Corporate Social Responsibility and Bond Volatility

Trevor Chamberlain[a], Zehua Zhang[b], Ran Zhao[c], and Lu Zhu[d]

[a]DeGroote School of Business, McMaster University

[b]Center for Economics, Finance and Management Studies, Hunan University

[c]Fowler College of Business, San Diego State University

[d]College of Business, California State University, Long Beach

This Version: September, 2024

[*]Zehua Zhang's Email: zehua@hnu.edu.cn

[†]Corresponding Author. Fowler College of Business, San Diego State University. Email: rzhao2@sdsu.edu. Postal Address: 5500 Campanile Dr, San Diego, CA 92182, United States.

[‡]Lu Zhu's Email: lu.zhu@csulb.edu

[§]Trevor Chamberlain's Email: chambert@mcmaster.ca

ESG Performance and Corporate Bond Volatility

Abstract

This study examines the effects of environmental, social and governance (ESG) performance on bond volatility. After controlling for bond characteristics and firm fundamentals, we find a robust positive relationship between ESG performance and bond volatility. The empirical results demonstrate that the impact on bond volatility is primarily driven by ESG strengths instead of concerns. Additionally, the increase in bond volatility is concentrated around short-term bonds. The results are robust to alternative measures, sample periods, and endogeneity controls. Furthermore, the effect of ESG performance is more pronounced for firms with higher managerial risk-taking and poor information environments.

JEL Classification: G10, G12, G30, G32, M14

Keywords: Bond volatility, corporate social responsibility, risk-taking, information environment

"US sustainable investing is under fire for reasons that have nothing to do with its impact or return results, " — 2022 Report on US Sustainable Investing Trends.

1 Introduction

In the past decade, companies have devoted significant amounts of resources to improving their environmental, social, and governance (ESG) performance, or corporate social responsibility (CSR).[1] Although ESG expenditure cannot be precisely measured, the amount is substantial. US- and UK-based companies on the Fortune Global 500 list reported spending $15.2 billion on ESG-related activities in 2014 (Cai et al. 2020). This study examines the secondary credit market reactions to firms' engagement in ESG activities from a return volatility perspective.

The asset pricing implications of firms' ESG performance in the secondary bond market have drawn the attention of researchers. Recent studies have shown mixed climate or carbon risk-pricing results in bond returns (Duan et al. 2021; Huynh and Xia 2021). Huynh and Xia (2021) show that climate change news risk, measured by beta exposure to a climate change news index, is priced in corporate bond returns. However, Duan et al. (2021) find that climate risk, measured by firms' carbon emissions, is not priced in bond returns. This suggests that bond investors underreact to climate risk.

It is not apparent whether ESG engagement increases or decreases bond return volatility. The long-standing academic debate on the interpretation of ESG (i.e., stakeholder maximization and agency problem arguments) offers opposite signs for the relationship between ESG and bond return volatility.[2] This study supplements this literature by examining

[1] In this study, we use the term ESG when ESG and CSR are interchangeable in the context. We specify the terminology when it is necessary.

[2] On one hand, the risk mitigation effect of ESG suggests a negative relationship between ESG and bond return volatility. For instance, Becchetti et al. (2016) argue that socially responsible firms are more likely to effectively navigate conflicts with the stakeholder interests. Philanthropy activities contribute to building positive moral capital for companies, thereby protecting shareholders from adverse downside risk (Godfrey 2005). On the other hand, the agency problem associated with ESG spending suggests a positive relationship between ESG and bond return volatility. Certain authors argue that ESG is a manifestation

bondholders' reactions to firms' ESG performance from uncertainty and holding period risk perspectives. It provides the first empirical evidence establishing a positive relationship between ESG performance and bond return volatility.

Our main hypothesis is that better ESG performance is associated with greater corporate bond volatility. We find that ESG strengths, rather than concerns, drive this positive relationship. The positive relationship is concentrated around short-term bonds. Bond investors are less sensitive to information about upside potentials but more sensitive to information about downside risks (Bai et al. 2019) than stock investors. They are more concerned about short-term repayment capacity than long-term benefits. Although corporate irresponsibility (measured using ESG concerns) has been consistently registered as a risk (Goss and Roberts 2011; Seltzer et al. 2022), bondholders, especially short-term bondholders, are unwilling to pay for firms' goodness (Larcker and Watts 2020). Moreover, the benefits of reputation insurance tend to materialize in the long run (Kim et al. 2019). Bondholders are concerned about firms' ESG investment beyond legal or regulatory requirements, which could distort the capital allocation efficiency, decrease firms' flexibility in responding to adverse shocks, and increase earning unpredictability (Becchetti et al. 2013; Becchetti et al. 2015; Bhandari and Javakhadze 2017). This results in higher forecasting dispersion, noise trading, and bond volatility (Harjoto and Jo 2015; Orlitzky 2013).

We construct the data sample by merging the ESG scores (net ESG and industry-scaled ESG scores) from the MSCI ESG KLD database with corporate bond data (bond return volatility, bond illiquidity, and other bond characteristic variables) from Trade Reporting and Compliance Engine (TRACE), Bloomberg, and Mergent FISD. The sample spans from 2002 to 2018, with firm ESG scores ranging from -10 to 18 and annualized bond return volatilities ranging from 1.39% to 44.09%. The baseline empirical results show a robust positive relationship between ESG performance and bond return volatility, which is statistically and economically significant. A firm's ESG performance can be considered an endogenous

of agency problems (Bénabou and Tirole 2010; Cheng et al. 2013; Jensen and Meckling 1976; Masulis and Reza 2015). ESG investments may enhance a manager's own reputation but potentially reduce firm values.

variable. To alleviate the possibility of hidden factors or common industry trends affecting our empirical analysis, we adopt a two-stage least-squared approach (2SLS) and further investigate the relationship between ESG and bond volatility. We select a Democratic state dummy (Albuquerque et al. 2019; Di Giuli and Kostovetsky 2014; Hong and Kostovetsky 2012) and average industry ESG score (Bardos et al. 2020; El Ghoul et al. 2011; Kim et al. 2014) as the instrumental variables. The coefficients of ESG remain positively significant, indicating that our results do not qualitatively change after addressing endogeneity. The proposed effect remains robust across various tests.

We further explore the possible channels between ESG spending and bond return volatility. Bond investors may be concerned about the motivation for firms' ESG investments in the presence of managerial risk-taking, measured using CEO risk-taking incentives (Dunbar et al. 2020), and information asymmetry, measured using analyst coverage and forecasting dispersion (Aouadi and Marsat 2018; Wu et al. 2020). Opportunistic managers can exploit the insurance effect of ESG to cover risk-taking behaviors. Moreover, the information asymmetry associated with the costs and benefits of ESG further encourages manager opportunism (Orlitzky 2013), resulting in greater bond volatility. Our empirical evidence strongly supports the expectation that the positive relationship between ESG performance and bond volatility is more significant for firms with greater managerial risk-taking and information asymmetry.

Our contribution to the literature is twofold. First, we provide novel evidence on secondary credit market reactions to firms' ESG engagement. Previous studies on ESG and corporate bonds have mainly focused on credit ratings or yield spreads to measure firms' credit risk (Gillan et al. 2021). Second, we establish a robust economic connection between ESG performance and corporate bond–return volatility. From a volatility standpoint, this finding complements the corporate bond pricing effects of ESG. Second, our study contributes to the existing literature on asymmetric reactions to ESG strengths and concerns. We document that the increased bond volatility is primarily from ESG strengths instead of

concerns. Our findings align with Krüger (2015), which provides evidence suggesting that equity investors generally respond negatively to improvements in ESG strengths.

The remainder of this study is organized as follows. We review the relevant literature and develop the hypotheses in section2. We introduce the data and present the sample statistics in section 3. Section 4 presents the empirical results of the baseline specifications and various robustness checks. We examine the conditional effects of ESG on bond volatility in section 5. Finally, section 6 concludes the study.

2 Related Literature and Hypotheses Development

2.1 Literature of ESG and Corporate Bond

ESG research has extensively examined the effects of ESG performance on the equity market. Recent studies have consistently documented environmental risk premiums in the equity market. This premium is largely exogenous and determined by a firm's industry. Investors recognize environmental regulatory uncertainty as a significant risk factor because such policy outcomes affect firm sustainability. Consequently, investors require higher returns in exchange for greater exposure to environmental risk (Bolton and Kacperczyk 2021; Hsu et al. 2023; Ilhan et al. 2021; Sautner et al. 2023). How the stock market reacts to firms' discretionary ESG engagements remains debatable, and the literature is far from reaching a consensus (Gillan et al. 2021).

Limited research exists on the effects of ESG performance on the secondary corporate bond market. Empirical evidence supports the argument that better ESG performance improves credit ratings. Attig et al. (2013) and Jiraporn et al. (2014) use the MSCI ESG KLD database to show that rating agencies reward firms' ESG investments with favorable ratings. They have concluded that a higher degree of ESG performance leads to better credit ratings. Christoph et al. (2015) study Eurozone corporate bonds and find that ESG performance is rewarded with favorable (penalized with unfavorable) bond ratings in countries whose ESG

ratings are above (below) average.

The literature consistently shows that creditors charge the yield spread for socially irresponsible firms (or firms with ESG concerns) whose businesses are severely impaired by legal or regulatory requirements (Hong and Liskovich 2015; Seltzer et al. 2022). Chava (2014) and Goss and Roberts (2011) find that firms with social responsibility concerns suffer higher debt financing costs. Seltzer et al. (2022) uses both third-party ESG rating scores and firms' carbon emissions to measure firms' environmental performance. They document that poor environmental performance raises credit rating analysts' and bond investors' concerns regarding potential regulatory costs, leading to unfavorable credit ratings and a higher bond yield spread.

Socially responsible firms are not necessarily rewarded with lower bond yields. Goss and Roberts (2011) show that ESG investments, measured based on ESG strengths, of low-quality (high-quality) borrowers are associated with higher (lower) loan spreads. Chava (2014) find that equity and debt capital costs are not lower for firms with environmental strengths. Recent empirical evidence from green bonds shows no significant "greenium" in green bond pricing, suggesting few pro-environmental preferences among bond investors (Zerbib 2019; Larcker and Watts 2020).

The heterogeneous effects of ESG concerns and strengths on bond yields are consistent with the documented heterogeneous equity market reactions to positive and negative ESG news. (Aouadi and Marsat 2018; Capelle-Blancard and Petit 2019; Krüger 2015). Adverse ESG events have a huge negative impact on stock investors. However, they may be concerned about the agency cost of ESG investment (Bénabou and Tirole 2010; Cheng et al. 2013; Cai et al. 2020; Krüger 2015; Masulis and Reza 2015; Shohfi and White 2020), and positively react only to positive ESG events conditional on firms' visibility and information transparency (Aouadi and Marsat 2018; Capelle-Blancard and Petit 2019). The heterogeneous effects reflect that financial market participants penalize irresponsible firms because of legal or regulatory risk exposure but are unwilling to support corporate goodness at their

own cost (Harjoto and Jo 2015). Becchetti et al. (2013) show that ESG strengths are associated with greater analyst earnings forecast errors. Becchetti et al. (2015) show that ESG positively correlates with stock idiosyncratic volatility because it reduces earnings predictability. Harjoto and Jo (2015) disaggregate ESG into legal and normative ESG and find that normative ESG increases analyst dispersion and stock return volatility.

Investors' attitudes toward firms' ESG performance differ according to their investment horizons. Justifying ESG engagements requires a long-term perspective (Graves and Waddock 1994; Johnson and Greening 1999) because firms' ESG performance helps mitigate legal or regulatory risk and builds a reputation in the long run (Deng et al. 2013; Hong and Liskovich 2015; Kim et al. 2019; Sharfman and Fernando 2008). Long-term investors monitor a firm and pursue ESG performance, which benefits the firm in the long run. Conversely, short-term investors regard ESG expenditure as a cost (Gloßner 2019; Kim et al. 2019).

2.2 Hypothesis Development

Based on bond investors' preferences, this study proposes that there is a link between ESG performance and bond return volatility. Bondholders place greater emphasis on a firm's current debt service capacity than on long-term profitability and are more (less) sensitive to downside risk (upside potential) (Bai et al. 2019). Although bond investors have consistently regarded corporate social irresponsibility as a risk, as reflected in bond prices (yield) and ratings (Chava 2014; Seltzer et al. 2022), they are not necessarily willing to finance firms' ESG engagement at the cost of their own wealth (Goss and Roberts 2011; Larcker and Watts 2020). Firms' ESG performance suggests a deviation in profit maximization operating targets, which may distort capital allocation efficiency (Bhandari and Javakhadze 2017) and reduce firms' operating flexibility in responding to adverse productivity shocks (Becchetti et al. 2015). Firms may not recover their ESG expenditures through increased sales (Di Giuli and Kostovetsky 2014). ESG investments beyond legal or regulatory requirements can lead to greater earnings unpredictability and stock volatility (Becchetti et al. 2013; Becchetti

et al. 2015; Harjoto and Jo 2015). We argue that higher ESG performance is associated with greater uncertainty for bondholders, resulting in higher corporate bond volatility. Our main hypothesis is as follows:

Hypothesis 1 (Main Hypothesis)**.** *Firms with higher ESG performance scores tend to have higher corporate bond volatility.*

ESG concerns reflect a firm's compliance with industry standards, which are primarily exogenous and related to legal and regulatory risk (Goss and Roberts 2011; Becchetti et al. 2013). Bond investors agree to penalize ESG concerns, especially environmental concerns, with greater yields and worse ratings. However, ESG strengths indicate firms' discretionary investments to improve ESG performance (Becchetti et al. 2015), which bondholders may not reward because they are less sensitive to the potential benefits of ESG strengths. Moreover, prior literature shows evidence of asymmetric reactions of market participants to ESG strengths and concerns. According to Krüger (2015), stock market participants respond positively only when firms address ESG concerns but negatively to positive news about ESG strengths, which is likely attributed to agency problems. We expect the increase in bond return volatility to be driven by ESG strengths instead of concerns.

ESG investments primarily benefit long-term institutional shareholders who can monitor managers and benefit from ESG performance in the long run (Gloßner 2019; Kim et al. 2019). However, debt financing has been documented to improve ESG performance (Attig 2023), and ESG firms prefer to finance capital expenditures with short-term bonds (Benlemlih 2017). Holders of short-term bonds may be concerned about unnecessary ESG investments, resulting in greater bond volatility.

Overall, we expect the positive relationship between ESG and bond volatility to focus on ESG strength and short-term bonds after controlling for credit ratings, as stated in the following two testable implications of Hypothesis 1:

Hypothesis 1a. *ESG strengths are positively associated with bond volatility, and ESG concerns insignificantly impact corporate bond volatility.*

Hypothesis 1b. *The positive relationship between ESG and bond volatility is more pronounced for short-term bonds.*

Bondholders may be concerned about the motivation of firms' ESG engagement because opportunistic managers could exploit the risk-mitigating effects of ESG to cover risk-taking behaviors. Sharfman and Fernando (2008) argue that firms investing in environmental risk management have higher leverage levels and reap more tax benefits. Dunbar et al. (2020) find that shareholders of firms with better ESG scores encourage CEOs to pursue risky projects because ESG reduces the firm's "left-tail" risk. CEO risk-taking incentives (measured using stock option Vega) are associated with greater firm risk and stock volatility (Armstrong and Vashishtha 2012; Coles et al. 2006; Chava and Purnanandam 2010; Shue and Townsend 2017). From a credit market perspective, risk-taking incentives are positively associated with default risk, resulting in worse credit ratings (Kuang and Qin 2013). Combining these findings, we propose that ESG standing allows for higher managerial risk-taking, as measured by the stock option Vega, and leads to higher bond volatility.

Hypothesis 2 (Risk-taking Channel)**.** *The positive association between ESG and bond volatility is more pronounced for firms with greater managerial risk-taking.*

Bondholders are concerned that firms may blindly increase ESG at the cost of the firm's resources, suggesting an agency cost problem for ESG engagement (Krüger 2015). Higher information asymmetry regarding ESG costs and benefits could encourage managers' opportunism and result in higher analyst dispersion, earnings unpredictability, noise trading, and stock volatility (Aouadi and Marsat 2018; Dhaliwal et al. 2011; Harjoto and Jo 2015; Orlitzky 2013; Wu et al. 2020). ESG investment by firms with more information asymmetry raises concerns among bondholders. Thus, the following hypothesis is based on the firm's information environment:

Hypothesis 3 (Information Asymmetry Channel)**.** *The positive association between ESG and corporate bond volatility is more pronounced for firms with higher information asymme-*

try.

3 Data and Descriptive Statistics

3.1 Corporate Social Performance

We retrieved ESG information from the MSCI ESG KLD dataset. MSCI ESG quantifies US-listed and international firms' ESG based on seven categories and six exclusionary screens.[3] We follow the extant literature (Chatterji et al. 2009; Kim et al. 2014; Kim et al. 2012) and compute the ESG for US-listed firms based on the following six categories: community, diversity, employee relations, environment, and product. The exclusion of human rights follows Kim et al. (2012) and Kim et al. (2014). The net ESG score is calculated as follows:

$$\text{Net ESG Score}_{i,t} = \sum_{j=1}^{6} \text{Strengths}_{i,j,t} - \sum_{j=1}^{6} \text{Concerns}_{i,j,t}, \tag{1}$$

where $j = 1, 2, \ldots, 6$ represents six ESG qualitative categories, and $\text{Net ESG Score}_{i,t}$ is the relative measure of firm i's ESG performance for year t. We exclude highly regulated industries from the sample, including finance (SIC codes 6000-6799) and utility (SIC codes 4900-4999). For each ESG category, the MSCI ESG provides numerical strength and concern ratings (positive values) for companies based on predetermined criteria. The final net ESG score, following the definition adopted by Becchetti et al. (2015), is calculated as the net of total strengths and concerns (i.e., the sum of positive ratings minus the sum of negative ratings). The sample period is from 2002 to 2018, with a minimum ESG value of −10 and a maximum ESG value of 18.

One may argue that the net ESG score is exposed to methodological inconsistencies and time-varying social behaviors. We propose an alternative measure of corporate social

[3]The seven categories are community, corporate governance, diversity, employee relations, environment, human rights, and products. The six exclusionary screens are alcohol, gambling, firearms, military, nuclear power, and tobacco.

behavior by considering the ratio of the net ESG score, as defined in Eq. (1) and the maximum absolute value of the net ESG scores for the year. Therefore,

$$\text{Scaled ESG Score}_{i,t} = \frac{\text{Net ESG Score}_{i,t}}{\max |\text{Net ESG Score}_t|}, \tag{2}$$

where Net ESG Score$_t$ is the net score in year t. By normalizing the net ESG score, we obtain a scaled ESG score in the range $[-1, 1]$ every year. Accordingly, we aim to minimize the noise from inconsistent ESG measures from year to year. Moreover, the estimated results are less biased by the time-varying nature of corporate social behavior.

Additionally, we construct an alternative ESG measure by transforming the net ESG counts into Fama-French 48-industry classification-based relative ESG scores, following Kim et al. (2014):

$$\text{Industry-scaled ESG}_{i,t} = \frac{ESG_{i,t} - \min ESG_{I,t}}{\max ESG_{I,t} - \min ESG_{I,t}}, \tag{3}$$

where I represents the industry to which firm i belongs. The measures min $ESG_{I,t}$ and max $ESG_{I,t}$ are the minimum and maximum values of the net ESG scores of firms in industry I and year t, respectively. $ESG_{i,t}$ in Eq. (3) is the net ESG score calculated in Eq. (1). After scaling, the ESG ratings range between 0 and 1 for firms in each industry.[4] Both ESG measures are constructed on an annual basis. This transformation eliminates bias in ESG scores associated with industry-specific engagement in social activities (Cai et al. 2011).

3.2 Bond Returns and Volatility

We calculate annualized corporate bond volatility using monthly corporate bond returns. Bond return is the simple return from the "dirty price" of the bond. The dirty price is decomposed into clean price, accrued interest, and coupon payment. We compute a volume-weighted market price for each bond using intra-day transaction-level data from FINRA's

[4]Alternatively, subtract the average ESG score from the numerator in Eq. (3). The choice of minimum or average ESG score for an industry does not alter the conclusions drawn from the main regressions.

TRACE database.[5] The TRACE dataset and corresponding data processing approach are widely used in the corporate bond return literature, for example, Bessembinder et al. (2006), Bessembinder et al. (2009), Bao and Pan (2013) and Bai et al. (2019).

We further filtered the TRACE dataset following a procedure from Bao and Pan (2013) and Bai et al. (2019). To be specific, we:

- Remove bonds that are not traded in the US market or in US dollars;
- Remove exotic bond types such as structured notes, floating-rate bonds, convertible bonds, and asset-backed, mortgage-backed, or agency-backed bonds;
- Remove bonds that trade under $5 or above $1000;
- Remove bonds with a time-to-maturity of less than one year.

We retain all remaining transactions but exclude canceled records and transactions with a trading volume of less than $10,000. If a trading day has transaction records from the Enhanced TRACE and Standard datasets, we prioritize the Enhanced TRACE dataset and compute the clean market price of each bond using only the Enhanced TRACE data for the day. The enhanced data incorporate uncapped transaction volumes as the most significant enhancement over the standard data. We use five volume-weighted final trades for each month to compute the clean market price of the bond, $P_{i,t}$. The monthly corporate bond return at time t is calculated as follows:

$$r_{i,t} = \frac{P_{i,t} + AI_{i,t} + C_{i,t}}{P_{i,t-1} + AI_{i,t-1}} - 1, \tag{4}$$

where $AI_{i,t}$ is the accrued interest since the last coupon payment and $C_{i,t}$ is the coupon payment, if any, of bond i in month t. The accrued interest and coupon payments are

[5]Formed in 2007, the Financial Industry Regulatory Authority (FINRA) is a non-governmental regulator of the securities industry. The TRACE database contains OTC corporate bond market real-time transaction-level price data. The establishment of the TRACE data set improved the transparency of the OTC corporate bond market. The TRACE data set was created in July 2002. TRACE consolidates the transaction-level data for all eligible corporate bonds, including investment grade (IG), high yield (HY), and convertible debt, for over 30,000 securities.

from the Mergent FISD data set, whose bond information includes coupon rates, coupon frequency, and first/last payment dates. The day-conversion information is also retrieved from the FISD, and most corporate bonds follow the 30/360 convention. The bond volatility for the sample period is estimated by calculating the standard deviation of the monthly bond return, which is then converted into annualized volatility. This volatility serves as the main dependent variable in the following regression analysis.

3.3 Bond Illiquidity and Other Controls

3.3.1 Bond Illiquidity Proxy

Bao and Pan (2013) document the relationship between empirical bond volatility and bond illiquidity. To examine the marginal contribution of ESG to bond volatility, it is important to control for bond illiquidity. We construct a series of illiquidity variables at the bond level to serve as controls. Dick-Nielsen et al. (2012) argue that there is no clear consensus on assessing a bond's illiquidity. Therefore, we analyze several illiquidity-related measures for corporate bonds based on the literature. Following Chen et al. (2007), we collect bid-ask quotes from Bloomberg.[6] The bid-ask spread measure is specified as follows:

$$\text{B/A Spread} = \frac{\text{Ask} - \text{Bid}}{\text{Mid Price}}, \tag{5}$$

where *Mid Price* is the average of the bid and ask prices for the quote. There are no daily bid-ask quotes for every bond, and missing data are common in corporate bond quotes. We use the monthly average to include as many bonds as possible. The B/A Spread for each period is computed as the mean monthly average.

Following Dick-Nielsen et al. (2012), we include the Amihud measure, defined as the price impact per unit of traded (Amihud 2002), as another bond illiquidity control. This measure is constructed as the monthly average of absolute returns r_j divided by the trade size Q_j

[6]The bid-ask quotes from Bloomberg are the Bloomberg Generic Quotes, which reflect the consensus quotes among market participants.

from consecutive transactions j:

$$Amihud_t = \frac{1}{N} \sum_{j=1}^{N_t} \frac{\overline{r_j}}{Q_j} = \frac{1}{N} \sum_{j=1}^{N_t} \frac{\left| \frac{P_j - P_{j-1}}{P_{j-1}} \right|}{Q_j}, \quad (6)$$

where N_t is the number of returns on day t. Next, we define the Amihud measure as the mean of daily measures for each period. We include the bond amount outstanding (Houweling et al. 2005), time-to-maturity, and bond credit rating (Bao and Pan 2013) as bond characteristic variables. We use the bond B/A spread and Amihud measure as the main bond illiquidity proxies in the baseline regressions to keep the model parsimonious.

3.3.2 Firm Fundamental Controls

At the firm level, we construct a series of firm fundamental variables that have been shown to affect default risk, and thus, bond volatility. Following Campbell et al. (2008) and Subrahmanyam et al. (2014), we control for leverage ratio, net income over assets, firm size (logarithm of total assets), sales level, and retained earnings. These firm fundamentals are calculated using data from Compustat for a specific fiscal year and serve as firm characteristic controls in the baseline regressions. The detailed definitions of the variables are presented in Table 1.

[Insert Table 1 about here]

Apart from the firm fundamentals, we also include financial analyst coverage and institutional ownership to control for the corresponding firm and bond information asymmetry. The literature finds a correlation between analyst behavior, corporate debt costs (Mansi et al. 2011), and ESG activities (Dhaliwal et al. 2012; Muslu et al. 2019). Furthermore, institutional investors influence corporate social activities (Buchanan et al. 2018; Harjoto et al. 2017; Oh et al. 2017) and corporate credit spreads.

3.4 Sample Description

Table 2 summarizes the statistical features of the independent (bond volatility), ESG-related, and control variables for the sample period. For bond volatility (dependent variable), the entire sample has an average annualized volatility of 8.7% with an 8.1% standard deviation. Annually, 90% of bond volatility ranges from 1.5% to 23.0%.

The financial crisis (2007-2009) involved higher systematic risk, resulting in lower bond returns and volatility. In the test sample, excluding crisis years, we obtain a bond sample with 7.8% annualized bond volatility and a 6.9% standard deviation. Credit ratings are closely associated with a bond's default risk and risk profile. When separating the bond sample into investment grade (IG: BBB+ and above) and high yield (HY: BBB and below), we obtain lower bond volatility (7.9% for IG vs. 12.4% for HY), as expected. The annual volatility of IG bonds is lower than that of HY bonds across all quantiles. The sample comprises 83% IG-rated and 17% HY-rated observations.

[Insert Table 2 about here]

For ESG-related scores reported in the MSCI KLD dataset, 46, 489 records were collected between 2002 and 2018. The mean net ESG score is 0.62, with a standard deviation of 3.31. On average, the sample companies have 3.3 strengths and 2.7 concerns in terms of social performance. When broken down into the six qualitative ESG categories, firms generally have good ESG scores for community (net score mean 0.27) and diversity (net score mean of 0.91), and poor ESG scores for corporate governance (net score mean -0.33) and products (net score mean -0.38). The aggregated net ESG score ranges from -4 to +7 90% of the time.

Panel C of Table 2 presents summary statistics of the control variables. The credit rating has a mean of 8.4 (between BBB+ and BBB) and a median of BBB. The average to-maturity was nine years on average, with a median of approximately six years. For bond illiquidity, the mean bid-ask spread is 0.71%, with a median of 0.52%. Overall, the illiquidity is more severe in corporate bonds than in equity markets. Regarding credit risk, the mean leverage

ratio is 35.2% in the sample, with 90% of firms having leverage ratios between 12.9% and 65.3%.

The pairwise Pearson correlations for the variables are presented in Table 3. The key independent variables, net ESG score, and industry-scaled ESG are all positively correlated with bond volatility. Among other variables, credit rating (numerically), bond illiquidity measures, and the leverage ratio are positively associated with bond volatility. This is consistent with the fact that these variables positively correlate with credit risk and, thus, the bond risk measure (volatility). Profitability measures, sales, retained earnings, and net income scaled by assets negatively correlate with bond volatility. The negative correlation between firm size and bond volatility is consistent with the evidence suggesting that a larger firm reduces default risk.

[Insert Table 3 about here]

4 Effect of ESG on Bond Volatility

In this section, we describe the empirical findings for the relationship between corporate social performance and bond volatility, along with the robustness checks (univariate analysis, different, and sample periods). We separate the strengths and concerns of ESGs to examine their individual effects on corporate debt market uncertainty. We find that the ESG strengths, instead of ESG concerns, drive the increase in bond volatility. We also address the endogeneity issue and verify that the empirical relationship remains valid after considering the common factors for the dependent and independent variables.

4.1 Baseline Regressions

To examine the link between bond volatility and ESG, we start with the following baseline regression specifications.

$$\begin{aligned}\sigma_{i,t} &= \alpha \cdot \mathrm{ESG}_{i,t} + \beta_1 \cdot B_{i,j,t} + \beta_2 \cdot Illiq_{i,j,t} + \beta_3 \cdot Firms_{i,t} \\ &\quad + \gamma_1 \cdot D_i + \gamma_2 \cdot D_t + \epsilon_{i,t}, \end{aligned} \tag{7}$$

where $\sigma_{i,t}$ represents the annualized bond return volatility for bond i in year t. The variable of interest, ESG_i, is either the net ESG score, scaled ESG score, or the industry-scaled ESG score of firm i. Among the included control variables, $B_{i,j,t}$ denotes bond characteristics (S&P rating, amount outstanding, and time to maturity) for bond j, $Illiq_{i,j,t}$ represents bond-level illiquidity control variables (B/A spread and the Amihud measure), $Firms_{i,t}$ represents firm-level fundamental control variables (Sales/Assets, RE/Assets, NI/Assets, leverage, log(Assets)), analyst coverage and institutional ownership. D_i is the firm fixed effect, D_t is the time fixed effect at year level, and ϵ_i is the residual term. Standard errors are clustered at firm-level.

Table 4 presents the results of baseline regressions using the specifications in Eq. (7). The key independent variables are positive with high statistical significance when controlling for bond characteristics and firm fundamentals. The coefficient for the net ESG score is 0.050 (t-statistic = 3.791), indicating an average of 16.5-basis-point increase in annualized bond volatility with a one standard deviation increase in the net ESG score. This corresponds to an average of 1.91% increase in annualized bond volatility (2.13% for the non-crisis period). Therefore, the magnitude of the critical coefficient is economically significant. The reported within-group adjusted R^2 is 0.5305. A similar pattern is observed for the following two dependent variables: the scaled ESG score (0.378, t-statistic = 2.007) and industry-scaled ESG score (0.646, t-statistic = 3.746).

[Insert Table 4 about here]

Among the control variables, the bond rating and illiquidity measures have statistically significant positive coefficients, consistent with the expectation that bond volatility risk is associated with default risk (Bao and Pan 2013). The leverage ratio also has a positively significant coefficient. Profitability measures have negative coefficients. The most significant profitability variable is net income over total assets. Apart from these variables, time-to-maturity is positively related to bond volatility, which declines with the firm size and amount outstanding of the bond. Bond volatility decreases with institutional investor ownership. The direction of the control variables is consistent with that suggested in the literature on bond volatility (Bao and Pan 2013) [7].

4.2 Strengths vs. Concerns

We propose that the positive relationship between ESG and bond volatility reflects bond-holders' concerns regarding a firm's discretionary ESG investment, which could be measured using ESG strength (Becchetti et al. 2013). We separate the relative ESG scores in the baseline regressions into ESG strengths and concerns. Next, we estimate their conditional contributions to bond volatility. The separation of ESG strengths and concerns is applied across all three ESG measures (net ESG, scaled ESG, and industry-scale scores). The model specification takes the following form:

$$\begin{aligned} \sigma_{i,t} \quad = \quad & \alpha_1 \cdot \text{ESG Strengths}_{i,t} + \alpha_2 \cdot \text{ESG Concerns}_{i,t} \\ & + \beta_1 \cdot B_{i,j,t} + \beta_2 \cdot Illiq_{i,j,t} + \beta_3 \cdot Firms_{i,t} + \gamma_1 \cdot D_i + \gamma_2 \cdot D_t + \epsilon_{i,t}, \end{aligned} \tag{8}$$

[7] To avoid potential variable selection or collinearity issues leading to biased estimation results, we perform a univariate regression analysis and pair the *net ESG score* with at most one control variable in the baseline regression. The estimation results are shown in Table A1 of the Appendix. When only the net ESG score is included in the regression, the coefficient is 0.056 with a ***t***-statistic of 3.607. When paired with one of the control variables, the coefficient ranges between 0.029 and 0.090 with a statistical significance of at least 5%, corresponding to a 0.1% to 0.3% average increase in annualized bond volatility and a one standard deviation increase in the net ESG score.

where ESG Strengths$_{i,t}$ and ESG Concerns$_{i,t}$ represent the sum of the strengths and concerns related to corporate social performance. We expect α_1 to be significantly positive and α_2 to be insignificant, as in Hypothesis 1a.

The breakdown of ESG strengths and concerns in Table 5 indicates that ESG strengths significantly increase bond volatility, whereas ESG concerns do not. In the regression with bond characteristics and firm fundamentals, the coefficient of ESG strength is statistically significant with a magnitude of 0.062 (t-statistic=2.591), compared with the insignificant ESG concern coefficient of -0.061. Similarly, when scaled ESG or industry-scaled ESG scores are used, *ESG Strengths* have positively significant coefficients. The *ESG Concerns* have insignificant coefficients with firm and bond control variables included. We conclude that ESG strengths, and not ESG concerns, raise bond volatility.

[Insert Table 5 about here]

4.3 Short-term vs. Long-term Bonds

We conduct a further investigation to determine whether the positive relationship between ESG and bond volatility primarily applies to short-term or long-term bonds. We separate the full sample by median time-to-maturity (5.79 years). Table 6 shows the conditional effect of ESG on groups with shorter versus longer time-to-maturity periods. The coefficient of the net ESG score is 0.068 (t-statistic = 4.40) for the short time-to-maturity group and 0.029 (t-statistic = 1.46) for the long time-to-maturity group. The average time-to-maturity is 2.80 (15.34) years in the short (long) time-to-maturity groups.

[Insert Table 6 about here]

We conclude that the positive relationship between ESG and bond volatility is mainly driven by short-term bonds, suggesting that short-term bondholders do not appreciate firms' ESG investments.

4.4 Robustness: Financial Crisis

During the subprime financial crisis, firms experienced a systematic economic shock and asset prices were more volatile than in other periods. Therefore, the financial crisis may have caused a simultaneous reduction in ESG expenditures and increased bond volatility. Therefore, we exclude the period of the financial crisis (2007–09) from the full sample period (2002–18). Table A2 in the Appendix reports the estimation outcomes after excluding the financial crisis observations. The sample size is reduced by around 14%. However, the coefficients of the ESG variables remain positive with high statistical significance. For example, the magnitude of the *net ESG score* is 0.068, excluding the crisis period, compared with 0.050 for the full sample.

Overall, the effect of ESG on bond volatility is robust to univariate analysis, full control variables, and an alternative sample period. Therefore, our empirical results support the main hypothesis that corporate social performance increases bond volatility.

4.5 Addressing Endogeneity

We also investigate the potential endogeneity between corporate social behavior and bond volatility using a 2SLS approach. For the selection of an exogenous instrumental variable (IV), we follow the literature and select the "blue state" dummy (Albuquerque et al. 2019; Di Giuli and Kostovetsky 2014; Dunbar et al. 2020; Hong and Kostovetsky 2012). This IV takes the value of one when the headquarters is located in a democratic state during the observation period. This variable is highly exogenous to the dependent variable, whereas firms in democratic states tend to be socially responsible. The first-stage regression has the following specifications:

$$\text{ESG Score}_{i,t} = \alpha + \beta \cdot \text{Blue State Dummy}_{j,t} + \text{Controls}_{i,t} + \epsilon_{i,t}, \quad (9)$$

where Blue State Dummy$_{j,t}$ is the Democratic state dummy (Blue State Dummy$_{j,t}$ = 1 when firm i is headquartered in the Democratic state j in year t). The first three columns in Table 7 present the second-stage regressions of the IV results. The coefficients of the instrumented ESG variables remain statistically significant with reasonable magnitudes and expected signs. For instance, the instrumented *net ESG score* has a coefficient of 0.019 with a t-statistic of 2.864.

[Insert Table 7 about here]

Second, the ESG variables are instrumented by the average industry (Fama-French 48-industry classification) ESG scores. The selection of this instrumental variable follows the practices from related literature (Bardos et al. 2020; El Ghoul et al. 2011; Kim et al. 2014). Using the industry-averaged ESG score, we attempt to establish whether the bond market reacts to social performance tendencies (e.g., response to regulatory requirements) within an industry. The first-stage estimation is based on the following equation:

$$\text{ESG Score}_{i,t} = \alpha + \beta \cdot \text{Averaged Industry ESG Score}_{i,t} + \text{Controls}_{i,t} + \epsilon_{i,t}, \quad (10)$$

where ESG Score$_{i,t}$ represents either the net or industry-scaled ESG score. The last three columns of Table 7 present the estimation results. Corporate social performance remains statistically and economically significant after being instrumented by industry-averaged social performance. The leverage ratio also becomes statistically significant, indicating that idiosyncratic credit risk emerges after controlling for industry-wide social performance.

Additionally, we consider whether our results are driven by bond ratings. Attig et al. (2013) show that ESG performance benefits a firm's bond ratings. In an unreported analysis, we controlled for the residual value of credit ratings and found that our inferences remained robust. Moreover, to address potential selection bias (e.g., only a small fraction of firms on Compustat issue bonds), we apply the Heckman-type correction to the full Compustat sample and control for the inverse Mills ratio. We obtain similar quantitative results.

Overall, our evidence strongly supports a robust positive relationship between ESG and bond volatility, driven by ESG strengths, which measure firms' investments in improving their ESG performance.

5 Channels and Mechanisms

In this section, we consider and examine the channels and mechanisms through which corporate social performance affects bond market uncertainty.

5.1 Managerial Risk-Taking

We conjecture that the ESG performance of firms with greater managerial risk-taking raises bondholders' concerns, resulting in greater bond volatility. We use the CEO Vega[8], the sensitivity of wealth with respect to stock return volatility (Coles et al. 2006; Shue and Townsend 2017), to proxy managerial risk-taking. Accordingly, we conduct a subsample analysis to validate Hypothesis 2.

Table 8 presents the conditional effect of ESG on bond volatility given the asymmetric CEO risk-taking incentives in the different subsamples. The results clearly indicate that the proposed effect is more significant in the sample of firms with higher *CEO Vega*, in terms of coefficient magnitude and statistical significance. For instance, the coefficient of *net ESG score* in the high CEO Vega group is 0.074 (with t-statistic=3.375), which is much higher than the corresponding coefficient of -0.010 (with t-statistic=-0.604) in the low CEO Vega group. The estimated coefficients for *scaled ESG score* and *industry scaled ESG score* show the same pattern. Our finding is consistent with that of Chava and Purnanandam (2010) and extends the literature by showing that the CEO Vega is an important channel for explaining the higher bond volatility observed for highly socially responsible firms.

[Insert Table 8 about here]

[8]We retrieve the CEO Vega data from https://sites.temple.edu/lnaveen/data/.

Overall, we document empirical evidence that strongly supports our conjecture that bondholders are concerned about the ESG performance of risk-taking managerial firms, as in Hypothesis 2.

5.2 Information Asymmetry

Bondholders raise more concerns about ESG investments when there is high information asymmetry, which could encourage managerial opportunism (Harjoto and Jo 2015; Orlitzky 2013). Following the literature, we use analysts' forecasting dispersion and coverage as proxies for information asymmetry. We hypothesize that the effect of ESG on bond volatility is more pronounced for firms with high information asymmetry (greater analyst forecasting dispersion and lower analyst coverage) and conduct a subsample analysis.

[Insert Table 9 about here]

Table 9 presents the estimation results of the subsample analysis conditional on information asymmetry. As shown in Panel A of Table 9, the net ESG score coefficient for firms with high analyst dispersion has a magnitude of 0.040 (t-statistic = 2.648), compared with the low analyst dispersion coefficient of 0.030. Regarding analyst coverage, the net ESG score coefficient for firms with low coverage is 0.062 (t-statistic = 3.595), compared with the high coverage coefficient of 0.046 (t-statistic = 2.142).

Overall, the empirical results show that the positive relationship between ESG and bond volatility is economically and statistically more significant for firms with greater information asymmetry, (i.e., higher analyst forecasting dispersion and low analyst coverage), supporting Hypothesis 3.

6 Conclusion

This study investigates whether active corporate social performance affects corporate bond volatility. Our results confirm that firms' ESG performance is positively associated with

bond volatility and that this positive relationship is driven by ESG strengths. The positive impact on bond volatility is predominantly concentrated on short-term bonds. Using the Democratic state dummy and average industry ESG level, we validate the proposed effect through instrumental variable analysis. We further examine the channels and mechanisms of the connection between ESG behaviors and corporate bond volatility and show that bondholders are more concerned about firms' motivation to engage in ESG in the presence of managerial risk-taking and information asymmetry, resulting in greater bond volatility.

Our results suggest that bondholders, especially short-term bondholders, do not appreciate firms' ESG performance beyond legal or regulatory requirements, especially in the presence of managerial risk-taking and information asymmetry. An important practical implication of our findings is the potential conflict of interest between bondholders and corporations as social entities. Thus, commitment to a larger group of stakeholders, such as communities, employees, and the environment, may deviate from the bondholders' goals.

References

Albuquerque, R., Koskinen, Y., and Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science* 65(10), 4451–4469.

Amihud, Y. (2002). Illiquidity and stock returns: cross-section and time-series effects. *Journal of Financial Markets* 5(1), 31–56.

Aouadi, A. and Marsat, S. (2018). Do ESG controversies matter for firm value? Evidence from international data. *Journal of Business Ethics* 151, 1027–1047.

Armstrong, C. S. and Vashishtha, R. (2012). Executive stock options, differential risk-taking incentives, and firm value. *Journal of Financial Economics* 104(1), 70–88.

Attig, N. (2023). Relaxed Financial Constraints and Corporate Social Responsibility. *Journal of Business Ethics*, 1–21.

Attig, N., El Ghoul, S., Guedhami, O., and Suh, J. (2013). Corporate social responsibility and credit ratings. *Journal of Business Ethics* 117(4), 679–694.

Bai, J., Bali, T. G., and Wen, Q. (2019). Common risk factors in the cross-section of corporate bond returns. *Journal of Financial Economics* 131(3), 619–642.

Bao, J. and Pan, J. (2013). Bond illiquidity and excess volatility. *Review of Financial Studies* 26(12), 3068–3103.

Bardos, K. S., Ertugrul, M., and Gao, L. S. (2020). Corporate social responsibility, product market perception, and firm value. *Journal of Corporate Finance* 62, 101588.

Becchetti, L., Ciciretti, R., and Giovannelli, A. (2013). Corporate social responsibility and earnings forecasting unbiasedness. *Journal of Banking and Finance* 37(9), 3654–3668.

Becchetti, L., Ciciretti, R., and Hasan, I. (2015). Corporate social responsibility, stakeholder risk, and idiosyncratic volatility. *Journal of Corporate Finance* 35(1), 297–309.

Becchetti, L., Solferino, N., and Tessitore, M. E. (2016). Corporate social responsibility and profit volatility: Theory and empirical evidence. *Industrial and Corporate Change* 25(1), 49–89.

Bénabou, R. and Tirole, J. (2010). Individual and corporate social responsibility. *Economica* 77(305), 1–19.

Benlemlih, M. (2017). Corporate social responsibility and firm debt maturity. *Journal of Business Ethics* 144(3), 491–517.

Bessembinder, H., Kahle, K. M., Maxwell, W. F., and Xu, D. (2009). Measuring abnormal bond performance. *Review of Financial Studies* 22(10), 4219–4258.

Bessembinder, H., Maxwell, W., and Venkataraman, K. (2006). Market transparency, liquidity externalities, and institutional trading costs in corporate bonds. *Journal of Financial Economics* 82(2), 251–288.

Bhandari, A. and Javakhadze, D. (2017). Corporate social responsibility and capital allocation efficiency. *Journal of Corporate Finance* 43, 354–377.

Bolton, P. and Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics* 142(2), 517–549.

Buchanan, B., Cao, C. X., and Chen, C. (2018). Corporate social responsibility, firm value, and influential institutional ownership. *Journal of Corporate Finance* 52, 73–95.

Cai, X., Gao, N., Garrett, I., and Xu, Y. (2020). Are CEOs judged on their companies' social reputation? *Journal of Corporate Finance* 64, 101621.

Cai, Y., Jo, H., and Pan, C. (2011). Vice or virtue? The impact of corporate social responsibility on executive compensation. *Journal of Business Ethics* 104(2), 159–173.

Campbell, J. Y., Hilscher, J., and Szilagyi, J. (2008). In search of distress risk. *Journal of Finance* 63(6), 2899–2939.

Capelle-Blancard, G. and Petit, A. (2019). Every little helps? ESG news and stock market reaction. *Journal of Business Ethics* 157, 543–565.

Chatterji, A. K., Levine, D. I., and Toffel, M. W. (2009). How well do social ratings actually measure corporate social responsibility? *Journal of Economics and Management Strategy* 18(1), 125–169.

Chava, S. (2014). Environmental externalities and cost of capital. *Management Science* 60(9), 2223–2247.

Chava, S. and Purnanandam, A. (2010). CEOs versus CFOs: Incentives and corporate policies. *Journal of Financial Economics* 97(2), 263–278.

Chen, L., Lesmond, D. A., and Wei, J. (2007). Corporate yield spreads and bond liquidity. *Journal of Finance* 62(1), 119–149.

Cheng, H., Hong, H., and Shue, K. (2013). Do managers do good with other people's money? *Working paper*.

Christoph, S., Christian, K., and Bernhard, Z. (2015). Corporate social responsibility and Eurozone corporate bonds: The moderating role of country sustainability. *Journal of Banking and Finance* 59, 538–549.

Coles, J. L., Daniel, N. D., and Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics* 79(2), 431–468.

Deng, X., Kang, J.-k., and Low, B. S. (2013). Corporate social responsibility and stakeholder value maximization: Evidence from mergers. *Journal of Financial Economics* 110(1), 87–109.

Dhaliwal, D. S., Li, O. Z., Tsang, A., and Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The accounting review* 86(1), 59–100.

Dhaliwal, D. S., Radhakrishnan, S., Tsang, A., and Yang, Y. G. (2012). Nonfinancial disclosure and analyst forecast accuracy: International evidence on corporate social responsibility disclosure. *Accounting Review* 87(3), 723–759.

Di Giuli, A. and Kostovetsky, L. (2014). Are red or blue companies more likely to go green? Politics and corporate social responsibility. *Journal of Financial Economics* 111(1), 158–180.

Dick-Nielsen, J., Feldhütter, P., and Lando, D. (2012). Corporate bond liquidity before and after the onset of the subprime crisis. *Journal of Financial Economics* 103(3), 471–492.

Duan, T., Li, F. W., and Wen, Q. (2021). Is carbon risk priced in the cross-section of corporate bond returns? *Working Paper*.

Dunbar, C., Li, Z. F., and Shi, Y. (2020). CEO risk-taking incentives and corporate social responsibility. *Journal of Corporate Finance* 64, 101714.

El Ghoul, S., Guedhami, O., Kwok, C. C., and Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking and Finance* 35(9), 2388–2406.

Gillan, S. L., Koch, A., and Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance* 66, 101889.

Gloßner, S. (2019). Investor horizons, long-term blockholders, and corporate social responsibility. *Journal of Banking and Finance* 103, 78–97.

Godfrey, P. C. (2005). The relationship between corporate philanthropy and shareholder wealth: A risk management perspective. *Academy of Management Review* 30(4), 777–798.

Goss, A. and Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking and Finance* 35(7), 1794–1810.

Graves, S. B. and Waddock, S. A. (1994). Institutional owners and corporate social performance. *Academy of Management journal* 37(4), 1034–1046.

Harjoto, M., Jo, H., and Kim, Y. (2017). Is institutional ownership related to corporate social responsibility? The nonlinear relation and its implication for stock return volatility. *Journal of Business Ethics* 146(1), 77–109.

Harjoto, M. A. and Jo, H. (2015). Legal vs. normative CSR: Differential impact on analyst dispersion, stock return volatility, cost of capital, and firm value. *Journal of Business Ethics* 128(1), 1–20.

Hong, H. and Kostovetsky, L. (2012). Red and blue investing: Values and finance. *Journal of Financial Economics* 103(1), 1–19.

Hong, H. and Liskovich, I. (2015). Crime, punishment and the halo effect of corporate social responsibility. *Working paper*.

Houweling, P., Mentink, A., and Vorst, T. (2005). Comparing possible proxies of corporate bond liquidity. *Journal of Banking and Finance* 29(6), 1331–1358.

Hsu, P.-h., Li, K., and Tsou, C.-y. (2023). The pollution premium. *Journal of Finance* 78(3), 1343–1392.

Huynh, T. D. and Xia, Y. (2021). Climate change news risk and corporate bond returns. *Journal of Financial and Quantitative Analysis* 56(6), 1985–2009.

Ilhan, E., Sautner, Z., and Vilkov, G. (2021). Carbon tail risk. *Review of Financial Studies* 34(3), 1540–1571.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3(4), 305–360.

Jiraporn, P., Jiraporn, N., Boeprasert, A., and Chang, K. (2014). Does corporate social responsibility (CSR) improve credit ratings? Evidence from geographic identification. *Financial Management* 43(3), 505–531.

Johnson, R. A. and Greening, D. W. (1999). The effects of corporate governance and institutional ownership types on corporate social performance. *Academy of Management Journal* 42(5), 564–576.

Kim, H.-D., Kim, T., Kim, Y., and Park, K. (2019). Do long-term institutional investors promote corporate social responsibility activities? *Journal of Banking and Finance* 101, 256–269.

Kim, Y., Li, H., and Li, S. (2014). Corporate social responsibility and stock price crash risk. *Journal of Banking and Finance* 43, 1–13.

Kim, Y., Park, M. S., and Wier, B. (2012). Is earnings quality associated with corporate social responsibility? *Accounting Review* 87(3), 761–796.

Krüger, P. (2015). Corporate goodness and shareholder wealth. *Journal of Financial Economics* 115(2), 304–329.

Kuang, Y. F. and Qin, B. (2013). Credit ratings and CEO risk-taking incentives. *Contemporary Accounting Research* 30(4), 1524–1559.

Larcker, D. F. and Watts, E. M. (2020). Where's the Greenium? *Journal of Accounting and Economics* 69(2-3), 101312.

Mansi, S. A., Maxwell, W. F., and Miller, D. P. (2011). Analyst forecast characteristics and the cost of debt. *Review of Accounting Studies* 16(1), 116–142.

Masulis, R. W. and Reza, S. W. (2015). Agency problems of corporate philanthropy. *Review of Financial Studies* 28(2), 592–636.

Muslu, V., Mutlu, S., Radhakrishnan, S., and Tsang, A. (2019). Corporate social responsibility report narratives and analyst forecast accuracy. *Journal of Business Ethics* 154(4), 1119–1142.

Oh, W.-Y., Cha, J., and Chang, Y. K. (2017). Does ownership structure matter? The effects of insider and institutional ownership on corporate social responsibility. *Journal of Business Ethics* 146(1), 111–124.

Orlitzky, M. (2013). Corporate social responsibility, noise, and stock market volatility. *Academy of Management Perspectives* 27(3), 238–254.

Sautner, Z., Van Lent, L., Vilkov, G., and Zhang, R. (2023). Firm-level climate change exposure. *The Journal of Finance* 78(3), 1449–1498.

Seltzer, L. H., Starks, L., and Zhu, Q. (2022). Climate regulatory risk and corporate bonds. *Working paper*.

Sharfman, M. P. and Fernando, C. S. (2008). Environmental risk management and the cost of capital. *Strategic Management Journal* 29(6), 569–592.

Shohfi, T. D. and White, R. M. (2020). The dark side of individual blockholder philanthropy. *Financial Management* 49(3), 741–767.

Shue, K. and Townsend, R. R. (2017). How do quasi-random option grants affect CEO risk-taking? *Journal of Finance* 72(6), 2551–2588.

Subrahmanyam, M. G., Tang, D. Y., and Wang, S. Q. (2014). Does the tail wag the dog?: The effect of credit default swaps on credit risk. *Review of Financial Studies* 27(10), 2927–2960.

Wu, Y., Zhang, K., and Xie, J. (2020). Bad greenwashing, good greenwashing: Corporate social responsibility and information transparency. *Management Science* 66(7), 3095–3112.

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking and Finance* 98, 39–60.

Table 1: Variable definitions.

Variable	Definition
Bond Vol	Annualized volatility in percentage calculated from monthly bond prices. The bond price consists of the clean market price (volume weighted five last trades in each month), accrued interest and coupon payment.
Net ESG Score	The net of positive corporate social responsibility strengths and negative concerns. Six qualitative categories of ESG include community, corporate governance, diversity, employee relations, environment, and products.
Scaled ESG Score	The *Net SCR Score* scaled by the maximum absolute value of the *Net SCR Score* within the year.
Industry-scaled ESG	The net ESG score standardized using Fama-French 48 industries.
Rating	A numerical translation of S&P rating, where 1=AAA, 2=AA+, . . ., and 21=C.
Amount	Bond face value outstanding in millions.
B/A Spread	The bid-ask spread is defined as the average value of the difference between the ask price and the bid price over the mid-price of the bond.
Amihud	$Amihud_t = \frac{1}{N_t} \sum_{i=1}^{N_t} r_i/Q_i$ where N_t is the number of trades and Q_t is the size of the trade.
Time-to-Maturity	The time to maturity of a bond in years.
Leverage Ratio	Total liabilities divided by total assets.
Sales/Assets	The ratio of sales to total assets, defined as SALE/AT.
RE/Assets	The ratio of retained earnings to total assets, defined as RE/AT.
NI/Assets	The ratio of net income to total assets, defined as NI/AT.
Assets	The natural log of total assets in millions.
IO	The proportion of equity shares held by institutional investors (Thomson Reuters 13-F institutional holding database).
Analyst Coverage	The number of financial analysts covering the EPS estimate of the firm (I/B/E/S).

Table 2: Summary statistics for the U.S. traded bonds and firms.
The summary statistics for bond volatility (Panel A), ESG (Panel B), and control variables (Panel C) used in the empirical analysis. In Panel A, annualized bond volatility is summarized for the full sample, excluding the financial crisis period and according to credit rating groups. Panel B reports the statistics for the ESG-related variable, including net ESG score, industry-scaled ESG, total ESG strengths and concerns, and six qualitative categories. In Panel C, the summary statistics for the control variables are presented. Detailed variable definitions appear in Table 1.

Panel A: Bond Vol	N	Mean	Std. Dev.	5%	25%	50%	75%	95%
Bond Volatility	44,093	8.664	8.148	1.536	4.164	6.488	10.312	23.041
ex. Financial Crisis	38,146	7.777	6.876	1.445	3.973	6.147	9.530	18.520
Investment Grade	36,461	7.886	6.878	1.416	3.881	6.080	9.752	20.143
High Yield	7,632	12.380	11.871	3.475	5.855	8.366	13.575	38.949

Panel B: ESG	N	Mean	Std. Dev.	5%	25%	50%	75%	95%
Net ESG Score	46,489	0.620	3.306	-4.000	0.000	0.000	1.000	7.000
Scaled ESG Score	46,489	0.035	0.244	-0.357	0.000	0.000	0.111	0.500
Industry Scaled ESG	46,489	0.330	0.356	0.000	0.000	0.231	0.600	1.000
Total ESG Strengths	46,489	3.319	4.501	0.000	0.000	1.000	6.000	13.000
Total ESG Concerns	46,489	2.699	3.344	0.000	0.000	1.000	5.000	9.000
Community	46,489	0.272	0.810	-1.000	0.000	0.000	0.000	2.000
Corporate Governance	46,489	-0.329	0.727	-2.000	-1.000	0.000	0.000	1.000
Diversity	46,489	0.908	1.675	-1.000	0.000	0.000	2.000	5.000
Employee	46,489	0.116	1.322	-2.000	0.000	0.000	0.000	3.000
Environment	46,489	0.033	1.213	-2.000	0.000	0.000	0.000	2.000
Product	46,489	-0.380	0.880	-2.000	-1.000	0.000	0.000	1.000

Panel C: Controls	N	Mean	Std. Dev.	5%	25%	50%	75%	95%
Rating	46,109	8.368	3.537	3.000	6.000	8.000	10.000	15.000
log(Amt)	46,489	4.846	2.293	-0.034	3.930	5.306	6.387	7.692
B/A Spread	45,605	0.713	0.665	0.094	0.273	0.521	0.924	2.011
Amihud	45,605	0.392	0.653	0.017	0.076	0.177	0.421	1.459
Maturity	46,489	9.078	10.500	0.300	2.836	5.793	10.127	28.088
Leverage Ratio	46,487	0.352	0.166	0.129	0.232	0.321	0.450	0.653
Sales/Assets	46,489	0.866	0.031	0.229	0.444	0.686	1.085	2.306
RE/Assets	46,333	0.228	0.318	-0.308	0.072	0.236	0.392	0.747
NI/Assets	46,489	0.050	0.059	-0.052	0.023	0.051	0.082	0.145
log(Assets)	46,489	10.093	1.516	7.612	9.014	10.086	11.089	12.575
Analyst Coverage	44,950	3.072	0.538	2.079	2.833	3.135	3.434	3.784
IO	45,901	0.704	0.187	0.364	0.604	0.726	0.834	0.957

Table 3: Correlation matrix.
The pairwise Pearson correlation matrix for a sample of U.S. bond trades from 2002 to 2018 using bond-year panel data. Covariates include bond volatility, net ESG scores, bond rating, bond face value outstanding, bond bid-ask spread, Amihud measure, time-to-maturity, firm leverage ratio, firm sales to total assets ratio, the firm retained earnings over total assets, firm net income over total assets and firm size. Detailed variable definitions are presented in Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Bond Volatility	1.00															
(2) Net ESG Scores	0.11	1.00														
(3) Scaled ESG Scores	0.11	0.97	1.00													
(4) Ind. Scaled ESG	0.12	0.62	0.61	1.00												
(5) Rating	0.24	-0.24	-0.24	-0.15	1.00											
(6) Amount	-0.17	0.03	0.01	-0.13	0.03	1.00										
(7) B/A Spread	0.51	-0.04	-0.04	0.24	0.03	-0.26	1.00									
(8) Amihud	0.44	-0.03	-0.02	0.17	0.03	-0.35	0.63	1.00								
(9) Time-to-Maturity	0.31	0.02	0.01	-0.01	-0.10	-0.01	0.39	0.22	1.00							
(10) Leverage Ratio	0.07	-0.06	-0.06	-0.10	0.33	0.12	-0.06	-0.02	-0.08	1.00						
(11) Sales/Assets	0.00	-0.09	-0.10	-0.05	0.08	-0.03	0.00	-0.01	-0.03	-0.12	1.00					
(12) RE/Assets	-0.21	0.12	0.12	-0.01	-0.50	-0.05	-0.08	-0.08	0.06	-0.36	0.08	1.00				
(13) NI/Assets	-0.28	0.15	0.15	0.00	-0.35	0.00	-0.13	-0.12	0.07	-0.19	0.14	0.46	1.00			
(14) Assets	-0.13	0.22	0.21	0.12	-0.57	0.10	-0.02	0.03	0.09	-0.03	-0.26	0.07	0.03	1.00		
(15) Analyst Coverage	-0.10	0.15	0.14	0.01	-0.36	0.11	-0.04	-0.02	0.12	-0.17	-0.12	0.09	0.12	0.50	1.00	
(16) IO	0.01	-0.10	-0.10	-0.11	0.22	-0.03	-0.03	-0.04	-0.01	-0.11	0.07	0.03	-0.02	-0.39	-0.01	1.00

Table 4: Effect of corporate social performance on bond volatility.
Baseline regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score (1), scaled ESG score (2), and industry-scaled ESG (3). Bond characteristic controls include bond rating, outstanding amount, bid-ask spread, Amihud measure, and time-to-maturity. Firm characteristic controls include leverage ratio, sales over total assets, retained earnings over total assets, net income over total assets, firm size, analyst coverage, and institutional ownership. *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	(1) Net ESG	(2) Scaled ESG	(3) Industry ESG
ESG Score	0.050***	0.378**	0.646***
	[3.791]	[2.007]	[3.746]
Rating	0.476***	0.474***	0.477***
	[9.198]	[9.129]	[9.237]
Amount	-0.148***	-0.148***	-0.147***
	[-4.666]	[-4.651]	[-4.633]
B/A Spread	2.922***	2.924***	2.921***
	[17.644]	[17.649]	[17.639]
Amihud	1.820***	1.819***	1.819***
	[13.295]	[13.296]	[13.289]
Time-to-Maturity	0.198***	0.198***	0.198***
	[21.146]	[21.143]	[21.141]
Leverage Ratio	3.405***	3.396***	3.396***
	[6.938]	[6.908]	[6.913]
Sales/Assets	0.351*	0.350*	0.345*
	[1.702]	[1.694]	[1.668]
RE/Assets	-0.111	-0.122	-0.128
	[-0.315]	[-0.344]	[-0.363]
NI/Assets	-19.986***	-19.959***	-19.977***
	[-18.123]	[-18.086]	[-18.148]
Assets	-0.668***	-0.658***	-0.652***
	[-4.996]	[-4.911]	[-4.885]
Analyst Coverage	0.204	0.209	0.188
	[1.062]	[1.083]	[0.975]
IO	-1.977***	-1.961***	-1.978***
	[-4.894]	[-4.857]	[-4.906]
Intercept	10.745***	10.627***	10.308***
	[6.541]	[6.453]	[6.272]
N	41,821	41,821	41,821
Adj. R^2	0.5305	0.5303	0.5305
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Table 5: Effect of corporate social performance on bond volatility: Strengths and concerns. Baseline regressions for U.S. bonds from 2002 to 2018 using bond-year panel data. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score (1), scaled ESG score (2), and industry-scaled ESG (3), with separation of ESG strengths and concerns. The *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	(1) Net ESG	(2) Scaled ESG	(3) Industry ESG
ESG Strengths	0.062***	1.195***	0.252**
	[2.591]	[3.147]	[1.990]
ESG Concerns	-0.061	-0.857	-0.562
	[-1.050]	[-1.009]	[-1.093]
Rating	0.478***	0.477***	0.475***
	[9.209]	[9.185]	[9.147]
Amount	-0.149***	-0.148***	-0.148***
	[-4.687]	[-4.670]	[-4.672]
B/A Spread	2.930***	2.931***	2.929***
	[17.629]	[17.634]	[17.645]
Amihud	1.821***	1.821***	1.820***
	[13.317]	[13.314]	[13.308]
Time-to-Maturity	0.198***	0.198***	0.198***
	[21.140]	[21.140]	[21.141]
Leverage Ratio	3.499***	3.505***	3.392***
	[7.110]	[7.121]	[6.917]
Sales/Assets	0.372*	0.372*	0.359*
	[1.799]	[1.799]	[1.732]
RE/Assets	-0.149	-0.151	-0.222
	[-0.423]	[-0.429]	[-0.632]
NI/Assets	-19.921***	-19.887***	-19.939***
	[-18.066]	[-18.070]	[-18.118]
Assets	-0.625***	-0.619***	-0.610***
	[-4.549]	[-4.502]	[-4.475]
Analyst Coverage	0.227	0.223	0.234
	[1.175]	[1.155]	[1.215]
IO	-1.950***	-1.947***	-1.950***
	[-4.821]	[-4.817]	[-4.835]
Intercept	10.324***	10.235***	10.264***
	[6.141]	[6.097]	[6.185]
N	41,821	41,821	41,821
Adj. R^2	0.5305	0.5305	0.5304
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes

Table 6: CEffect of corporate social performance on bond volatility: Time-to-Maturity. Regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data, conditioned on time-to-maturity. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score, scaled ESG score, and industry-scaled ESG. The *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	Short Maturity			Long Maturity		
	(1) Net	(2) Scaled	(3) Industry	(4) Net	(5) Scaled	(6) Industry
ESG Score	0.068***	0.662***	1.016***	0.029	0.089	0.230
	[4.396]	[2.821]	[5.226]	[1.462]	[0.294]	[0.872]
Rating	0.440***	0.439***	0.441***	0.451***	0.448***	0.449***
	[6.246]	[6.208]	[6.282]	[6.167]	[6.103]	[6.159]
Amount	-0.099***	-0.098***	-0.096***	-0.384***	-0.384***	-0.384***
	[-2.739]	[-2.711]	[-2.664]	[-8.197]	[-8.189]	[-8.187]
B/A Spread	4.681***	4.684***	4.679***	1.138***	1.140***	1.138***
	[13.846]	[13.846]	[13.844]	[5.774]	[5.783]	[5.783]
Amihud	2.066***	2.066***	2.065***	1.507***	1.507***	1.507***
	[8.159]	[8.157]	[8.158]	[9.555]	[9.565]	[9.557]
Time-to-Maturity	0.386***	0.385***	0.386***	0.152***	0.152***	0.152***
	[13.232]	[13.198]	[13.251]	[16.721]	[16.718]	[16.717]
Leverage Ratio	2.978***	2.989***	2.981***	3.902***	3.877***	3.881***
	[5.101]	[5.106]	[5.107]	[5.216]	[5.177]	[5.187]
Sales/Assets	0.185	0.199	0.182	0.137	0.121	0.124
	[0.720]	[0.776]	[0.709]	[0.460]	[0.404]	[0.416]
RE/Assets	-0.299	-0.292	-0.302	0.015	-0.002	-0.003
	[-0.680]	[-0.658]	[-0.692]	[0.029]	[-0.004]	[-0.005]
NI/Assets	-16.974***	-16.975***	-16.958***	-22.560***	-22.511***	-22.534***
	[-12.205]	[-12.189]	[-12.222]	[-14.443]	[-14.402]	[-14.442]
Assets	-0.859***	-0.839***	-0.836***	-0.549***	-0.550***	-0.546***
	[-5.094]	[-4.968]	[-4.991]	[-2.800]	[-2.808]	[-2.784]
Analyst Coverage	0.181	0.178	0.154	0.283	0.295	0.282
	[0.749]	[0.732]	[0.637]	[1.015]	[1.057]	[1.010]
IO	-1.772***	-1.749***	-1.783***	-2.056***	-2.046***	-2.053***
	[-4.316]	[-4.264]	[-4.341]	[-3.049]	[-3.035]	[-3.050]
Intercept	9.987***	9.765***	9.329***	14.681***	14.676***	14.548***
	[4.763]	[4.649]	[4.445]	[5.993]	[5.988]	[5.930]
N	20,766	20,766	20,766	21,055	21,055	21,055
Adj. R^2	0.5326	0.5324	0.5328	0.5109	0.5109	0.5109
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Effect of corporate social performance on bond volatility: Addressing endogeneity. Regressions to address potential endogeneity in U.S. bond trades using an instrumental variable approach. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score, scaled ESG score, and industry-scaled ESG. Instruments used for the key independent variables are the Democratic blue state dummy (Columns (1) to (3)) and the Fama-French 48-industry average of corresponding ESG measures (Columns (4) to (6)). ***t***-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

Instrument	Blue State Dummy			Average Industry ESG		
	(1) Net	(2) Scaled	(3) Industry	(4) Net	(5) Scaled	(6) Industry
IV(ESG Score)	0.019***	2.305***	0.075***	0.055***	1.392**	3.526***
	[2.864]	[2.966]	[3.581]	[2.893]	[2.214]	[3.340]
Rating	0.520***	0.518***	0.521***	0.156**	0.166***	0.179***
	[9.313]	[9.244]	[9.338]	[2.513]	[2.632]	[2.904]
Amount	-0.209***	-0.209***	-0.209***	0.001	0.004	0.003
	[-6.883]	[-6.869]	[-6.858]	[0.028]	[0.080]	[0.059]
B/A Spread	2.328***	2.330***	2.327***	2.803***	2.799***	2.799***
	[15.913]	[15.927]	[15.905]	[13.523]	[13.477]	[13.522]
Amihud	1.497***	1.497***	1.497***	1.881***	1.875***	1.877***
	[10.314]	[10.313]	[10.316]	[11.840]	[11.854]	[11.792]
Time-to-Maturity	0.189***	0.189***	0.189***	0.606***	0.609***	0.499***
	[19.755]	[19.755]	[19.752]	[24.401]	[24.266]	[12.011]
Leverage Ratio	3.413***	3.401***	3.363***	2.872***	2.952***	3.084***
	[6.942]	[6.911]	[6.828]	[4.602]	[4.668]	[4.824]
Sales/Assets	0.166	0.164	0.161	0.069	0.069	0.123
	[0.784]	[0.776]	[0.760]	[0.268]	[0.270]	[0.467]
RE/Assets	-0.271	-0.282	-0.277	-0.062	-0.008	-0.019
	[-0.763]	[-0.791]	[-0.780]	[-0.140]	[-0.017]	[-0.042]
NI/Assets	-20.304***	-20.282***	-20.321***	-18.768***	-18.861***	-18.840***
	[-18.189]	[-18.156]	[-18.193]	[-16.505]	[-16.474]	[-16.581]
Assets	-0.611***	-0.601***	-0.596***	-0.271*	-0.274*	-0.275*
	[-4.578]	[-4.495]	[-4.477]	[-1.935]	[-1.956]	[-1.956]
Analyst Coverage	0.008	0.012	-0.005	0.256	0.212	0.093
	[0.041]	[0.063]	[-0.029]	[1.080]	[0.884]	[0.379]
IO	-1.836***	-1.820***	-1.828***	-2.033***	-2.064***	-2.229***
	[-4.659]	[-4.624]	[-4.647]	[-3.846]	[-3.893]	[-4.206]
Intercept	10.134***	10.020***	9.759***	3.142	3.189	3.734*
	[6.170]	[6.086]	[5.937]	[1.517]	[1.542]	[1.807]
N	41,821	41,821	41,821	41,821	41,821	41,821
Adj. R^2	0.2247	0.2016	0.1618	0.3191	0.3171	0.3610
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Conditional effect of corporate social performance on bond volatility: Managerial risk-taking.

Regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data, conditioned on risk-taking incentives measured by CEO compensation vega. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score, scaled ESG score, and industry-scaled ESG. The *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	Low CEO Vega			High CEO Vega		
	(1) Net	(2) Scaled	(3) Industry	(4) Net	(5) Scaled	(6) Industry
ESG Score	-0.010	-0.172	0.275	0.074***	0.737***	0.591**
	[-0.604]	[-0.735]	[1.046]	[3.375]	[2.820]	[2.054]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	20,991	20,991	20,991	20,571	20,571	20,571
Adj. R^2	0.5035	0.5035	0.5037	0.5581	0.5580	0.5580
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Conditional effect of corporate social performance on bond volatility: Information Asymmetry.

Regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data, conditioned on information asymmetry, measured by analyst forecast dispersion (Panel A) and analyst coverage (Panel B). All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score, scaled ESG score, and industry-scaled ESG. The *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

Panel A	Low Dispersion			High Dispersion		
Analyst Dispersion	(1) Net	(2) Scaled	(3) Industry	(4) Net	(5) Scaled	(6) Industry
ESG Score	0.030	-0.027	0.310	0.040***	0.133***	0.687**
	[1.250]	[-0.076]	[1.477]	[2.648]	[2.617]	[2.348]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	21,720	21,720	21,720	20,101	20,101	20,101
Adj. R^2	0.5568	0.5567	0.5568	0.551	0.5509	0.5511
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B	High Coverage			Low Coverage		
Analyst Coverage	(1) Net	(2) Scaled	(3) Industry	(4) Net	(5) Scaled	(6) Industry
ESG Score	0.046**	0.324	0.644**	0.062***	0.547*	0.747***
	[2.142]	[1.071]	[2.523]	[3.595]	[1.855]	[2.919]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	23,216	23,216	23,216	18,605	18,605	18,605
Adj. R^2	0.5629	0.5628	0.5629	0.5165	0.5163	0.5164
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes

Internet Appendix to
Corporate Social Responsibility and Bond Volatility

Abstract

This paper examines the effects of corporate social performance on bond volatility. After controlling for bond characteristics and firm fundamentals, we find a robust positive relationship between corporate social performance and bond volatility. The empirical results demonstrate that the impact on bond volatility is primarily driven by social performance strengths rather than concerns. Additionally, the increase in bond volatility is concentrated among short-term bonds. Our results are robust to alternative measures, sample periods, and endogeneity controls. Furthermore, the effect is more pronounced for firms with higher managerial risk-taking and a worse information environment.

JEL Classification: G10, G12, G30, G32, M14

Keywords: Bond volatility, corporate social responsibility, risk-taking, information environment

Table A1: Effect of corporate social performance on bond volatility: Univariate analysis

Baseline regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data. All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. The key independent variable is the net ESG score. Only one control variable is included in each regression. *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ESG Score	0.056***	0.090***	0.057***	0.029**	0.047***	0.048***	0.066***	0.053***	0.061***	0.058***	0.064***	0.055***	0.051***
	[3.607]	[5.736]	[3.699]	[2.299]	[3.251]	[3.605]	[4.271]	[3.398]	[3.905]	[3.771]	[4.123]	[3.488]	[3.273]
Rating		0.764***											
		[13.291]											
Amount			-0.543***										
			[-11.887]										
B/A Spread				5.345***									
				[43.509]									
Amihud					3.925***								
					[26.093]								
Time-to-Maturity						0.275***							
						[25.313]							
Leverage Ratio							9.564***						
							[13.809]						
Sales/Assets								-0.858***					
								[-2.960]					
RE/Assets									-5.063***				
									[-13.188]				
NI/Assets										-20.614***			
										[-18.109]			
Assets											-1.315***		
											[-8.271]		
Analyst Coverage												-1.469***	
												[-6.646]	
IO													-1.221**
													[-2.411]
Intercept	5.844***	-0.716	8.616***	3.849***	5.021***	3.316***	2.011***	6.550***	7.095***	7.033***	19.483***	10.425***	6.598***
	[71.363]	[-1.457]	[34.470]	[47.803]	[62.576]	[30.638]	[6.806]	[26.086]	[58.330]	[69.766]	[11.808]	[14.744]	[19.508]
N	44,093	43,862	44,093	43,663	43,849	44,093	44,091	44,093	43,951	44,093	44,093	42,620	43,518
Adj. R^2	0.3291	0.3388	0.3417	0.4469	0.4095	0.4349	0.3356	0.3294	0.3345	0.3449	0.3307	0.3262	0.3314
Firm FE	Yes	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	Yes
Cluster SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A2: Effect of corporate social performance on bond volatility: Excluding financial crisis.

Baseline regressions for U.S. bond trades from 2002 to 2018 using bond-year panel data, with the exclusion of the financial crisis period (2007 - 2009). All regressions include time and firm fixed effects. Standard errors are clustered at the firm level. The dependent variable is annualized bond volatility. Key independent variables are net ESG score, scaled ESG score, and industry-scaled ESG. *t*-statistics are reported in brackets. ***, ** and * indicate the coefficients are statistically significant at the 1%, 5% and 10% levels, respectively.

	(1) Net ESG	(2) Scaled ESG	(3) Industry ESG
ESG Score	0.068***	0.665***	0.468***
	[5.455]	[3.281]	[2.972]
Rating	0.381***	0.380***	0.378***
	[5.978]	[5.939]	[5.930]
Amount	-0.243***	-0.242***	-0.243***
	[-8.598]	[-8.552]	[-8.555]
B/A Spread	2.274***	2.277***	2.276***
	[15.983]	[16.000]	[15.987]
Amihud	0.989***	0.987***	0.990***
	[6.697]	[6.692]	[6.701]
Time-to-Maturity	0.179***	0.179***	0.179***
	[19.920]	[19.922]	[19.905]
Leverage Ratio	1.800***	1.801***	1.723***
	[3.773]	[3.770]	[3.609]
Sales/Assets	0.337	0.344	0.327
	[1.575]	[1.607]	[1.519]
RE/Assets	0.105	0.109	0.086
	[0.284]	[0.295]	[0.232]
NI/Assets	-18.874***	-18.874***	-18.904***
	[-15.419]	[-15.395]	[-15.370]
Assets	-0.351***	-0.337**	-0.327**
	[-2.616]	[-2.507]	[-2.446]
Analyst Coverage	0.249	0.241	0.253
	[1.307]	[1.260]	[1.325]
IO	-1.883***	-1.870***	-1.857***
	[-5.163]	[-5.126]	[-5.088]
Intercept	9.072***	8.942***	8.606***
	[5.365]	[5.276]	[5.068]
N	35,995	35,995	35,995
Adj. R^2	0.4993	0.4991	0.499
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster SE	Yes	Yes	Yes