive memory in the risk measures and endogeneity problems in the ESG-risk relationship are considered, so that the reliability of the inference is enhanced (Roberts and Whited, 2013). Furthermore, robust standard errors introduced by Windmeijer (2005) are employed in the estimation. The general model can be illustrated as follows:

$$y_{i,t} = \beta_1 y_{i,t-1} + \beta_2 ESG_{i,t} + \beta_3 x_{i,t} + \upsilon_i + \varphi_t + \epsilon_{i,t} \ . \tag{4}$$

Here, $y_{i,t}$ represents the respective dependent variable on which to evaluate the impact of ESG activity. $y_{i,t-1}$ is the corresponding variable lagged by one period. $ESG_{i,t}$ represents the firm-specific and time-dependent ESG score. $x_{i,t}$ is a vector of control variables. υ_i and φ_t are time-constant firm effects and firm-constant time effects that are unobservable. $\epsilon_{i,t}$ denotes the idiosyncratic error term in the regression. The coefficient of interest is β_2, as it measures the impact of ESG on firm risk. We report two-step estimation results with a heteroscedasticity weighting matrix based on a consistent estimate of the parameters' covariance matrix. These have been shown to be most efficient (Windmeijer, 2005). Level variables are instrumented with lagged first-differenced terms in this approach.

4.2.1 ESG and equity-based risk

Table 7 reports results from the dynamic panel regression, separately for the U.S. and the European firm sample, where different equity-based firm risk measures are employed as dependent variables. As can be seen, the ESG score reduces firm risk, both for U.S. firms and for European firms. For the U.S. sample, apart from the idiosyncratic risk all risk measures significantly decrease along with firms' ESG activity. A similar result is obtained also for the European sample, with the exception of no significant effect also on LPM(0,3). In general, however, we see that an increasing ESG score leads to a significant reduction in both realized stock volatility and in tail risks such as value at risk or expected shortfall. The size of the risk-reducing effect is much stronger for U.S. firms than for European firms, though. For instance, an increase in the ESG score by one point leads to an average decrease in value at risk by 3.3% for a U.S. firm and by 1.1% for a European firm. With regard to control factors, we obtain the expected results: There is a significantly positive effect of leverage and of the dividend yield on the different risk proxies and an - albeit slightly weaker - significantly negative effect of profitability, in both samples.

Table 7: ESG effects on equity risk - Total ESG score

This table presents the dynamic panel estimation of the effects of the *ESG score* on companies' equity risk in the U.S. and the European sample. Coefficients are estimated using the two-step Arellano and Bover (1995) / Blundell and Bond (1998) GMM system estimator. The dependent variables are the stock volatility σ, idiosyncratic risk σ_ϵ, *VaR*, *CVaR* as well as the second and third order lower partial moments (*LPM(0,2)* and *LPM(0,3)*). Lagged DV denotes the lagged value of the respective dependent variable. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.						Europe					
	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)
Lagged DV	0.553***	0.441***	0.527***	0.467***	0.513***	0.446***	0.459***	0.373***	0.415***	0.369***	0.412***	0.343***
	(0.0213)	(0.0329)	(0.0200)	(0.0215)	(0.0214)	(0.0234)	(0.0206)	(0.0312)	(0.0209)	(0.0207)	(0.0210)	(0.0225)
ESG score	-0.0200***	-0.00133	-0.0331***	-0.0467***	-0.0201***	-0.0229***	-0.00635***	-0.00156	-0.0110***	-0.0127**	-0.00503**	-0.00486
	(0.00357)	(0.00130)	(0.00579)	(0.00860)	(0.00351)	(0.00478)	(0.00239)	(0.00136)	(0.00400)	(0.00573)	(0.00246)	(0.00355)
Leverage	3.068***	0.524***	4.586***	7.123***	2.996***	3.491***	2.378***	1.095***	3.831***	4.500***	1.985***	2.227***
	(0.417)	(0.151)	(0.679)	(0.988)	(0.406)	(0.522)	(0.352)	(0.229)	(0.588)	(0.816)	(0.336)	(0.455)
Growth	-0.141	-0.135**	-0.00337	0.0421	-0.0686	-0.104	-0.0148	-0.117**	0.186	0.217	0.0720	0.0305
	(0.152)	(0.0596)	(0.229)	(0.360)	(0.147)	(0.211)	(0.0777)	(0.0523)	(0.135)	(0.206)	(0.0802)	(0.119)
Profitability	-1.743**	-0.587**	-3.267**	-3.113	-1.449*	-2.088*	-1.544**	-1.203***	-1.317	-2.548*	-1.464**	-1.528*
	(0.822)	(0.296)	(1.299)	(1.960)	(0.802)	(1.108)	(0.612)	(0.408)	(0.956)	(1.400)	(0.593)	(0.829)
Size	-0.211**	-0.0490	-0.233*	-0.346	-0.143	-0.206*	-0.0566	0.0474	-0.0644	-0.0871	-0.0385	0.0861
	(0.0878)	(0.0364)	(0.142)	(0.220)	(0.0908)	(0.124)	(0.0686)	(0.0501)	(0.0953)	(0.145)	(0.0662)	(0.104)
Dividend yield	0.437***	0.0325	0.748***	1.125***	0.414***	0.504***	0.215***	0.0624***	0.410***	0.559***	0.227***	0.283***
	(0.0535)	(0.0207)	(0.0827)	(0.125)	(0.0477)	(0.0673)	(0.0125)	(0.00804)	(0.0219)	(0.0299)	(0.0123)	(0.0171)
Constant	2.767**	0.960*	2.979	4.054	1.790	2.965	0.364	-0.821	-0.00824	0.646	0.278	-1.536
	(1.341)	(0.554)	(2.114)	(3.297)	(1.367)	(1.887)	(1.002)	(0.810)	(1.412)	(2.189)	(0.990)	(1.568)
Firm-year Obs.	8,664	8,664	8,654	8,654	8,664	8,664	10,528	10,528	10,522	10,522	10,526	10,526
Obs.	1,072	1,072	1,071	1,071	1,072	1,072	1,109	1,109	1,109	1,109	1,109	1,109
χ^2	956.6	244.0	885.6	678.3	814.2	551.4	923.2	241.5	836.9	701.5	824.0	608.1

Our findings hence support and enhance the results by Monti, Pattitoni, Petracci, and Randl (2018). They consider the impact of environmental and social components of corporate social responsibility on equity risks and find a clear-cut decreasing effect on standard risk measures but not on VaR. We observe instead a generally risk decreasing impact of the comprehensive ESG score, with the exception of idiosyncratic risk that appears to be unaffected by corporate social responsibility. As our database allows to split the total ESG score into the three different pillars, however, we are able to test as well whether the ESG-risk relation is driven by a particular ESG component and whether the importance of the individual pillars is different for the U.S. sample as compared to the European sample. In order to answer these questions, we therefore rerun the earlier analysis and replace the total ESG score with the individual scores for the environmental, the social and the governance pillar. As these pillars should be seen as orthogonal, reflecting mutually exclusive subcategorical aspects of the total ESG score, we use these explanatory variables simultaneously in one regression. For reasons of brevity, the following table reports only the coefficients on the different ESG pillars' scores, even though the analyses contain the same set of control variables as before.[7]

As can be seen from Table 8, the overall negative effect of ESG activity on equity-based firm risk in the U.S. sample is driven in total by the environmental pillar. For the European sample, in contrast, the overall negative effect on risk results solely from the social pillar. As the distribution of firms over industries is quite homogeneous in the two samples (see Table 3), this observation seems to be driven by varying concerns of equity market investors and not by industry-specific risk drivers. The fact that there is no overlap in the role that the different ESG components play in the U.S. sample and the European sample furthermore underlines the importance to account for these geographical differences when studying the effect of corporate social responsibility. Obviously, environmental concerns appear to be much more important for U.S. companies whereas social issues play a much stronger role for

[7]It should be noted that the number of observations in these estimations is slightly lower as Thomson Reuters does not break down the total ESG rating into the three ESG pillars for all companies.

European firms.

Table 8: ESG effects on equity risk - Individual ESG pillars
This table presents the dynamic panel estimation of the effects of the ESG pillar scores on companies' equity risk in both the U.S. and Europe. Coefficients are estimated using the two-step Arellano and Bover (1995) / Blundell and Bond (1998) GMM system estimator. The dependent variables are the stock volatility σ, idiosyncratic risk σ_ϵ, *VaR*, *CVaR* as well as the second and third order lower partial moments (*LPM(0,2)* and *LPM(0,3)*). Control variables are the lagged dependent variable, Leverage, Growth, Profitability, Size and Dividend yield, but are not reported for the sake of brevity. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.					
	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)
Env. pillar	-0.0186***	-0.00195	-0.0308***	-0.0440***	-0.0184***	-0.0195***
	(0.00375)	(0.00129)	(0.00622)	(0.00896)	(0.00362)	(0.00483)
Soc. pillar	0.00260	0.000508	0.00852	0.00942	0.00315	0.00205
	(0.00316)	(0.00111)	(0.00535)	(0.00782)	(0.00320)	(0.00442)
Gov. pillar	-0.000857	0.00125	-0.00458	-0.00449	-0.00144	-0.00249
	(0.00231)	(0.000834)	(0.00375)	(0.00556)	(0.00224)	(0.00309)
Firm-year Obs.	6,261	6,261	6,251	6,251	6,261	6,261
Obs.	832	832	831	831	832	832
χ^2	793.4	205.2	742.3	577.0	705.9	500.1

	Europe					
	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)
Env. pillar	0.00232	7.65e-05	0.00211	0.00184	0.00125	0.00161
	(0.00211)	(0.00123)	(0.00368)	(0.00505)	(0.00214)	(0.00300)
Soc. pillar	-0.00601***	-0.00216**	-0.0100***	-0.00921*	-0.00383**	-0.00309
	(0.00198)	(0.00102)	(0.00319)	(0.00473)	(0.00194)	(0.00281)
Gov. pillar	-0.000564	0.00106	0.000484	-0.000190	-0.000166	-0.00125
	(0.00162)	(0.000937)	(0.00257)	(0.00372)	(0.00158)	(0.00224)
Firm-year Obs.	8,374	8,374	8,368	8,368	8,372	8,372
Obs.	882	882	882	882	882	882
χ^2	727.8	203.1	630.9	531.4	649.0	478.2

4.2.2 Cross-sectional variation and the role of volatility

Even though the dynamic panel approach employed in our estimations accounts for potential endogeneity problems, one might be concerned particularly with reverse causality or simultaneity in the ESG-risk relation. If corporate social responsibility is seen as a "luxury good"

(Cheng, Ioannou, and Serafeim, 2013), it stands to reason that firms might engage more strongly in ESG activities if they can afford to do so, for instance if their capital costs are sufficiently low due to only little firm risk. In this case we might expect the relation between the ESG score and firm risk to be stronger for firms with low risk as compared to firms with high risk. A subsample analysis should allow us to consider this cross-sectional variation in the ESG-risk relation. Table 9 reports the results from a dynamic panel regression where we categorize the firms in three groups: the 25% of firms with the highest risk (measured via the respective dummy variable, Top25), the 25% of firms with the lowest risk (Low25) and the remaining 50% of firms in-between. We treat the middle group as the base category and interact the ESG score with the two dummy variables for the Top25 and Low25 firms. Again, the analyses contain the same set of control variables as before, but we report only the coefficients of interest here.

Table 9 shows quite clearly that the reverse causality concern does not bear out. For the U.S. sample, we rather find that firms with the lowest risk show a slightly weaker ESG-risk relation. This is because the significantly positive coefficient of the corresponding interaction term runs into the opposite direction as the significantly negative coefficient of the ESG score and thus deducts from its absolute effect. The 25% of firms with the lowest risk in the sample hence display a significantly weaker effect of ESG on risk than the 50% of firms in the intermediate risk interval (the base category, whose effect is captured by the ESG score in this setup). Comparing the economic sizes of the coefficients shows, however, that even for the low-risk firms the effect of the ESG score on firm risk is still negative (with the exception of the idionsyncratic risk in model (2)). For the European firms, however, there is no cross-sectional variation at all as neither of the interaction terms displays a significant effect. Admittedly, though, neither does the ESG score itself. Instead, the dummy variables for the risk-categories appear to explain almost all the variation there is in the dependent variables.

Table 9: ESG effects on equity risk - Cross-sectional variation

This table presents the dynamic panel estimation of the effects of *ESG score* on companies' equity risk in both the U.S. and Europe, where firms are categorized into the 25% of firms with highest risk (Top25), according to the respective risk measure, the 25% of firms with the lowest risk (Low25) and the 50% of firms in-between. The latter category is dropped, i.e. serves as base category. Coefficients are estimated using the two-step Arellano and Bover (1995) / Blundell and Bond (1998) GMM system estimator. The dependent variables are the stock volatility σ, idiosyncratic risk σ_ϵ, *VaR*, *CVaR* as well as the second and third order lower partial moments (*LPM(0,2)* and *LPM(0,3)*). Lagged DV denotes the lagged value of the respective dependent variable. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.						Europe					
	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)
Lagged DV	0.509***	0.366***	0.492***	0.423***	0.472***	0.398***	0.419***	0.286***	0.367***	0.349***	0.377***	0.332***
	(0.0193)	(0.0300)	(0.0175)	(0.0190)	(0.0186)	(0.0196)	(0.0187)	(0.0270)	(0.0196)	(0.0194)	(0.0195)	(0.0210)
ESG Score	-0.0197***	-0.00112	-0.0311***	-0.0423***	-0.0187***	-0.0175***	0.00189	0.000222	0.00286	0.00750	0.00265	0.00294
	(0.00353)	(0.00112)	(0.00566)	(0.00847)	(0.00351)	(0.00450)	(0.00237)	(0.00134)	(0.00385)	(0.00576)	(0.00246)	(0.00339)
Top25	1.091***	0.509***	1.217***	2.244***	1.069***	1.821***	0.660***	0.389**	0.823***	1.654***	0.695***	1.033***
	(0.297)	(0.0816)	(0.445)	(0.555)	(0.233)	(0.290)	(0.229)	(0.189)	(0.297)	(0.452)	(0.180)	(0.253)
ESG*Top25	-0.00423	0.000229	0.000915	-0.00624	-0.00399	-0.00865	0.000715	0.00477	0.00524	-0.000509	0.000206	0.00189
	(0.00582)	(0.00156)	(0.00874)	(0.0110)	(0.00452)	(0.00547)	(0.00400)	(0.00334)	(0.00533)	(0.00810)	(0.00316)	(0.00429)
Low25	-0.693***	-0.242***	-1.082***	-1.310***	-0.637***	-0.807***	-0.218**	-0.268***	-0.499**	-0.991***	-0.377***	-0.606***
	(0.134)	(0.0349)	(0.193)	(0.292)	(0.121)	(0.144)	(0.110)	(0.0647)	(0.200)	(0.250)	(0.105)	(0.133)
ESG*Low25	0.00745***	0.000352	0.00987***	0.0112**	0.00588***	0.00549**	-0.00297*	-1.07e-05	-0.00268	0.000383	-0.000139	0.000721
	(0.00239)	(0.000593)	(0.00340)	(0.00499)	(0.00211)	(0.00244)	(0.00177)	(0.000993)	(0.00326)	(0.00412)	(0.00168)	(0.00213)
Firm-year Obs.	8,664	8,664	8,654	8,654	8,664	8,664	9,029	9,029	9,024	9,024	9,027	9,027
Obs.	1,072	1,072	1,071	1,071	1,072	1,072	987	987	986	986	987	987
χ^2	1406	1002	1268	996.5	1213	1097	1512	919.0	1272	1177	1345	1324

Overall, there is hence no reason to believe that reverse causality drives the observed negative effect of ESG activity on firm risk. Neither for the U.S. nor for the European sample is there evidence that the relation is stronger for those firms who could more easily afford to engage in costly corporate social responsibility.

Regarding further variations in the ESG-risk relation, there is one more aspect that might be of interest. All the proxies of firm risk employed so far are based on the perception of investors regarding the stock performance of companies. As perceptions tend to be influenced by the surrounding market environment, the question arises whether market-based factors exist that might moderate the ESG-risk relation. Indeed, Lins, Servaes, and Tamayo (2017), who take CSR activity as a proxy for firms' social capital, show that the positive effect of social capital on stock returns is particularly high during the financial crisis. Quite similarly, Monti, Pattitoni, Petracci, and Randl (2018) demonstrate that the link between CSR activity and firm risk has been particularly strong in the time period immediately after the financial crisis, while they do not find any association before the crisis. Similarly, Diemont, Moore, and Soppe (2015) hint at the role that extreme market conditions play for the relation between individual items of corporate social responsibility and tail risks.

In order to assess whether the surrounding market volatility influences the ESG-risk relation in our dataset, we approximate the market volatility by the annual volatility of the respective equity stock index, i.e. the S&P 1500 for the U.S. sample and the Euro Stoxx 600 for the European sample. We consider this variable as another explanatory factor in our regressions and include an interaction term with the ESG score as well. If volatility does play the stipulated moderating role, the interaction term should show a significant effect on firm risk. Table 10 presents the results.

As can be seen, the market volatility itself has a highly significant positive effect on firms' equity risk, both for the U.S. and the European sample. Interestingly, while the ESG score keeps its negative impact on risk in the European case, it loses significance for the U.S. sample. Instead, the interaction of the ESG score with the market volatility shows a highly

significant negative coefficient for U.S. firms. Obviously, therefore, the risk-reducing effect of ESG activities for U.S. firms is strongly dependent on the surrounding market volatility. The higher the volatility is on the equity market, the more strongly do investors perceive the risk-reducing impact of corporate ESG activities. If the market is fully stable, however, investors do not appear to see U.S. firms' ESG engagement as an effective tool to reduce firm risk, as neither standard risk measures nor proxies for tail risks are decreased. For European firms, in contrast, the general market volatility hardly seems to moderate the perception of ESG activities as insurance-like instruments: Here, the interaction term of the ESG score and the market volatility do not show a generally significant effect on firm risk, so that the risk-reducing effect of corporate social responsibility remains mainly independent of the surrounding market volatility. Only for the idiosyncratic risk do we observe a moderating role of the market volatility.

Table 10: ESG effects on equity risk - The moderating role of market volatility

This table presents the dynamic panel estimation of the effects of *ESG score* as well as *Index Volatility (σ_{Ind})* of the S&P1500 and Stoxx Europe 600 on companies' equity risk in both the U.S. and Europe. Coefficients are estimated using the two-step Arellano and Bover (1995) / Blundell and Bond (1998) GMM system estimator. The dependent variables are the stock volatility σ, idiosyncratic risk σ_ϵ, *VaR*, *CVaR* as well as the second and third order lower partial moments (*LPM(0,2)* and *LPM(0,3)*). Lagged DV denotes the lagged value of the respective dependent variable. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.						Europe					
	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0,3)	(1) σ	(2) σ_ϵ	(3) VaR	(4) CVaR	(5) LPM (0,2)	(6) LPM (0
Lagged DV	0.213***	0.408***	0.156***	0.122***	0.156***	0.137***	0.273***	0.353***	0.191***	0.178***	0.221***	0.196*
	(0.0140)	(0.0329)	(0.0127)	(0.0140)	(0.0135)	(0.0157)	(0.0153)	(0.0308)	(0.0148)	(0.0154)	(0.0159)	(0.016
ESG score	0.00146	5.98e-05	0.00406	0.0110**	0.00265	0.00310	-0.00961***	0.00225	-0.0137***	-0.0144**	-0.00676***	-0.005
	(0.00234)	(0.00165)	(0.00361)	(0.00562)	(0.00232)	(0.00359)	(0.00257)	(0.00175)	(0.00420)	(0.00634)	(0.00261)	(0.003
σ_{Ind}	1.647***	0.185***	2.818***	4.001***	1.641***	2.053***	0.866***	0.405***	1.745***	2.343***	0.927***	1.202*
	(0.105)	(0.0668)	(0.176)	(0.254)	(0.101)	(0.146)	(0.114)	(0.0794)	(0.199)	(0.311)	(0.116)	(0.16
ESG*σ_{Ind}	-0.00813***	-0.00168	-0.0125***	-0.0201***	-0.00831***	-0.0105***	0.00193	-0.00390***	0.000226	0.000307	0.000773	0.0003
	(0.00191)	(0.00118)	(0.00321)	(0.00469)	(0.00187)	(0.00271)	(0.00184)	(0.00120)	(0.00322)	(0.00499)	(0.00186)	(0.002
Firm-year Obs.	8,664	8,664	8,654	8,654	8,664	8,664	10,528	10,528	10,522	10,522	10,526	10,52
Obs.	1,072	1,072	1,071	1,071	1,072	1,072	1,109	1,109	1,109	1,109	1,109	1,109
χ^2	1801	225.7	1914	1648	1661	1404	1933	494.0	1997	1791	1891	1581

It should be noted that our results are confirmed if we follow the earlier literature and subdivide the sample into different time periods around the financial crisis. Particularly in the period 2011 to 2017, i.e. after the financial crisis, where equity capital markets have been extremely stable, we find no risk-reducing effect of ESG activities for the U.S. sample, while the effect remains stable in the European firm sample.[8] Investors hence seem to perceive the stabilizing impact of corporate social responsibility for U.S. companies particularly in times when markets are prone to strong volatility.

4.2.3 ESG and credit risk

If ESG activity truly acts as an insurance against extreme events, then a default of the firm should also become less likely. To enhance the validity of our results, we therefore also test whether corporate social responsibility has an effect on measures of default risk. In this respect, we analyze one-year and five-year CDS spreads, respectively, and distance-to-default as dependent variables in our dynamic panel data framework. Moreover, we investigate the ESG effect on S&P's credit ratings to allow also for the perspective of a credit rating agency. As agency ratings are based on a through-the-cycle rating methodology that filters out the effect of short-term business movements on default risk, this latter proxy of default risk may indeed differ from the market-based measures of credit risk. Results are derived again from a system GMM estimation in a dynamic panel approach.

The estimation results in Table 11 illustrate that ESG efforts significantly reduce market-based default risks in the U.S. sample. This shows particularly strongly for the short-term proxy of default risk, the one-year CDS spread. As the distance-to-default increases significantly with increasing ESG activity, this may also be interpreted as higher corporate social responsibility reducing credit risk. Interestingly, credit ratings are unaffected by ESG efforts. Our results in this respect contradict earlier findings by Oikonomou, Brooks, and Pavelin (2014) and Jiraporn, Jiraporn, Boeprasert, and Chang (2014) who show that credit ratings

[8]The corresponding results are available from the authors upon request.

improve with strengthening corporate social responsibility. For the European sample, in contrast, we observe no significant effect at all of ESG activities on default risk. In essence, these additional results hence confirm our earlier results for the U.S. sample: Stronger ESG activity reduces market-based measures of risk, taken both from equity and debt markets. For European firms, though, the risk-reducing impact of corporate social responsibility appears to be perceived only on the equity market.

Table 11: ESG effects on credit risk
This table presents the dynamic panel estimation of the effects of *ESG score* on companies' credit risk in both the U.S. and Europe. Coefficients are estimated using the two-step Arellano and Bover (1995)/Blundell and Bond (1998) GMM system estimator. The dependent variables are the one- and five-year *CDS Spread*, the *DTD* and the *Credit Rating* of the companies' debt - rated by the rating agency Standard & Poor's. Lagged DV denotes the lagged value of the respective dependent variable. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.				Europe			
	(1) CDS1Y	(2) CDS5Y	(3) DTD	(4) Credit Rating	(1) CDS1Y	(2) CDS5Y	(3) DTD	(4) Credit Rating
Lagged DV	0.284***	0.250***	0.397***	0.884***	0.175***	0.350***	0.355***	0.870***
	(0.0290)	(0.0311)	(0.0211)	(0.0364)	(0.0225)	(0.0274)	(0.0218)	(0.0423)
ESG score	-0.205***	-0.119*	0.0195**	0.000564	-0.0528	-0.0475	0.0110	0.000216
	(0.0682)	(0.0674)	(0.00797)	(0.00169)	(0.0416)	(0.0331)	(0.00718)	(0.00215)
Leverage	70.11***	37.13***	-6.570***	-1.313***	53.93***	37.91***	-8.370***	-2.326***
	(13.10)	(9.355)	(0.902)	(0.326)	(8.795)	(6.316)	(1.072)	(0.472)
Growth	12.98***	8.933**	-1.019***	0.159*	7.372***	6.288***	-1.098***	0.139*
	(4.127)	(4.296)	(0.285)	(0.0904)	(2.038)	(1.541)	(0.281)	(0.0782)
Profitability	-68.58***	-100.4***	3.294*	4.445***	-9.309	-23.16**	3.159*	4.143***
	(22.50)	(19.87)	(1.875)	(0.653)	(15.14)	(10.50)	(1.752)	(0.910)
Size	0.522	-1.179	0.682***	0.155**	2.185	2.775**	0.458***	-0.139
	(3.569)	(3.174)	(0.216)	(0.0623)	(2.102)	(1.318)	(0.173)	(0.0879)
Constant	-27.26	27.16	-4.355	-0.482	-55.85*	-52.51***	0.424	5.472***
	(56.06)	(48.63)	(3.143)	(0.962)	(31.74)	(20.12)	(2.529)	(1.999)
Firm-year obs.	8,497	8,497	8,496	6,245	9,310	9,310	9,388	3,998
Obs.	1,056	1,056	1,055	753	940	940	951	434
χ^2	198.0	129.4	481.3	887.9	146.3	311.6	480.7	1158

4.3 ESG returns per unit of risk

So far, our analyses have shown that a portfolio of the stocks of ESG-inactive firms delivers a higher abnormal return, controlling for market, size, value and momentum risk, than a portfolio of ESG-active firms. In addition, we have seen that ESG-activity reduces the firm

risk perceived on financial markets. We hence observe two countervailing effects of corporate social responsibility: It allows firms to be perceived as safer by financial market participants and it is associated with lower abnormal returns. The question remains therefore, whether the two effects offset each other in a return-per-risk perspective, such that the higher return of ESG-inactive firms is just sufficiently large to outweigh the ensuing higher risk.

In order to answer this question, we combine the results from the portfolio-level analyses with those from the firm-level analyses in the following. More precisely, we build return-to-risk ratios for each of the five quintile portfolios created in Section 4.1: We divide each portfolio's alpha by the average risk of the firms in this portfolio, where we use the different equity-based risk measures from Section 4.2.1 in turn. In addition to the abnormal return, we also consider the realized excess return (over the risk-free rate) in the ratio's numerator as this should capture the return due to all relevant risk factors be they CSR-driven or traditional risk factors. As can be seen from Table 12, with the exception of the ratio built with the idiosyncratic risk, we find that the return-to-risk ratios for the U.S. sample increase throughout with decreasing ESG level. Investing into firms with the lowest ESG activity hence delivers the highest abnormal return per unit of risk (Panel A) and also the highest realized excess return per unit of risk (Panel B), despite the fact that these firms show the highest risk levels, as we have seen in Section 4.2. For the European sample, the result is similar, but here the highest return-to-risk ratios are obtained not in Q1 but in Q2, i.e. in the second-to-lowest quintile of firms along the ESG-spectrum.

These results lead us to conclude that investing in the stocks of firms with only weak ESG activity allows to reap an immediate excess return, over and above the expected return from these firms' sensitivity towards the traditional risk factors. Though firms that do not engage strongly in corporate social responsibility are indeed perceived to be exposed to higher risks than ESG-active firms, leading to an immediate price discount that translates into a higher return, this higher return seems to more than overcompensate the higher risk. Overall, therefore, the immediate investment return per unit of risk is more favourable for

ESG-inactive firms than for those with strong ESG scores.

As our results are derived from an analysis of return-to-risk ratios, we cannot immediately pinpoint their root cause. It may well be that our results are driven by a particularly high risk premium requested from, or a particularly small risk assignment to firms with low ESG scores, or even both. The fact that our initial portfolio-level results were driven by low-ESG firms rather than high-ESG firms (see Section 4.1) only indicates that the relation between firms' ESG-scores and their market performance is based more strongly on those firms that show only little ESG engagement. This still leaves open the question of how investors in ESG-active companies fare.

Table 12: Return-to-risk ratios

This table presents ratios of average return to average risk from firm portfolios sorted by their respective ESG score, subdivided into quintiles where Q5 represents the companies with the highest ESG scores (top 20%) while Q1 comprises the companies with the lowest ESG scores (lowest 20%). Portfolios are reallocated annually. α measures the monthly abnormal return of the respective portfolio taken from the four-factor model in Section 4.1. The excess return is calculated as the average monthly realized return in excess of the risk-free rate.

	U.S.						Europe					
Panel A: Alpha	$\frac{\alpha}{\sigma}$	$\frac{\alpha}{\sigma_\epsilon}$	$\frac{\alpha}{VaR}$	$\frac{\alpha}{CVaR}$	$\frac{\alpha}{LPM(0,2)}$	$\frac{\alpha}{LPM(0,3)}$	$\frac{\alpha}{\sigma}$	$\frac{\alpha}{\sigma_\epsilon}$	$\frac{\alpha}{VaR}$	$\frac{\alpha}{CVaR}$	$\frac{\alpha}{LPM(0,2)}$	$\frac{\alpha}{LPM(0,3)}$
Q5	0.0182	0.9396	0.0107	0.0078	0.0163	0.0124	0.0433	0.3421	0.0265	0.0185	0.04	0.0319
Q4	0.0413	0.7604	0.0268	0.018	0.0373	0.0279	0.0695	0.5617	0.045	0.0311	0.067	0.052
Q3	0.0491	1.1163	0.0307	0.0213	0.0451	0.0355	0.0693	0.4894	0.0475	0.0294	0.0633	0.0489
Q2	0.0559	1.2006	0.0363	0.0252	0.0533	0.0408	0.1146	0.8181	0.0798	0.0503	0.1084	0.0818
Q1	0.0732	1.4925	0.049	0.0343	0.0697	0.0526	0.1029	0.6723	0.0631	0.0447	0.0955	0.072
Panel B: Excess return	$\frac{ER}{\sigma}$	$\frac{ER}{\sigma_\epsilon}$	$\frac{ER}{VaR}$	$\frac{ER}{CVaR}$	$\frac{ER}{LPM(0,2)}$	$\frac{ER}{LPM(0,3)}$	$\frac{ER}{\sigma}$	$\frac{ER}{\sigma_\epsilon}$	$\frac{ER}{VaR}$	$\frac{ER}{CVaR}$	$\frac{ER}{LPM(0,2)}$	$\frac{ER}{LPM(0,3)}$
Q5	0.2058	10.638	0.1216	0.0879	0.1849	0.1403	0.136	1.0739	0.0831	0.0582	0.1256	0.1001
Q4	0.2132	3.9234	0.138	0.093	0.1923	0.1439	0.1647	1.3308	0.1065	0.0736	0.1587	0.1232
Q3	0.2266	5.153	0.1419	0.0984	0.208	0.1639	0.177	1.2501	0.1214	0.075	0.1618	0.1249
Q2	0.2366	5.0799	0.1538	0.1065	0.2255	0.1726	0.2312	1.6511	0.1611	0.1015	0.2189	0.1651
Q1	0.2546	5.193	0.1705	0.1194	0.2425	0.1829	0.2167	1.4155	0.1329	0.0941	0.2012	0.1516

4.4 ESG effects on firm value

Our results so far were derived from the contemporaneous relation between corporate social responsibility as measured by Thomson Reuter's ESG scores and investment returns, respectively risk perceptions, on financial markets. We have not yet dealt with the issue whether and, if so, when the lower risk of ESG-active companies translates into a tangible positive effect on firm value. In order to answer this final question, we therefore run a dynamic panel estimation on firm value where, in addition to considering a contemporaneous relation, we lag the ESG score for one to four years. We believe that consideration of a time lag up to four years may be warranted, since ESG activities such as changes in environmental sourcing or management diversity may take some time from a first reporting to the public, allowing it to enter the ESG score calculation, and an eventual effect on productivity and profitability. Our perspective hence follows Eccles, Ioannou, and Serafeim (2014) who consider an extremely long time period over which firms' corporate social responsibility strategies may evolve. We hence estimate the following equation with system GMM:

$$y_{i,t} = \beta_1 y_{i,t-1} + \beta_2 ESG_{i,t-j} + \beta_3 x_{i,t} + \upsilon_i + \varphi_t + \epsilon_{i,t} \ , \tag{5}$$

where $j = \{0, 1, 2, 3, 4\}$ in individual regressions. The dependent variable in this equation is firm value that is approximated by Tobin's Q following Luo and Bhattacharya (2006) and Servaes and Tamayo (2013). Defined as the market value of a firm divided by its replacement costs, Tobin's Q represents a comprehensive measure of value created by management decisions or corporate policies. Due to the time lags considered in the ESG score, reverse causality in the firm value-ESG relation should be less of a problem in this model.

As can be seen from Table 13, for the U.S. sample the ESG score significantly increases firm value irrespective of the time lag considered. However, the coefficients of the lagged ESG scores are larger in size as compared to the contemporaneous score. From this we may conclude that higher ESG activity of U.S. firms does translate into higher firm value, but the

effect stretches over several years and becomes pronounced only with a time lag of at least one year. Interestingly, the positive effect of the ESG score on Tobin's Q remains highly significant and also of the same size over the four years after the score's publication. The value-increasing impact of corporate social responsibility hence does not dissipate quickly but stays substantive over several years.

For European firms, we do not find a significant impact of the ESG score on Tobin's Q in the same year. However, the lagged ESG score impacts firm value positively, peaking statistically and economically with a two-year lag. In contrast to the U.S. sample, the value-increasing effect becomes markedly smaller and also loses in significance from the third year on.

Table 13: Dynamic panel regressions of ESG score with lag structure on firm value

This table presents the dynamic panel estimation of the effects of the *ESG score* on firm value proxied as *Tobin's Q* in both the U.S. and Europe. The models 1 to 5 include different lagged ESG scores as explanatory variables, ranging from the ESG score in the same year (Model 1) to the lagged ESG score 4 years prior (Model 5). The sixth Model includes the same year's ESG score as well as all 4 lagged ESG scores. Coefficients are estimated using the two-step Arellano and Bover (1995) / Blundell and Bond (1998) GMM system estimator. Lagged DV denotes the lagged value of the respective dependent variable. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

	U.S.					Europe				
	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q	(5) Tobin's Q	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q	(4) Tobin's Q	(5) Tobin's Q
Lagged DV	0.494***	0.502***	0.543***	0.525***	0.547***	0.528***	0.541***	0.538***	0.512***	0.509***
	(0.0482)	(0.0485)	(0.0431)	(0.0490)	(0.0577)	(0.0630)	(0.0624)	(0.0666)	(0.0693)	(0.0805)
ESG score	0.00397**					-0.000476				
	(0.00166)					(0.00144)				
ESG score 1Y		0.00721***					0.00373***			
		(0.00160)					(0.00139)			
ESG score 2Y			0.00692***					0.00584***		
			(0.00178)					(0.00141)		
ESG score 3Y				0.00707***					0.00301*	
				(0.00178)					(0.00158)	
ESG score 4Y					0.00719***					0.00291*
					(0.00180)					(0.00151)
Leverage	0.238	0.240	0.462**	0.430*	0.322	0.256	0.255	0.324	0.257	0.269
	(0.214)	(0.210)	(0.222)	(0.225)	(0.253)	(0.259)	(0.255)	(0.270)	(0.293)	(0.334)
Growth	-0.0153	-0.0156	-0.0986	-0.109	-0.151*	-0.164**	-0.162**	-0.133*	-0.227***	-0.204**
	(0.0718)	(0.0712)	(0.0776)	(0.0818)	(0.0859)	(0.0664)	(0.0659)	(0.0759)	(0.0809)	(0.0878)
Profitability	0.875	0.855	0.952*	0.815	0.795	1.228**	1.304**	1.196**	1.190**	1.301**
	(0.572)	(0.567)	(0.507)	(0.535)	(0.499)	(0.564)	(0.556)	(0.572)	(0.581)	(0.642)
Efficiency	-0.0979	-0.0928	-0.103	-0.0775	0.00771	0.169*	0.165*	0.196*	0.262***	0.302***
	(0.108)	(0.109)	(0.116)	(0.119)	(0.125)	(0.0962)	(0.0960)	(0.107)	(0.102)	(0.110)
Size	-0.288***	-0.317***	-0.294***	-0.190**	-0.127	-0.307***	-0.333***	-0.346***	-0.249***	-0.215**
	(0.0686)	(0.0680)	(0.0656)	(0.0741)	(0.0782)	(0.0838)	(0.0843)	(0.0892)	(0.0856)	(0.0842)
Constant	5.164***	5.459***	4.906***	3.261***	2.214*	5.256***	5.408***	5.448***	4.082***	3.512**
	(1.110)	(1.105)	(1.067)	(1.202)	(1.272)	(1.370)	(1.381)	(1.471)	(1.391)	(1.384)
Firm-year obs.	6,926	6,926	6,089	5,379	4,739	8,318	8,318	7,469	6,689	5,948
Obs.	854	854	738	660	636	864	864	809	768	733
χ^2	248.9	259.6	309.0	205.8	133.4	319.2	319.8	248.1	198.6	121.6

Unreported results further indicate that the value-increasing effect of corporate social responsibility tends to be driven primarily by the environmental pillar for U.S. firms, though this effect seems to drop off before the four-year period considered. For European firms, both the environmental and the social pillar play a role in the two years following the publication of the respective scores.[9] While these additional findings support the earlier results on the ESG-risk relation, they also indicate that financial markets appear unable to immediately and fully assess the beneficial value effect of the insurance character inherent in corporate social responsibility. Rather, market participants need some years to incorporate this information from ESG-active firms in their trading decisions. This corresponds directly with our earlier results on the portfolio level where the contemporaneous ESG-effect appeared strangely unaffected by those firms that engage strongly in corporate social responsibility. Seen from the market's perspective, socially responsible investment hence seems attractive only for market participants with a sufficiently long investment horizon.

5 Conclusion

Our paper examines the attractiveness of ESG investing in the U.S. and in Europe using data between 2003 and 2017. Based on analyses at the portfolio level and at the firm level, we find that corporate social responsibility shows insurance-like characteristics: Investing into a portfolio that is long in ESG-active firms and short in ESG-inactive firms delivers a highly significant negative abnormal return of between -28 and -31 basis points per month. Firms with low ESG scores offer a highly significant abnormal return, i.e. a risk premium over and above a potential premium for market, size, value and momentum-based risk.

This finding at the portfolio level is supported by firm-level results that show that higher ESG activity reduces the firm risk perceived on financial markets. We observe that both standard risk measures and proxies for downside risk decrease with increasing ESG ratings.

[9] Results are available from the authors upon request.

While these results hold for both U.S. and European firms, the underlying drivers appear to be different: For U.S. firms, we see that the environmental component in ESG activity play the most important role for reducing risk, while for European firms it seems to be the social component. As earlier research has shown that the beneficial conception of corporate social responsibility may be strongest in extreme market phases, we also test whether the insurance-linked perception of ESG activity is dependent on the overall volatility on the market. Indeed, we find this to be the case for U.S. firms: For them, the risk-reducing effect of ESG activity is strengthened by the general market volatility. In Europe, in contrast, this is not the case.

If ESG activity reduces firm risk, is this effect sufficiently strong to outweigh the lower risk premium on a return-to-risk basis? By combining our results from the portfolio level with the firm level, we find that ESG-inactive companies also yield higher returns per unit of risk than ESG-active firms. A lack of corporate social responsibility hence seems to be penalized by financial markets so that low ESG firms are required to offer higher returns that even overcompensate their higher risk. Given this apparent disadvantage of ESG-active firms, the question remains whether their lower risk eventually translates into higher firm value. In further firm-level analyses we find this indeed to be the case. More precisely, we see that the value-increasing effect of ESG activity stretches over several years for both U.S. and European firms.

Our analysis hence does not only deliver a robust answer to the question whether ESG-based investing may help to derive superior portfolio returns. We also show that corporate social responsibility has slightly different effects on U.S. as compared to European firms. While in both cases, CSR shows distinct insurance-like characteristics so that capital markets perceive firms with higher ESG activity as safer, the drivers of this risk-reducing effect are different. Moreover, the employment of an ESG-based risk factor for portfolio performance evaluation may deviate between an U.S. and an European portfolio as for the former the general market volatility needs to be considered: In the U.S., any ESG risk premium

appears to gain importance in more volatile market phases. Irrespective of the surrounding market conditions, however, our study leads us to conclude that corporate social responsibility primarily allows to "do safe by doing good". Only investors with sufficient tenacity will (eventually) "do well by being safe".

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