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By *Dimitris Andriosopoulos and Sheikh Tanzila Deepty*

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Abstract

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JEL classification: G31; G33; M14

Keywords: ESG, Corporate Investment, Economic Uncertainty, Default Probability, Signal Jamming

Dimitris Andriosopoulos (d.andriosopoulos@strath.ac.uk) is at the university of Strathclyde. Sheikh Tanzila Deepty (tanziladeepty@du.ac.bd) is at the University of Dhaka. We are grateful to Timo Korkeamaki, Christian Andres, Eliza Wu, Hue Hwa Au Yong, Aziz Jaafar, Sabri Boubaker, Peter Truc Do, Panagiotis Loukopoulos, Andrew Marshall, and seminar participants at the University of Strathclyde, for their valuable comments. Any errors are our own. Sheikh Tanzila Deepty gratefully acknowledges financial support from the Commonwealth Scholarship Commission in the UK.

1. Introduction

Based on 250 global firms with revenues totaling approximately $7.9 trillion, a 2019 survey from the Chief Executives for Corporate Purpose® (CECP) shows that the surveyed firms invested more than $26 billion in environmental, social and governance (ESG) activities in 2018, an 11% increase from 2016. The increase in ESG spending highlights a potential concern that firms exploit corporate resources for immediate payoffs at the cost of long-term firm value, contrary to the spirit of ESG.

ESG activities can reduce agency costs through information asymmetries (Attig et al., 2014). Meanwhile, managers can mislead stakeholders with their ESG reputation to validate practices related to their own or a particular stakeholder's interests at the cost of long-term financial objectives. Such opportunistic use of ESG reputation can lead to greater agency problems (Cennamo et al., 2009). This leads to the following question: Do firms exploit their ESG reputation opportunistically via risky investments? We examine this question by estimating the relationship between ESG reputation and firm investment. We also assess whether firms with high ESG reputation transfer wealth from creditors to shareholders through risky investments (i.e., risk-shifting).

Agency problems affect ESG investment due to conflicts among different shareholders (Barnea and Rubin, 2010) or between managers and shareholders (Di Giuli and Kostovetsky, 2014; Masulis and Reza, 2015). We argue that the focus should also be on the transfer of wealth from creditors to shareholders, called risk-shifting. The risk-shifting hypothesis posits that highly levered or financially distressed firms have an incentive to extract wealth from debtholders (Jensen and Meckling, 1976; Smith and Warner, 1979). Financially distressed firms increase risky investments since shareholders will reap the benefits if things go well; otherwise creditors bear the costs (Eisdorfer, 2008; Becker and Strömberg, 2012). A risk-

shifting behavior is likely to adversely affect a firm's reputation and reduce future access to capital and its ability to pursue positive NPV projects (Diamond, 1989; Almeida et al., 2011).

ESG activities accrue reputational credits by reducing information asymmetries, in turn creating a buffer that allows firms to take more risk even in the form of socially irresponsible activities (Bouslah et al., 2018). For instance, firms increase ESG investment to restore their credit ratings after a major worsening of their investment-grade rating (Karampatsas et al., 2020). Moreover, stakeholders downplay the negative information of firms with greater ESG reputation and reduce market discipline for respective CEOs. Similarly, firms with greater ESG reputation can avoid the higher risk premium for engaging in earnings management practices and managers can shield themselves from the scrutiny of the affected stakeholders (Martínez-Ferrero et al., 2016). Therefore, firms with high ESG reputation and higher default probability are more likely to engage in risk-shifting.

We test whether ESG reputation affects firms' risk-shifting incentives by using the sensitivity of investment intensity on volatility as the empirical set-up. The real options approach suggests that firms prefer to delay an irreversible investment when waiting leads to a higher option value than the immediate investment (McDonald and Siegel, 1986). Hence, firms will reduce their investment in response to higher expected volatility, as the option value of waiting increases with the degree of uncertainty of its payoff (Pindyck and Solimano, 1993). Meanwhile, Eisdorfer (2008) finds that firms with higher default probability shift risk by increasing their investments in response to expected higher volatility. However, as creditors expect that high ESG firms are less likely to engage in asset substitution (Amiraslani et al., 2017), the ESG reputation of distressed firms can protect them from increased scrutiny for risk-shifting. Therefore, risk-shifting behavior can increase agency costs and limit access to finance. But ESG reputation can mitigate these potential negative effects. Hence, it is reasonable to

expect that high ESG firms with higher default probability increase investment in response to expected higher volatility compared to low ESG firms.

We also test an alternative hypothesis: firms that are more financially distressed increase ESG investment motivated by signal jamming. During economic uncertainty firms have fewer resources available, in which case managers tend to limit information flows to gain some control over this adverse situation (Staw et al., 1981). Financially strong competitors may conduct predatory attacks against their financially constrained rivals by reducing their rivals' cash flow with a price war (Telser, 1966). Firms having higher probability of default may face such predatory attacks during economic uncertainty more intensely, due to the competition for scarce resources in the economy. However, ESG reputation has a 'halo effect' as it creates a positive impression regarding other corporate actions (Klein and Dawar, 2004). This signal jamming via ESG reputation can help the distressed firms to attract investors (Graves and Waddock, 1994; Hermalin and Weisbach, 2017) in this highly competitive environment. Hence, through high ESG investment, firms with higher default probability can portray a 'deep-pocket' status and mask their actual financial fragility from rivals and other stakeholders (signal jamming). We argue that firms' ESG investment increase during greater volatility indicates their signal-jamming motivation if they have higher default probability, as firms usually reduce ESG investment during a recession (Bansal et al., 2015). However, signal jamming could adversely affect long-term firm value. During high economic volatility, distressed firms should prioritize investing their scarce resources in basic operations rather than non-core business activities such as ESG.

While our risk-shifting hypothesis is conditional on firms' existing ESG level, the signal-jamming hypothesis is not. Therefore, in this paper, the risk-shifting and signal-jamming hypotheses are independent, but not mutually exclusive. However, for firms with higher default probability, investment in ESG activities cannot directly transfer wealth to shareholders. But it

can provide a false signal that a firm has 'deep pockets' to hide its distressed financial conditions. Therefore, increasing ESG investment during high economic uncertainty indicates a signal-jamming motivation for firms with higher default probability, rather than risk-shifting.

We assess all publicly traded U.S. firms from 2002 to 2016, excluding financials and utilities. For identification, we use four alternative proxies to measure volatility: (i) expected market volatility measured by a GARCH (1,1) model, (ii) U.S. composite Economic Policy Uncertainty index of Baker et al. (2016), (iii) NBER recession indicator, and (iv) Consumer Sentiment Index (CSI) of the University of Michigan. We also address the potential reverse causation between investment intensity and ESG reputation. As ESG investment has the trade-off of requiring resources which may be more needed for operations in times of financial distress, firms may be constrained financially to engage in ESG. To mitigate this endogeneity concern, we apply a difference-in-differences (DiD) methodology by using the Deepwater Horizon BP oil spill in 2010 as an exogenous shock to ESG. The Deepwater Horizon explosion is one of the major environmental disasters in U.S. history (Zeller, 2010). It is an exogenous negative shock to firms' ESG reputation, which leads the firms in affected industries to improve their ESG performance (Liang and Renneboog, 2017; Pek et al., 2018). As treated firms, we use the firms belonging to the Oil and Gas industries directly exposed to the BP oil spill event in the years after the disaster.

We find that when financially distressed firms have greater ESG reputation, they increase their investment intensity in operational assets at times of greater economic uncertainty. This finding suggests that firms with higher default probability use ESG reputation for risk-shifting purposes during greater economic uncertainty. The results are significant, both statistically and economically. With an average investment intensity ratio of 0.13 for the entire sample, at times of high volatility, firms with high ESG and higher default probability increase investment by 11.26% to 28.90% across different estimation specifications compared to firms with low ESG

and higher default probability. The results of the DiD analysis support our main finding: firms with high ESG reputation have risk-shifting incentives. Hence, high ESG firms increase investment in basic operations when macroeconomic or industry-specific uncertainty is high if their default probability is also high.

Regarding the signal jamming hypothesis, our alternative tests show that firms with higher default probability increase their ESG investment during economic uncertainty by 0.54% to 2.36% compared to firms with low default probability. These results support our argument that firms use ESG for signal jamming. Overall, our study finds novel empirical evidence that firms with higher default probability increase ESG investment during economic uncertainty to jam the signal of the information on firms' actual financial fragility. Meanwhile, if firms with higher default probability already have higher ESG reputation, they increase investment in core business operations during economic uncertainty to transfer wealth from creditors to shareholders.

Our contribution is twofold. First, we examine the relationship between ESG and risk-shifting. Second, we test whether firms that are financially distressed use their ESG reputation for signal-jamming purposes. We show that high ESG firms shift risk from shareholders to creditors. Also, firms facing higher probability of default use ESG reputation as a signal-jamming mechanism. Both risk-shifting and signal-jamming mechanisms prioritize immediate payoffs at the cost of long-term firm value.

This paper provides new insights by testing the ESG investment behavior of firms with higher default probability conditional on economic uncertainty. In a related paper, Bansal et al. (2015) focus on firms' ESG spending during economic uncertainty by using the 2008-2009 global financial crisis as a shock and find that firms reduced their ESG during the recession. However, the 2008-09 financial crisis is not a valid exogenous shock as this recession event had a direct effect on all aspects of the economy (Berger et al., 2020). We contribute to the

literature by showing that the investment intensity of high ESG firms is conditional on default probability and economic volatility. Finally, we provide robust evidence by using alternative measures of financial distress.

2. Literature review

2.1 ESG reputation and risk-shifting

Masulis and Reza (2015) suggest that CEOs are inclined to use ESG for enhancing their reputation and strengthening their social bond with directors at the cost of shareholders' cash flow rights. Barnea and Rubin (2010) show that high ESG investment creates conflict among different shareholders, as insiders (e.g., corporate managers, directors, and large blockholders) insist on overinvesting in ESG to improve their reputation, though they bear relatively little fraction of the costs. The existing evidence suggests that high ESG firms invest more efficiently as they are less prone to overinvest or underinvest (Benlemlih and Bitar, 2018; Cook et al., 2019). Bhandari and Javakhadze (2017) find that the effect of corporate growth options is weaker, and the effect of cash flow is stronger on investment for high ESG firms. In contrast, Attig et al. (2014) find that ESG reduces the internal cash flow for investment and argue that ESG activities can reduce information asymmetries and agency costs by decreasing the sensitivity of investment to cash flows. Meanwhile, firms with high leverage invest less in ESG (Barnea and Rubin, 2010). Similarly, Hong et al. (2012) find that firms spend less on ESG when they are financially constrained.

We argue that the focus should also be on the agency problem that arises from the debtholder-equityholder conflict, referred to as risk-shifting and introduced by Jensen and Meckling (1976) and Galai and Masulis (1976). This problem arises if equityholders have an incentive to extract wealth from debtholders. As risk-shifting behavior distorts firm reputation, and in turn, future access to capital and the ability to pursue positive NPV projects (Diamond,

1989; Almeida et al., 2011), our study addresses the question whether ESG reputation creates risk-shifting incentives.

Firm-specific ESG reputation creates trust between the firm and stakeholders, leading firms with high ESG scores to experience superior financial performance (Lins et al., 2017). While ESG reputation becomes an essential element of corporate strategies, firms can use their ESG reputation to shield corporate activities or policies. Martínez-Ferrero et al. (2016) highlight that high ESG firms can successfully avoid the higher risk premium for engaging in earnings management and managers can shield themselves from the negative reactions of the affected stakeholders. Moreover, Hasan et al. (2019) show that multinational firms with higher ESG scores engage in profit shifting (i.e., cross-country tax avoidance) and face relatively lower scrutiny by stakeholders. Bouslah et al. (2018) suggest that ESG reputation creates a buffer to take more risk in the form of socially irresponsible activities. Therefore, it is reasonable to expect that ESG reputation creates risk-shifting incentives for firms with higher default probability.

Eisdorfer (2008) tests the risk-shifting hypothesis based on the relationship between volatility and investment of firms with higher default probability. According to the real options approach, if firms have the right to delay investment, they prefer to delay an irreversible investment, when waiting results in higher option value than the immediate investment (McDonald and Siegel, 1986). Hence, firms will decrease investment during expected higher volatility to achieve a higher option value of waiting as its payoff increases with the degree of uncertainty (Pindyck and Solimano, 1993). However, equityholders of distressed firms have the incentive to increase risky investments because they receive the benefit if everything turns out well; otherwise debtholders bear the costs (Becker and Strömberg, 2012). Eisdorfer (2008) considers both the risk-shifting behavior and real options approach to gauge the relationship

between expected market volatility and investment, and states that risk-shifting incentives of distressed firms dominate the real options perspective.

We posit that the inverse relation between investment intensity and economic volatility should be conditional on ESG reputation. While distressed firms take additional risk by making risky investments, this increases the potential payoff to equityholders but to the detriment of debtholders. Meanwhile, stakeholders downplay negative information about high ESG firms (Godfrey et al., 2009; Lins et al., 2017). While risk-shifting behavior is more likely when the interests of equity holders and managers are better aligned, via compensation-based incentives and reputation concerns among other factors (Eisdorfer, 2008), high ESG standing can help reduce market discipline for CEOs (Dunbar et al., 2020). Therefore, firms with relatively higher default probability along with high ESG reputation may be motivated to do more risk-shifting and increase investment during economic volatility. Based on this argument, our first hypothesis is the following:

H1: Firms with strong ESG reputation increase investment during high economic uncertainty when their default probability is higher.

2.2 Signal jamming and ESG investment

Firms reduce investment when volatility is high (Pindyck and Solimano, 1993; Gulen and Ion, 2016). Bansal et al. (2015) find that firms also reduce ESG investment during a recession. During adverse economic conditions, firms may choose to invest more in basic operations rather than non-core business activities such as ESG. Hence, firms may follow a similar pattern for ESG investment decisions as other investment decisions (Sun and Gunia, 2018). In this regard, this paper investigates whether firms' ESG investment during market volatility is conditional on default probability.

While firms have a higher probability of default, competitors may plan predatory attacks by reducing rivals' cash flow through a price war (Telser, 1966). Moreover, firms having higher

probability of default may face such predatory attacks during economic uncertainty more intensely, as this adverse circumstance creates competition for a deflated pool of resources in the business environment. Meanwhile, ESG reputation is perceived positively by stakeholders leading to a 'halo effect' for the firm. Hence, high ESG investment can limit information on firms' actual economic condition from the stakeholders and rivals, indicate firms' 'deep-pocket' status, and counter the predatory attacks (i.e., signal jam). Therefore, we argue that firms with a higher default probability may have a signal-jamming motivation to increase ESG investment during high economic volatility in order to avoid predation. For instance, high leverage firms may fail to honor their implicit contract with customers (Matsa, 2011; Kini et al., 2017), which results in product market underperformance (Campello, 2006). Bae et al. (2019) suggest that ESG guards the highly levered firms against rivals' predation, keeps customers, and reduces the loss of market share. Meanwhile, as investors value a firm based on current performance, distressed firms become more incentivized to jam the signal of their current financial condition with the intention of boosting the estimated value and attracting investors (Hermalin and Weisbach, 2017). Moreover, managers may mask their firms' probability of default via ESG investment for favorable future CEOs' compensation contracts (Mahoney and Thorne, 2005; 2006), especially during economic volatility, to lessen the probability of CEO turnover (Harjoto and Jo, 2011). Hence, our second hypothesis is the following:

H2: Firms with high default probability increase ESG investment during high economic uncertainty.

3. Data and Summary Statistics

This paper analyzes all publicly listed U.S. firms from 2002 to 2016, available in the CRSP/Compustat merged database. Utilities (SIC codes 4900-4949) and financial (SIC codes

6000-6999) firms are excluded. From the Asset4[2] database of Refinitiv (formerly Thomson Reuters), we collect the equally weighted Environmental, Social, and Governance (ESG) score and use this for ESG measurement. Firm-level financial data are from CRSP/Compustat. Monthly returns of the NYSE Value-weighted market index are collected from CRSP. We also use the Economic Policy Uncertainty Index (EPU) of Baker et al. (2016) available at http://www.policyuncertainty.com/. Yields of the long-term Baa and Aaa securities and the NBER recession indicator are from the Federal Reserve Bank of St. Louis. We obtain the CSI from the University of Michigan available at http://www.sca.isr.umich.edu/. Finally, our sample comprises 5,742 unique U.S. firms and 43,723 firm-year observations, of which 1,708 unique firms with 9,523 firm-year observations have ESG scores.

Table 1 reports the summary statistics of the main variables of this study. We report the descriptive statistics of all sample firms in Panel A. Panel B, C and D present the descriptive statistics of high-ESG, low-ESG, and no-ESG firms, respectively. The mean overall Asset4 ESG score for all sample firms is 52.99, consistent with Ferrell et al. (2016). Summary statistics for firm-level financial variables are largely consistent with the extant literature. The average investment is higher for low ESG firms (0.1492) than high ESG firms (0.0979). Meanwhile, default probability is low for high ESG firms as the average Campbell et al. (2008) (CHS) score is lower for high ESG firms (0.0660) than low ESG firms (0.1481). Table 2 shows the average values and differences in means of the main variables for firms with and without a ESG score, and firms with low and high ESG scores, in Panels A and B, respectively.

[2] Asset4 provides ESG score since 2002 for more than 4,300 companies globally, including 2,693 U.S. firms. Based on 900 evaluation points and 250 key performance indicators, ESG measurements are calculated for four pillars: Environmental, Social, Corporate Governance, and Economic. The overall ESG score is the equally weighted score of these four pillars.

4. Empirical results

4.1 ESG and risk-shifting

To estimate the impact of ESG reputation on investment intensity, we test the following equation:

$$Investment\ Intensity_{i,t} = \alpha + \beta 1 \times Uncertainty_{t} + \beta 2 \times Distress_{i,t-1} + \beta 3 \times ESG_{t-1} + \beta 4 \times Uncertainty_{t} \times Distress_{i,t-1} \times ESG_{i,t-1} + X_{i,t-1} + \theta + \gamma + \varepsilon_{i,t} \qquad (1)$$

By following Eisdorfer (2008), we estimate *Investment Intensity* as the ratio of gross capital expenditures in a given year to PP&E at the beginning of the year.[3] We use two alternative measures for *Distress*: (i) Altman's (1968) Z-score and (ii) the CHS-score by Campbell et al. (2008). Based on Altman's Z-score we create a binary variable, *Z score-Dummy*, equal to one if the Z-score is below 1.81 at the beginning of the year (indicating financial distress), and zero otherwise. *CHS-Default Probability* is a dummy variable set to one if the CHS-score based default probability is in the top tercile in year *t-1*, and zero otherwise. We use four alternative proxies to measure uncertainty: (i) The expected market volatility at the beginning of the year by applying the generalized autoregressive conditional heteroskedasticity (GARCH) model to monthly returns of the NYSE Value-weighted market index from 2002 to 2016[4]; (ii) The US composite EPU index of Baker et al. (2016) in time *t-*

[3] We scale gross capital expenditures in a given year with the PP&E at the beginning of the year, as our intention is to measure the investment intensity of firms conditional on their probability of default at the beginning of the year.

[4] The GARCH (1,1) model yields k-step-ahead expected volatility for each month. Therefore a 12-month-ahead forecasted volatility for each year is generated which is conditional on the information of the last month of the year before. As the expected annual variance is a linear function of the expected variance for the next month as well as the expected variance for any month during the year, Eisdorfer (2008) suggests that regressing annual investment on expected volatility for the first month of the year is sufficient.

1[5]; (iii) The NBER recession indicator at time *t*; and (iv) The inverted values of the CSI at time *t*.[6] Here, Uncertainty is a binary variable set to one if the uncertainty measurement is in the top tercile[7] in year *t* (classified as high volatility), and zero otherwise. *ESG* is a dummy variable set to one if firms have an annual equally-weighted ESG score in the top tercile in year *t-1*, and zero otherwise.[8] *X* is a vector of control variables which affect investment intensity according to the extant literature. All variables are defined in the Appendix. θ and γ denote year and firm fixed effects respectively.

Table 3 reports the OLS regression estimates for ESG reputation and risk-shifting. In Panel A, we report the results for *Z score-Dummy*. Columns (1), (3), (5) and (7) show the results for uncertainty measured by a GARCH (1,1) model, EPU, Recession, and Inverted CSI, respectively. The results suggest that ESG reputation has a positive and statistically significant impact on the investment intensity of the firms with higher default probability during economic volatility. The results are also economically significant. With an average investment of 0.1332 for the entire sample, firms with high ESG reputation increase investment when their distress likelihood is higher during high uncertainty by 23.87%, 28%, 19.37% and 19.37% in columns (1), (3), (5) and (7) respectively. Then, we include control variables to alleviate omitted

[5] We use annual average of the monthly EPU index by following Gulen and Ion (2016).

[6] The CSI of the University of Michigan is a phone survey-based monthly index which represents consumers' level of optimism/pessimism regarding future economic policy. We use the annual average value of the index.

[7] While Eisdorfer (2008) estimates low- and high-expected volatilities based on median values, we use tercile values to avoid marginal cases. We repeat the estimations with median classification of low and high uncertainty and the results, presented in the Appendix (Table A1), remain qualitatively similar.

[8] We repeat the estimations with mean, median, quartile and quantile classifications of CSR, CSR and no-CSR score, and continuous CSR values. The results are presented in the Appendix (Tables A2 and A3). For most specifications, the results are qualitatively similar, and economically and statistically significant.

variable bias concerns. The results remain consistent in all the specifications, except column (8).

Panel B presents the results for the *CHS-Default Probability*. All specifications show that ESG has a statistically and economically significant positive effect on the relationship between volatility and investment of firms with higher default probability. High ESG reputation increases the investment of firms with higher default probability during high uncertainty by 23.57%, 26.73%, 16.74% and 28.90% in columns (1), (3), (5) and (7) respectively. The results remain statistically and economically significant when we add control variables. Hence, the empirical evidence supports our first hypothesis and suggests that firms with strong ESG reputation have higher risk-shifting incentives as they increase investment during high economic volatility when their distress likelihood is high.

4.2 Difference-in-Differences

The relationship between ESG reputation and risk-shifting incentives can be endogenous due to potential reverse causality. Firms engaging in high risk-shifting behavior may intend to invest less in ESG activities due to resource constraints during economic volatility. To address this endogeneity concern, we apply a difference-in-differences (DiD) methodology by using the Deepwater Horizon BP oil spill event in 2010 as a quasi-natural experiment. The Deepwater Horizon explosion of April 20, 2010 is considered to be one of the major environmental disasters in U.S. history (Zeller, 2010). This rig explosion event shattered BP's reputation and stakeholders' trust. While prior to this disaster BP claimed itself to be one of the best among the industry in terms of safety culture, its ignoring of key safety warning signs led to the deaths of 11 people and the offshore oil spill caused damage amounting to more than $20 billion (Rogers, 2010). Meanwhile, this oil spill disaster created uncertainty for all energy-related industries due to the negative spillover effect (Dyck et al., 2019). This environmental shock forced the affected firms to improve their ESG performance in the post-disaster period to

restore their reputation (Liang and Renneboog, 2017; Pek et al., 2018). Since this ESG disaster is an exogenous shock to firms' ESG performance (Liang and Renneboog, 2017), we use this oil spill disaster for our DiD set-up. As treated firms, we use those belonging to the Oil and Gas industries that were directly exposed to the BP oil spill event in the years after the disaster. Overall, we test the following model:

$$\textit{Investment Intensity}_{i,t} = \alpha + \beta 1 \times \textit{ESG Disaster}_{t-1} + \beta 2 \times \textit{Distress}_{i,t-1} + \beta 3 \times \textit{ESG}_{i,t-1} + \beta 4 \times \textit{ESG Disaster}_{t-1} \times \textit{Distress}_{i,t-1} \times \textit{ESG}_{i,t-1} + X_{i,t-1} + \theta + \gamma + \varepsilon_{i,t} \quad (2)$$

We follow Dyck et al. (2019) to consider the Oil and Gas Extraction industries (SIC=13) as affected by this disaster and use the years 2009 to 2012 to balance the pre- and post-event periods. The *ESG Disaster* is a binary variable equal to one for the post-event years 2011 and 2012 and the treated firms, and zero otherwise. We use the median classification for ESG and CHS-Default Probability dummy variables for this DiD estimation due to the lack of observations for the interaction term ESG Disaster × Default Probability × ESG Dummy with tercile classification. Finally, we include the same control variables used in our baseline regressions along with firm and year fixed effects.

Table 4 shows the estimates of the DiD analysis. In panel A, we report the estimates based on the overall ESG score. In columns (1) and (2), we use the *Z score-Dummy* as a proxy of financial distress. The results show that firms with high ESG reputation and higher default probability increase their investment intensity during economic uncertainty. This supports the risk-shifting behavior of firms with high ESG reputation. The results do not hold when we use *CHS-Default Probability* alternatively in columns (3) and (4).

As the BP oil event is an environmental shock, this ESG disaster has a direct impact on firms' environmental ESG activities (Liang and Renneboog, 2017). Hence, in Panel B, we repeat the analysis by using the environmental score, similarly to Dyck et al. (2019). The results are consistent with Panel A, suggesting that firms with higher default probability increase their

investment intensity during economic uncertainty if they have a higher reputation for environmental ESG activities.[9]

Finally, the results show that the interaction term *ESG Disaster* × *Distress* × *ESG* is statistically and economically significant for the *Z score-Dummy*, which is consistent for different alternative specifications and supports our earlier findings in Table 3. Hence, ESG reputation creates risk-shifting incentives for firms with higher default probability during macroeconomic or industry-specific uncertainty.

4.2 Signal jamming and ESG investment

We examine the ESG investment patterns of financially distressed firms during economic volatility to empirically assess firms' signal-jamming motivation. We argue that firms with higher probability of default have a strong intention to engage in signal jamming during higher economic volatility. By increasing ESG investment against this backdrop, firms that are higher in the financial distress spectrum hope to influence market perception about their financial ability. Hence, we expect that firms with higher default probability increase ESG investment in response to expected higher volatility. We use the following first-order differences regression to test the change in ESG investment of financially distressed firms during volatility:

$$\Delta\, ESG\ Investment_{i,t} = \alpha + \beta 1 \times Distress_{i,t-1} + \beta 2 \times Uncertainty_{t} + \beta 3 \times Distress_{i,t-1} \times Uncertainty_{t} + \Delta\, Y_{i,t-1} + \vartheta + \gamma + u_{i,t} \qquad (3)$$

where *ESG Investment* is the overall equally weighted ESG score. We set ESG to zero if firms do not have ESG scores. *Y* indicates the vector of control variables which affect ESG investment. In this model, we use the first difference of the *ESG Investment* and control variables. The estimation based on changes in variables can alleviate the possible endogeneity

[9] We also repeat the analysis by including Petroleum Refining and Related industries (SIC=29). The results are presented in the Appendix (Table A4) and remain almost identical.

biases (Roberts and Whited, 2013). ϑ and γ denote year and industry fixed effects, respectively.[10] As we argue that firms with higher default probability may increase ESG investment during economic volatility, with signal-jamming motivation, it is reasonable to expect a positive coefficient for the interaction term *Distress* × *Uncertainty*.

In Table 5, we report the OLS regression estimates for the ESG investment pattern for firms with higher default probability during macroeconomic uncertainty. Panel A reports the estimates for the *Z score-Dummy*. In all specifications, except columns (5) and (6), coefficients on the interactive variable are positive and statistically significant. Firms with higher default probability increase their ESG investment during economic uncertainty by 0.54%, 0.63% and 1.64% (on a scale of 100) in columns (1), (3), and (7), respectively. The results remain statistically and economically consistent when we add control variables. In columns (5) and (6), we measure *Uncertainty* by the recession and the results are counterintuitive. This may be due to the fact that our other *Uncertainty* proxies measure expected high volatility, while the recession is real economic volatility. Hence, while firms face recession, real massive economic volatility, they may have little scope to revise their ESG investment policy immediately.

Panel B reports the estimates for the *CHS-Default Probability*, which are similar to Panel A. The results show that firms with higher distress likelihood increase their ESG investment during high economic volatility by 1%, 1.29% and 2.36% (on a scale of 100) in columns (1), (3) and (7) respectively and remain consistent when we add control variables.[11] Overall, the

[10] We also estimate this model by using firm fixed effects. For this, we use the first difference of the CSR investment only. The results are reported in the Appendix (Table A5) and remain consistent.

[11] We repeat this OLS estimations with continuous values of the *Uncertainty* and report the results in the Appendix (Table A6). The results remain qualitatively similar and significant (both economically and statistically). Moreover, we estimate this model with median classification of uncertainty and CHS-Default Probability and find the results, reported in the Appendix (Table A7), remain largely consistent.

results strongly support our argument that firms with higher default probability signal jam during economic uncertainty by increasing their investment in ESG activities.

5. Conclusion

We examine the risk-shifting incentives of ESG reputation by focusing on the investment decisions of firms with higher default probability during economic volatility. We use a number of alternative proxies of uncertainty and find that high ESG firms with higher default probability increase investment when volatility is high. We also use the BP oil spill event in 2010 as an exogenous shock to ESG performance, and our results confirm that ESG reputation affects risk-shifting incentives. Meanwhile, our alternative tests suggest that firms with higher distress likelihood increase ESG investment during economic volatility, which acts as a signal-jamming mechanism to hide firms' distressed economic condition from stakeholders and prevent predatory attacks. Finally, high ESG firms shift risk from shareholders to creditors and use ESG reputation as a signal-jamming mechanism to prioritize immediate payoffs instead of long-term firm value.

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Table 1: Summary Statistics

This table reports descriptive statistics for all sample firms analyzed in this paper from 2002 to 2016 (Panel A). Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms are excluded. We also report summary statistics for high ESG firms (Panel B), low ESG firms (Panel C), and no ESG firms (Panel D). We classify firms as high and low ESG firms by using a *Tercile classification* of annual ESG scores. All continuous variables are winsorized at the 1st and 99th percentiles. All the variables are described in the Appendix.

Panel A: All Firms

	N	***Mean***	***SD***	***10th Percentile***	***90th Percentile***
ESG	9523	52.9945	29.5955	15.0100	93.7300
Investment	42957	0.1332	0.1564	0.0250	0.2732
Cash Flow	43723	-0.2264	3.2150	-0.9769	1.0721
Market-to-Book	43723	1.5627	1.5845	0.3283	3.3568
Leverage	43723	0.1728	0.2013	0.0000	0.4489
Z score-Dummy	33703	0.1855	0.3887	0.0000	1.0000
Default probability (CHS)	43654	0.4096	2.0826	0.0199	0.3098

Panel B: High ESG Firms

	N	***Mean***	***SD***	***10th Percentile***	***90th Percentile***
ESG	2666	87.5605	11.0872	74.3200	96.0400
Investment	2684	0.0979	0.0680	0.0436	0.1648
Cash Flow	2691	0.4764	0.4728	0.1307	0.9605
Market-to-Book	2691	1.4732	1.0963	0.4790	2.8507
Leverage	2691	0.2118	0.1323	0.0460	0.3852
Z score-Dummy	2550	0.0612	0.2397	0.0000	0.0000
Default probability (CHS)	2691	0.0660	0.5634	0.0179	0.0525

Panel C: Low ESG Firms

	N	***Mean***	***SD***	***10th Percentile***	***90th Percentile***
ESG	2663	28.8606	15.0874	13.1000	49.5700
Investment	2684	0.1492	0.1492	0.0400	0.2890
Cash Flow	2705	0.4870	2.3429	0.0354	1.8460
Market-to-Book	2705	1.7522	1.6786	0.3920	3.7443
Leverage	2705	0.2371	0.2096	0.0000	0.5119
Z score-Dummy	2213	0.1672	0.3732	0.0000	1.0000
Default probability (CHS)	2704	0.1481	1.1289	0.0193	0.0964

Panel D: No ESG Firms

	N	*Mean*	*SD*	*10th Percentile*	*90th Percentile*
Investment	33458	0.1350	0.1648	0.0213	0.2848
Cash Flow	34200	-0.4108	3.4740	-1.5033	0.9974
Market-to-Book	34200	1.5407	1.6155	0.3044	3.3487
Leverage	34200	0.1597	0.2054	0.0000	0.4502
Z score-Dummy	25374	0.2085	0.4062	0.0000	1.0000
Default probability (CHS)	34135	0.4950	2.3033	0.0207	0.4083

Table 2: Univariate analysis for ESG, no-ESG, low-ESG, and high-ESG firms

This table shows the average values and differences in means of the main variables for firms with and without a ESG score in Panel A, and for firms with low and high ESG scores (based on Tercile classification) in Panel B for our sample firms during the period 2002 to 2016. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms are excluded. All continuous variables are winsorized at the 1% and 99% tails. All the variables are described in the Appendix. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: ESG and No ESG Firms

	no-ESG Firms		***ESG Firms***		
	N	***Mean***	***N***	***Mean***	***Difference***
ESG			9,523	52.9945	
Investment	33,458	0.1350	9,499	0.127	0.0080***
Cash Flow	34,200	-0.4108	9,523	0.4361	-0.8469***
Market-to-Book	34,200	1.5407	9,523	1.6415	-0.1008***
Leverage	34,200	0.1597	9,523	0.2199	-0.0602***
Z score-Dummy	25,374	0.2085	8,329	0.1156	0.0929***
Default probability (CHS)	34,135	0.4950	9,519	0.1030	0.3920***

Panel B: Low and High ESG Firms (Tercile Classification)

	Low-ESG Firms(Q1)		***High-ESG Firms(Q3)***		
	N	***Mean***	***N***	***Mean***	***Difference***
ESG	2,663	28.8606	2,666	87.5605	-58.6999***
Investment	2,684	0.1492	2,684	0.0979	0.0512***
Cash Flow	2,705	0.4870	2,691	0.4764	0.0106
Market-to-Book	2,705	1.7522	2,691	1.4732	0.2790***
Leverage	2,705	0.2371	2,691	0.2118	0.0252***
Z score-Dummy	2,213	0.1672	2,550	0.0612	0.1060***
Default probability (CHS)	2,704	0.1481	2,691	0.066	0..0821***

Table 3: ESG reputation and risk-shifting

This table presents the OLS regression results of ESG reputation and risk-shifting for our sample firms during the period 2002 to 2016. The dependent variable, *Investment Intensity,* is gross capital expenditures in a given year scaled by PP&E at the beginning of the year. As a measure of default probability, we use *Z score-Dummy* by using Altman's (1968) model (Panel A) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the *CHS-score associated default probability is in the top tercile in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4), Recession (in columns 5 and 6), and Inverted Consumer Sentiment Index (CSI) (in columns 7 and 8). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is in the top tercile in year *t* (classified as high volatility), and zero otherwise. *ESG* is a dummy variable set to one if firms have an annual equally-weighted ESG score in the top tercile in year *t-1*, and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1st and 99th percentiles. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	0.0344***	0.0152**	-0.0341***	-0.2355***	-0.0340***	0.0317***	-0.0159**	-0.0994**
	(0.0072)	(0.0067)	(0.0065)	(0.0483)	(0.0077)	(0.0083)	(0.0068)	(0.0409)
Z score-Dummy	-0.0689***	-0.0442***	-0.0781***	-0.0512***	-0.0638***	-0.0405***	-0.0534***	-0.0330***
	(0.0162)	(0.0142)	(0.0183)	(0.0163)	(0.0125)	(0.0112)	(0.0118)	(0.0116)
ESG-Dummy	0.0057	0.0038	-0.0006	0.0001	0.0011	0.0030	-0.0036	0.0015
	(0.0067)	(0.0062)	(0.0077)	(0.0060)	(0.0065)	(0.0056)	(0.0085)	(0.0068)

Uncertainty*Z score-Dummy*ESG-Dummy	0.0318**	0.0194*	0.0373**	0.0210*	0.0258**	0.0208*	0.0258**	0.0155
	(0.0131)	(0.0109)	(0.0149)	(0.0125)	(0.0129)	(0.0115)	(0.0108)	(0.0099)
Cash Flow		-0.0024		-0.0044		0.0090		0.0097
		(0.0208)		(0.0181)		(0.0180)		(0.0173)
Market-to-Book		0.0352***		0.0367***		0.0347***		0.0312***
		(0.0070)		(0.0071)		(0.0060)		(0.0067)
Leverage		-0.0152		-0.0141		-0.0286		-0.0119
		(0.0477)		(0.0468)		(0.0341)		(0.0421)
Default Spread		0.0305***		0.4432***		0.1548***		-1.3259***
		(0.0101)		(0.0897)		(0.0371)		(0.4965)
Recession		-0.0429***		-0.3246***		-0.1298***		1.2570***
		(0.0090)		(0.0650)		(0.0305)		(0.4744)
Constant	0.1008***	0.0280	0.1455***	-0.2556***	0.1427***	-0.1158**	0.1391***	1.5347***
	(0.0050)	(0.0218)	(0.0063)	(0.0729)	(0.0074)	(0.0490)	(0.0068)	(0.5453)
Observations	3,284	3,284	3,373	3,373	4,745	4,745	3,225	3,225
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0813	0.173	0.0961	0.193	0.0818	0.190	0.0675	0.153

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	0.0370***	0.0185***	-0.0417***	-0.2741***	-0.0344***	-0.0752***	-0.0160*	-0.0845

	(0.0079)	(0.0068)	(0.0078)	(0.0549)	(0.0077)	(0.0235)	(0.0089)	(0.0521)
CHS-Default Probability	-0.0765***	-0.0486***	-0.0769***	-0.0511***	-0.0720***	-0.0455***	-0.0721***	-0.0481***
	(0.0132)	(0.0124)	(0.0134)	(0.0124)	(0.0099)	(0.0087)	(0.0121)	(0.0114)
ESG-Dummy	0.0048	-0.0010	0.0000	-0.0026	-0.0010	-0.0031	-0.0079	-0.0085
	(0.0105)	(0.0085)	(0.0108)	(0.0087)	(0.0082)	(0.0071)	(0.0110)	(0.0100)
Uncertainty*CHS-Default Probability*ESG-Dummy	0.0314***	0.0188**	0.0356***	0.0231*	0.0223**	0.0150*	0.0385***	0.0273***
	(0.0102)	(0.0095)	(0.0130)	(0.0120)	(0.0089)	(0.0081)	(0.0110)	(0.0100)
Cash Flow		0.0193***		0.0172***		0.0225***		0.0251***
		(0.0050)		(0.0048)		(0.0053)		(0.0069)
Market-to-Book		0.0237***		0.0222***		0.0232***		0.0199***
		(0.0037)		(0.0038)		(0.0030)		(0.0027)
Leverage		-0.0328		-0.0427		-0.0448*		-0.0384
		(0.0358)		(0.0355)		(0.0249)		(0.0308)
Default Spread		0.0189**		0.4955***		0.1110***		-1.1568*
		(0.0084)		(0.0991)		(0.0381)		(0.6302)
Recession		-0.0363***		-0.3594***				1.0881*
		(0.0087)		(0.0718)				(0.6034)
Constant	0.1142***	0.0536***	0.1632***	-0.2683***	0.1537***	-0.0447	0.1634***	1.3769**
	(0.0071)	(0.0177)	(0.0080)	(0.0760)	(0.0075)	(0.0499)	(0.0087)	(0.6939)
Observations	2,459	2,459	2,533	2,533	3,561	3,561	2,425	2,425
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.132	0.204	0.140	0.199	0.126	0.206	0.123	0.193

Table 4: ESG reputation and risk-shifting (difference-in-differences)

This table reports the DiD estimates of ESG and risk-shifting. The dependent variable, *Investment Intensity,* is estimated by using the ratio of gross capital expenditures in a given year to PP&E at the beginning of the year. We measure ESG by using overall ESG score in Panel A and Environmental score in Panel B. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (columns 1 and 2) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (columns 3 and 4). *Z score-Dummy* is a dummy variable that equals one for firms with a Z-score below 1.81 at the beginning of the year (classified as firms with higher default probability), and zero otherwise. *CHS-Default Probability* is also a dummy variable that equals one if the CHS-score associated default probability is above the median value in year *t-1* (classified as firms with higher default probability), and zero otherwise. Here, we use the BP oil spill event as a source of uncertainty and an exogenous shock to firms' ESG performance. *ESG Disaster* is a dummy variable that equals one for the firms of the treated industries which are exposed to the BP oil spill in the years of the disaster and afterwards. We consider Oil and Gas Extraction industries (SIC=13) as the treatment industries. *ESG* is a binary variable that equals one for those firms with an annual ESG score above the median ESG score in year *t-1,* and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Overall ESG Score

	(1)	(2)	(3)	(4)
		SIC=13		
	Investment Intensity	Investment Intensity	Investment Intensity	Investment Intensity
ESG Disaster	-0.0365*	-0.0302	-0.0402*	-0.0341
	(0.0218)	(0.0217)	(0.0226)	(0.0221)
ESG	-0.0040	-0.0061	-0.0080*	-0.0092**
	(0.0037)	(0.0039)	(0.0046)	(0.0046)
Z score-Dummy	-0.0557***	-0.0391***		
	(0.0165)	(0.0124)		
ESG Disaster*Z score-Dummy*ESG	0.0444***	0.0334**		
	(0.0147)	(0.0143)		
CHS-Default Probability			-0.0331***	-0.0258***
			(0.0069)	(0.0063)
ESG Disaster*CHS-Default Probability*ESG			0.0168	0.0134
			(0.0202)	(0.0199)
Cash Flow		0.0268*		0.0091
		(0.0141)		(0.0060)
Market-to-Book		0.0172***		0.0180***
		(0.0053)		(0.0039)
Leverage		-0.0928*		-0.0761
		(0.0535)		(0.0511)

Default Spread		-0.0230**		-0.0447***
		(0.0114)		(0.0140)
Recession		0.0135		0.0291**
		(0.0095)		(0.0114)
Constant	0.1129***	0.1300***	0.1220***	0.1671***
	(0.0043)	(0.0204)	(0.0048)	(0.0207)
Observations	2,348	2,348	2,649	2,649
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj R-squared	0.0377	0.0773	0.0435	0.0737

Panel B: Environmental Score

	(1)	(2)	(3)	(4)
			SIC=13	
	Investment Intensity	Investment Intensity	Investment Intensity	Investment Intensity
ESG Disaster	-0.0366*	-0.0304	-0.0401*	-0.0341
	(0.0218)	(0.0217)	(0.0228)	(0.0223)
ESG-Dummy	-0.0085	-0.0064	-0.0072	-0.0048
	(0.0071)	(0.0071)	(0.0067)	(0.0068)
Z score-Dummy	-0.0553***	-0.0391***		
	(0.0165)	(0.0124)		
ESG Disaster*Z score-Dummy*ESG	0.0491***	0.0340**		
	(0.0161)	(0.0160)		
CHS-Default Probability			-0.0325***	-0.0254***
			(0.0068)	(0.0062)
ESG Disaster*CHS-Default Probability*ESG			0.0146	0.0105
			(0.0218)	(0.0221)
Cash Flow		0.0262*		0.0087
		(0.0137)		(0.0058)
Market-to-Book		0.0171***		0.0180***
		(0.0053)		(0.0039)
Leverage		-0.0907*		-0.0744
		(0.0539)		(0.0514)
Default Spread		-0.0233**		-0.0448***
		(0.0113)		(0.0140)
Recession		0.0137		0.0293**
		(0.0095)		(0.0115)
Constant	0.1152***	0.1302***	0.1214***	0.1647***
	(0.0056)	(0.0198)	(0.0056)	(0.0194)

Observations	2,348	2,348	2,649	2,649
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj R-squared	0.0386	0.0773	0.0431	0.0727

Table 5: ESG investment of firms with higher default probability during uncertainty (Uncertainty as a binary variable)

This table reports the OLS estimates of the ESG investment-volatility sensitivity of the firms with higher default probability. The dependent variable, *ESG Investment,* is estimated by the change in ESG score from year *t-1* to year *t*. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (Panel A) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the CHS-score associated default probability is in the top tercile in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4), Recession (in columns 5 and 6), and Inverted CSI (in columns 7 and 8). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is in the top tercile in year *t* (classified as high volatility), and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Industry and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	-4.8766***	-4.8789***	-0.6307**	-0.6434**	1.3454***	1.3621***	-4.3350***	-4.2865***
	(0.2581)	(0.2586)	(0.2838)	(0.2842)	(0.2793)	(0.2794)	(0.2926)	(0.2975)
Z score-Dummy	-0.8402***	-0.8570***	-0.9559***	-0.9434***	-0.8639***	-0.8412***	-2.0988***	-2.0564***
	(0.1896)	(0.1933)	(0.2156)	(0.2186)	(0.1084)	(0.1104)	(0.2408)	(0.2436)
Uncertainty*Z score-Dummy	0.5403**	0.5386**	0.6294**	0.6155**	0.4060	0.4080	1.6410***	1.6295***
	(0.2433)	(0.2434)	(0.2811)	(0.2813)	(0.3406)	(0.3407)	(0.2969)	(0.2971)
Cash Flow		-0.0204		-0.0300**		-0.0163		-0.0353*
		(0.0155)		(0.0145)		(0.0146)		(0.0204)

Market-to-Book		0.0301		0.1183**		0.0341		0.0450
		(0.0477)		(0.0554)		(0.0420)		(0.0586)
Leverage		0.3134		-0.0132		-0.4817		-0.8515
		(0.4528)		(0.5093)		(0.4164)		(0.5464)
Investment		-0.4420*		-0.4682*		-0.0455		-0.1394
		(0.2599)		(0.2811)		(0.2167)		(0.3014)
Constant	4.2884***	4.2776***	0.5485	0.5494	-0.5000	-0.4882	2.0885***	2.0693***
	(0.4108)	(0.4112)	(0.5354)	(0.5318)	(0.5300)	(0.5311)	(0.6974)	(0.6994)
Observations	20,835	20,835	20,247	20,247	29,048	29,048	18,356	18,356
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0256	0.0255	0.0240	0.0240	0.0381	0.0380	0.0398	0.0397

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	-4.3752***	-4.3903***	-0.9017***	-0.9014***	2.1245***	2.1385***	-4.9117***	-4.8537***
	(0.2925)	(0.2943)	(0.3150)	(0.3149)	(0.3544)	(0.3541)	(0.3483)	(0.3541)
CHS-Default Probability	-1.0255***	-1.0367***	-1.4568***	-1.4512***	-1.0222***	-1.0218***	-3.0016***	-2.9889***
	(0.1611)	(0.1622)	(0.1757)	(0.1763)	(0.0932)	(0.0943)	(0.2111)	(0.2115)
Uncertainty * CHS-Default Probability	1.0026***	0.9967***	1.2858***	1.2715***	-1.0562***	-1.0441***	2.3559***	2.3576***
	(0.2300)	(0.2301)	(0.2522)	(0.2518)	(0.3439)	(0.3442)	(0.2768)	(0.2770)

Cash Flow		-0.0229**		-0.0296***		-0.0197**		-0.0346**
		(0.0113)		(0.0109)		(0.0100)		(0.0139)
Market-to-Book		0.0147		0.0610		0.0081		0.0433
		(0.0341)		(0.0392)		(0.0302)		(0.0431)
Leverage		-0.0381		-0.3320		-0.6697		-1.1976**
		(0.4090)		(0.4608)		(0.4116)		(0.5459)
Investment		-0.3957*		-0.4139*		-0.2535		-0.2497
		(0.2260)		(0.2426)		(0.1873)		(0.2576)
Constant	3.7414***	3.7410***	1.2161***	1.2055***	-0.0783	-0.0878	3.5585***	3.5169***
	(0.2858)	(0.2906)	(0.4485)	(0.4517)	(0.3170)	(0.3223)	(0.5287)	(0.5397)
Observations	18,027	18,027	17,614	17,614	25,098	25,098	15,891	15,891
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0230	0.0229	0.0229	0.0228	0.0356	0.0356	0.0434	0.0434

Appendix A. Variables' Definitions

This table describes all the variables used in this paper.

Variables	**Definitions**
Expected market volatility	Measured by applying a GARCH (1,1) model to monthly returns of the NYSE Value-weighted market index.
EPU	The US composite EPU index of Baker et al. (2016).
Recession	The NBER recession indicator.
CSI	The inverted values of the Consumer Sentiment Index of the University of Michigan.
ESG	Equally weighted overall Environmental, Social, and Governance (ESG) score from Asset4.
ESG Disaster	A binary variable equal to one for the years 2011 and 2012 if the firms belong to the Oil and Gas Extraction industries (SIC=13).
Default Spread	Spread between the yields of long-term Baa and Aaa securities.
Investment Intensity	Gross capital expenditures (Compustat item CAPX) over gross plant, property, and equipment (Compustat item PPEGT) at the beginning of the year.
Market-to-Book	Market value of equity (Compustat item PRCC times item CSHO) over total assets (Compustat item AT).
Cash Flow	Operating income before depreciation (Compustat item OIBDP) over gross plant, property, and equipment (Compustat item PPEGT) at the beginning of the year.
Leverage	Long-term debt (Compustat item DLTT) over total assets (Compustat item AT).
Z score	Altman's (1968) Z-score computed as follows: Z-score = 3.3 × (item EBIT / item AT) + 1.2 × ((item ACT - item LCT) / item AT) + 0.999 × (item SALE / item AT) + 0.6 × ((item CSHO × item PRCC_F) / (item DLTT + item DLC)) + 1.4 × (item RE / item AT). All are Compustat items.
Z score-Dummy	A binary variable equal to one if the Z-score is below 1.81, otherwise it equals zero.
CHS-score	CHS score measured based on the coefficients of Column 4 in Table IV of Campbell et al. (2008).
Default probability (CHS)	(1 / (1 + exp(- CHS-score))) * 100

Table A1: ESG and risk-shifting – high vs low uncertainty based on medians classification

This table presents the OLS regression results of ESG reputation and risk-shifting. The dependent variable, *Investment Intensity*, is gross capital expenditures in a given year scaled by PP&E at the beginning of the year. To measure default probability, we use Altman's (1968) Z-score (Panel A) and Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the CHS-score associated default probability is above the median value in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4), Recession (in columns 5 and 6), and Inverted CSI (in columns 7 and 8). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is above median value in year *t* (classified as high volatility), and zero otherwise. *ESG* is a dummy variable set to one for firms having an annual ESG score above the median value of the annual ESG score in year *t-1*, and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	0.0351***	-0.0726***	-0.0312***	0.0445***	-0.0346***	-0.1116***	-0.0311***	0.0444***
	(0.0069)	(0.0155)	(0.0070)	(0.0101)	(0.0069)	(0.0228)	(0.0070)	(0.0101)
Z score-Dummy	-0.0545***	-0.0357***	-0.0579***	-0.0393***	-0.0535***	-0.0357***	-0.0579***	-0.0393***
	(0.0101)	(0.0096)	(0.0099)	(0.0094)	(0.0087)	(0.0084)	(0.0100)	(0.0095)
ESG-Dummy	-0.0026	-0.0032	-0.0036	-0.0041	-0.0024	-0.0032	-0.0036	-0.0042
	(0.0033)	(0.0031)	(0.0034)	(0.0031)	(0.0033)	(0.0031)	(0.0034)	(0.0032)
Uncertainty* Z score-Dummy* ESG-Dummy	0.0063	0.0025	0.0203**	0.0156**	0.0172*	0.0116	0.0193**	0.0152*
	(0.0079)	(0.0071)	(0.0083)	(0.0077)	(0.0091)	(0.0083)	(0.0086)	(0.0080)
Cash Flow		0.0279		0.0280		0.0279		0.0280

		(0.0179)		(0.0179)		(0.0179)		(0.0179)
Market-to-Book		0.0275***		0.0274***		0.0275***		0.0274***
		(0.0050)		(0.0050)		(0.0050)		(0.0050)
Leverage		-0.0208		-0.0199		-0.0207		-0.0201
		(0.0254)		(0.0254)		(0.0254)		(0.0254)
Default Spread		0.1747***		0.1716***		0.1738***		0.1712***
		(0.0344)		(0.0345)		(0.0345)		(0.0345)
Recession		-0.1410***		-0.1843***				-0.1837***
		(0.0286)		(0.0381)				(0.0381)
Constant	0.1071***	-0.0664**	0.1433***	-0.1341***	0.1423***	-0.1376***	0.1433***	-0.1335***
	(0.0029)	(0.0292)	(0.0065)	(0.0440)	(0.0064)	(0.0440)	(0.0065)	(0.0440)
Observations	7,146	7,146	7,146	7,146	7,146	7,146	7,146	7,146
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0792	0.172	0.0803	0.173	0.0794	0.172	0.0802	0.173

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	0.0383***	-0.0701***	-0.0319***	0.0455***	-0.0389***	-0.1093***	-0.0320***	0.0448***
	(0.0064)	(0.0154)	(0.0065)	(0.0099)	(0.0064)	(0.0212)	(0.0065)	(0.0100)
CHS-Default Probability	-0.0322***	-0.0184***	-0.0361***	-0.0216***	-0.0332***	-0.0195***	-0.0372***	-0.0224***
	(0.0038)	(0.0033)	(0.0038)	(0.0033)	(0.0034)	(0.0030)	(0.0040)	(0.0035)
ESG-Dummy	-0.0012	-0.0026	-0.0033	-0.0044	-0.0017	-0.0032	-0.0041	-0.0049

	(0.0035)	(0.0031)	(0.0035)	(0.0032)	(0.0034)	(0.0031)	(0.0036)	(0.0032)
Uncertainty* CHS-Default Probability* ESG-Dummy	-0.0015	-0.0021	0.0128***	0.0096***	0.0097*	0.0096*	0.0151***	0.0112***
	(0.0044)	(0.0039)	(0.0038)	(0.0036)	(0.0052)	(0.0052)	(0.0038)	(0.0035)
Cash Flow		0.0245***		0.0244***		0.0245***		0.0244***
		(0.0061)		(0.0061)		(0.0061)		(0.0061)
Market-to-Book		0.0276***		0.0275***		0.0276***		0.0275***
		(0.0038)		(0.0038)		(0.0038)		(0.0038)
Leverage		-0.0153		-0.0152		-0.0154		-0.0150
		(0.0215)		(0.0214)		(0.0215)		(0.0214)
Default Spread		0.1712***		0.1687***		0.1713***		0.1673***
		(0.0328)		(0.0325)		(0.0326)		(0.0326)
Recession		-0.1350***		-0.1800***				-0.1784***
		(0.0269)		(0.0360)				(0.0361)
Constant	0.1120***	-0.0627**	0.1520***	-0.1282***	0.1507***	-0.1325***	0.1526***	-0.1259***
	(0.0031)	(0.0275)	(0.0058)	(0.0418)	(0.0057)	(0.0419)	(0.0058)	(0.0420)
Observations	8,053	8,053	8,053	8,053	8,053	8,053	8,053	8,053
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0870	0.188	0.0880	0.188	0.0871	0.188	0.0884	0.188

Table A2: ESG and risk-shifting (Altman's Z-score) based on various ESG classifications

This table presents the OLS regression results of ESG reputation and risk-shifting. The dependent variable, *Investment Intensity*, is gross capital expenditures in a given year scaled by PP&E at the beginning of the year. To measure the default probability, we use Altman's (1968) model and construct a *Z score-Dummy* that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in Panel A), Economic Policy Uncertainty Index (in Panel B), Recession (in Panel C), and Inverted CSI (in Panel D). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is in the top tercile in year *t* (classified as high volatility), and zero otherwise. *ESG* is a continuous value in columns (1) and (2). In columns (3) and (4), ESG is a dummy variable that equals one if firms have a ESG score in year *t-1*, and zero otherwise. For columns (5) to (12), *ESG* is a dummy variable set to one if firms have an annual equally-weighted ESG score above the mean ESG score (in columns 5 and 6), above the median ESG score (in columns 7 and 8), in the top quartile (in columns 9 and 10) and in the top quantile (in columns 11 and 12) in year *t-1*, and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Expected Market Volatility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
Expected Market Volatility	0.0243***	0.0142***	0.0220***	0.0121***	0.0390***	0.0217***	0.0379***	0.0210***	0.0331***	0.0095	0.0295***	0.0114
	(0.0043)	(0.0040)	(0.0043)	(0.0040)	(0.0072)	(0.0071)	(0.0070)	(0.0070)	(0.0082)	(0.0075)	(0.0088)	(0.0085)
Z score-Dummy	-0.0625***	-0.0401***	-0.0627***	-0.0402***	-0.0566***	-0.0386***	-0.0572***	-0.0390***	-0.0788***	-0.0478**	-0.0695***	-0.0359**
	(0.0050)	(0.0048)	(0.0050)	(0.0048)	(0.0118)	(0.0111)	(0.0120)	(0.0114)	(0.0219)	(0.0187)	(0.0224)	(0.0171)
ESG	0.0001**	0.0001	-0.0012	-0.0057	0.0029	0.0008	0.0008	-0.0015	0.0118	0.0091	0.0204*	0.0184**
	(0.0001)	(0.0001)	(0.0054)	(0.0052)	(0.0039)	(0.0037)	(0.0038)	(0.0035)	(0.0089)	(0.0076)	(0.0106)	(0.0092)
Expected Market Volatility* Z score-Dummy* ESG	0.0003***	0.0002*	0.0161*	0.0102	0.0182**	0.0125	0.0187**	0.0129	0.0429**	0.0265	0.0412	0.0214

	(0.0001)	(0.0001)	(0.0093)	(0.0084)	(0.0092)	(0.0080)	(0.0094)	(0.0081)	(0.0203)	(0.0179)	(0.0266)	(0.0239)
Cash Flow		-0.0028		-0.0028		0.0194		0.0194		-0.0107		-0.0163
		(0.0024)		(0.0024)		(0.0216)		(0.0216)		(0.0202)		(0.0200)
Market-to-Book		0.0234***		0.0235***		0.0300***		0.0300***		0.0345***		0.0324***
		(0.0022)		(0.0022)		(0.0059)		(0.0059)		(0.0074)		(0.0083)
Leverage		-0.0523***		-0.0525***		-0.0236		-0.0239		-0.0509		-0.0501
		(0.0130)		(0.0130)		(0.0341)		(0.0340)		(0.0568)		(0.0658)
Default Spread		0.0206***		0.0203***		0.0268***		0.0268***		0.0353***		0.0280**
		(0.0059)		(0.0059)		(0.0077)		(0.0077)		(0.0118)		(0.0117)
Recession		-0.0399***		-0.0379***		-0.0429***		-0.0424***		-0.0435***		-0.0376***
		(0.0054)		(0.0054)		(0.0082)		(0.0080)		(0.0105)		(0.0114)
Constant	0.1141***	0.0761***	0.1172***	0.0794***	0.0991***	0.0305**	0.1005***	0.0320**	0.0984***	0.0366	0.0959***	0.0447
	(0.0033)	(0.0090)	(0.0034)	(0.0091)	(0.0036)	(0.0154)	(0.0035)	(0.0152)	(0.0064)	(0.0267)	(0.0075)	(0.0308)
Observations	21,546	21,546	21,546	21,546	4,942	4,942	4,942	4,942	2,451	2,451	1,958	1,958
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0579	0.0891	0.0576	0.0891	0.0790	0.162	0.0788	0.162	0.0806	0.166	0.0635	0.137

Panel B: EPU

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
EPU	-0.0372***	-0.2807***	-0.0355***	-0.2670***	-0.0333***	-0.2298***	-0.0330***	-0.2285***	-0.0321***	-0.2224***	-0.0319***	-0.1989***
	(0.0040)	(0.0305)	(0.0039)	(0.0303)	(0.0056)	(0.0427)	(0.0056)	(0.0427)	(0.0081)	(0.0606)	(0.0080)	(0.0629)
Z score-Dummy	-0.0644***	-0.0422***	-0.0639***	-0.0416***	-0.0630***	-0.0435***	-0.0634***	-0.0436***	-0.0965***	-0.0637***	-0.0839***	-0.0485**
	(0.0057)	(0.0054)	(0.0057)	(0.0054)	(0.0131)	(0.0122)	(0.0133)	(0.0124)	(0.0248)	(0.0213)	(0.0252)	(0.0196)
ESG	0.0002***	0.0001**	0.0030	-0.0022	0.0011	0.0000	0.0001	-0.0007	0.0068	0.0056	0.0102	0.0112

	(0.0001)	(0.0001)	(0.0059)	(0.0057)	(0.0037)	(0.0033)	(0.0036)	(0.0032)	(0.0108)	(0.0087)	(0.0152)	(0.0117)
EPU* Z score-Dummy* ESG	0.0003**	0.0002	0.0080	0.0018	0.0239**	0.0162*	0.0239**	0.0158*	0.0683***	0.0451**	0.0543*	0.0288
	(0.0001)	(0.0001)	(0.0103)	(0.0095)	(0.0101)	(0.0086)	(0.0101)	(0.0087)	(0.0250)	(0.0219)	(0.0325)	(0.0284)
Cash Flow		-0.0034		-0.0034		0.0154		0.0154		-0.0085		-0.0147
		(0.0025)		(0.0025)		(0.0206)		(0.0206)		(0.0185)		(0.0195)
Market-to-Book		0.0248***		0.0249***		0.0303***		0.0303***		0.0333***		0.0311***
		(0.0023)		(0.0023)		(0.0061)		(0.0061)		(0.0077)		(0.0084)
Leverage		-0.0467***		-0.0470***		-0.0255		-0.0257		-0.0461		-0.0562
		(0.0131)		(0.0130)		(0.0318)		(0.0318)		(0.0577)		(0.0669)
Default Spread		0.5141***		0.4901***		0.4290***		0.4268***		0.4225***		0.3730***
		(0.0562)		(0.0559)		(0.0776)		(0.0776)		(0.1121)		(0.1162)
Recession		-0.3810***		-0.3640***		-0.3111***		-0.3097***		-0.3126***		-0.2747***
		(0.0403)		(0.0401)		(0.0560)		(0.0559)		(0.0813)		(0.0841)
Constant	0.1588***	-0.2689***	0.1599***	-0.2494***	0.1421***	-0.2441***	0.1425***	-0.2421***	0.1435***	-0.2269**	0.1398***	-0.1837*
	(0.0027)	(0.0423)	(0.0028)	(0.0422)	(0.0056)	(0.0607)	(0.0056)	(0.0605)	(0.0074)	(0.0925)	(0.0092)	(0.0981)
Observations	20,980	20,980	20,980	20,980	5,077	5,077	5,077	5,077	2,515	2,515	2,005	2,005
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0657	0.0987	0.0651	0.0984	0.0906	0.176	0.0905	0.176	0.0999	0.173	0.0779	0.144

Panel C: Recession

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
Recession	-0.0348***	-0.1137***	-0.0341***	-0.1056***	-0.0349***	-0.1152***	-0.0346***	-0.1116***	-0.0269***	-0.0684***	-0.0229**	-0.0824***
	(0.0035)	(0.0124)	(0.0035)	(0.0123)	(0.0069)	(0.0234)	(0.0069)	(0.0228)	(0.0085)	(0.0238)	(0.0098)	(0.0278)

Z score-Dummy	-0.0640***	-0.0409***	-0.0644***	-0.0413***	-0.0535***	-0.0356***	-0.0535***	-0.0357***	-0.0730***	-0.0457***	-0.0719***	-0.0385***
	(0.0041)	(0.0039)	(0.0041)	(0.0039)	(0.0087)	(0.0083)	(0.0087)	(0.0084)	(0.0169)	(0.0143)	(0.0185)	(0.0144)
ESG-Dummy	0.0001**	0.0000	0.0006	-0.0050	0.0001	-0.0007	-0.0024	-0.0032	0.0035	0.0065	-0.0018	0.0049
	(0.0001)	(0.0001)	(0.0043)	(0.0040)	(0.0034)	(0.0032)	(0.0033)	(0.0031)	(0.0095)	(0.0074)	(0.0152)	(0.0110)
Recession* Z score-Dummy* ESG	0.0005***	0.0003***	0.0304***	0.0243***	0.0164*	0.0108	0.0172*	0.0116	0.0262	0.0221	0.0156	0.0119
	(0.0001)	(0.0001)	(0.0092)	(0.0089)	(0.0091)	(0.0082)	(0.0091)	(0.0083)	(0.0271)	(0.0252)	(0.0441)	(0.0414)
Cash Flow		-0.0030*		-0.0030*		0.0278		0.0279		-0.0035		-0.0082
		(0.0018)		(0.0018)		(0.0179)		(0.0179)		(0.0177)		(0.0183)
Market-to-Book		0.0253***		0.0254***		0.0275***		0.0275***		0.0338***		0.0366***
		(0.0018)		(0.0018)		(0.0050)		(0.0050)		(0.0064)		(0.0076)
Leverage		-0.0427***		-0.0427***		-0.0205		-0.0207		-0.0444		-0.0490
		(0.0108)		(0.0108)		(0.0254)		(0.0254)		(0.0422)		(0.0467)
Default Spread		0.1722***		0.1577***		0.1805***		0.1738***		0.1132***		0.1444***
		(0.0199)		(0.0199)		(0.0357)		(0.0345)		(0.0381)		(0.0447)
Constant	0.1403***	-0.1110***	0.1409***	-0.0912***	0.1414***	-0.1473***	0.1423***	-0.1376***	0.1372***	-0.0579	0.1413***	-0.0969
	(0.0026)	(0.0253)	(0.0026)	(0.0255)	(0.0063)	(0.0457)	(0.0064)	(0.0440)	(0.0074)	(0.0545)	(0.0096)	(0.0642)
Observations	30,093	30,093	30,093	30,093	7,146	7,146	7,146	7,146	3,536	3,536	2,818	2,818
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0551	0.0935	0.0551	0.0936	0.0792	0.172	0.0794	0.172	0.0824	0.180	0.0711	0.173

Panel D: CSI

	(1) ESG	(2) ESG	(3) ESG/No ESG	(4) ESG/No ESG	(5) Mean	(6) Mean	(7) Median	(8) Median	(9) Quartile	(10) Quartile	(11) Quantile	(12) Quantile
CSI	-0.0186***	-0.1751***	-0.0175***	-0.1652***	-0.0144***	-0.1253***	-0.0139***	-0.1176***	-0.0069	-0.0501	-0.0118	-0.0648
	(0.0038)	(0.0250)	(0.0036)	(0.0241)	(0.0051)	(0.0332)	(0.0051)	(0.0325)	(0.0074)	(0.0461)	(0.0084)	(0.0549)

Z score-Dummy	-0.0621***	-0.0426***	-0.0622***	-0.0428***	-0.0509***	-0.0354***	-0.0512***	-0.0355***	-0.0593***	-0.0321*	-0.0596***	-0.0291*
	(0.0049)	(0.0051)	(0.0050)	(0.0051)	(0.0084)	(0.0083)	(0.0085)	(0.0084)	(0.0179)	(0.0164)	(0.0192)	(0.0174)
ESG-Dummy	0.0002***	0.0001	0.0062	0.0003	-0.0021	-0.0027	-0.0048	-0.0053	-0.0015	0.0066	-0.0195	-0.0053
	(0.0001)	(0.0001)	(0.0045)	(0.0043)	(0.0036)	(0.0037)	(0.0036)	(0.0035)	(0.0141)	(0.0107)	(0.0240)	(0.0172)
CSI* Z score-Dummy* ESG	0.0003***	0.0002**	0.0175**	0.0124	0.0147*	0.0108	0.0150*	0.0107	0.0469**	0.0277	0.0446*	0.0226
	(0.0001)	(0.0001)	(0.0084)	(0.0077)	(0.0078)	(0.0073)	(0.0078)	(0.0073)	(0.0186)	(0.0175)	(0.0228)	(0.0213)
Cash Flow		-0.0034		-0.0034		0.0330		0.0330		-0.0031		-0.0092
		(0.0023)		(0.0023)		(0.0203)		(0.0203)		(0.0170)		(0.0205)
Market-to-Book		0.0231***		0.0231***		0.0212***		0.0212***		0.0305***		0.0310***
		(0.0023)		(0.0023)		(0.0052)		(0.0052)		(0.0077)		(0.0087)
Leverage		-0.0278**		-0.0277**		-0.0142		-0.0143		-0.0180		-0.0222
		(0.0122)		(0.0122)		(0.0310)		(0.0310)		(0.0536)		(0.0592)
Recession		2.1616***		2.0483***		1.5538***		1.4588***		0.7513		0.9063
		(0.2924)		(0.2850)		(0.3904)		(0.3811)		(0.5527)		(0.6633)
Default Spread		-2.2738***		-2.1557***		-1.6309***		-1.5318***		-0.8005		-0.9567
		(0.3053)		(0.2976)		(0.4083)		(0.3985)		(0.5785)		(0.6949)
Constant	0.1471***	2.6110***	0.1471***	2.4813***	0.1369***	1.8770***	0.1378***	1.7690***	0.1337***	0.9564	0.1442***	1.1367
	(0.0025)	(0.3369)	(0.0026)	(0.3282)	(0.0045)	(0.4487)	(0.0046)	(0.4379)	(0.0068)	(0.6303)	(0.0113)	(0.7565)
Observations	19,025	19,025	19,025	19,025	4,866	4,866	4,866	4,866	2,398	2,398	1,909	1,909
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0577	0.0911	0.0574	0.0910	0.0696	0.146	0.0700	0.146	0.0588	0.126	0.0544	0.120

Table A3: ESG and risk-shifting (CHS-default probability) based on various ESG classifications

This table reports the OLS estimates of ESG reputation and risk-shifting. The dependent variable, *Investment Intensity*, is estimated by using the ratio of gross capital expenditures in a given year to PP&E at the beginning of the year. As a measure of default probability, we use *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score. *CHS-Default Probability* is also a dummy variable that equals one if the CHS-score associated default probability is in the top tercile in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in Panel A), Economic Policy Uncertainty Index (in Panel B), Recession (in Panel C), and Inverted CSI (in Panel D). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is in the top tercile in year *t* (classified as high volatility), and zero otherwise. *ESG* is a continuous value in columns (1) and (2). In columns (3) and (4), ESG is a dummy variable that equals one if firms have a ESG score in year *t-1*, and zero otherwise. For columns (5) to (12), ESG is a dummy variable that equals one if firms have an annual ESG score above the mean ESG score (in columns 5 and 6), above the median ESG score (in columns 7 and 8), in the top quartile (in columns 9 and 10) and in the top quantile (in columns 11 and 12) in year *t-1*, and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Expected Market Volatility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
Expected Market Volatility	0.0193***	0.0100**	0.0170***	0.0077	0.0380***	0.0216***	0.0378***	0.0216***	0.0373***	0.0170**	0.0338***	0.0156
	(0.0051)	(0.0050)	(0.0050)	(0.0050)	(0.0071)	(0.0073)	(0.0071)	(0.0073)	(0.0097)	(0.0082)	(0.0105)	(0.0098)
CHS-Default Probability	-0.0712***	-0.0620***	-0.0713***	-0.0620***	-0.0657***	-0.0386***	-0.0670***	-0.0395***	-0.0847***	-0.0576***	-0.0923***	-0.0677***
	(0.0040)	(0.0042)	(0.0041)	(0.0042)	(0.0089)	(0.0082)	(0.0090)	(0.0083)	(0.0182)	(0.0171)	(0.0249)	(0.0250)
ESG	0.0000	0.0000	-0.0111	-0.0143**	-0.0023	-0.0040	-0.0041	-0.0054	0.0187	0.0108	0.0059	0.0003
	(0.0001)	(0.0001)	(0.0071)	(0.0069)	(0.0049)	(0.0043)	(0.0049)	(0.0045)	(0.0142)	(0.0104)	(0.0155)	(0.0130)
Expected Market Volatility*CHS-	0.0004***	0.0004***	0.0176***	0.0149**	0.0254***	0.0191***	0.0283***	0.0208***	0.0326***	0.0203*	0.0440**	0.0301*

Default Probability* ESG												
	(0.0001)	(0.0001)	(0.0060)	(0.0062)	(0.0071)	(0.0065)	(0.0071)	(0.0065)	(0.0124)	(0.0119)	(0.0179)	(0.0165)
Cash Flow		-0.0040**		-0.0040**		0.0268***		0.0267***		0.0158***		0.0112*
		(0.0018)		(0.0018)		(0.0053)		(0.0053)		(0.0058)		(0.0062)
Market-to-Book		0.0209***		0.0210***		0.0228***		0.0228***		0.0215***		0.0227***
		(0.0020)		(0.0020)		(0.0030)		(0.0030)		(0.0044)		(0.0047)
Leverage		-0.0501***		-0.0499***		0.0004		0.0004		-0.0570		-0.0205
		(0.0150)		(0.0150)		(0.0291)		(0.0290)		(0.0463)		(0.0546)
Default Spread		0.0213***		0.0213***		0.0217***		0.0219***		0.0199**		0.0227**
		(0.0078)		(0.0078)		(0.0064)		(0.0064)		(0.0095)		(0.0107)
Recession		-0.0388***		-0.0367***		-0.0372***		-0.0377***		-0.0358***		-0.0346***
		(0.0068)		(0.0067)		(0.0083)		(0.0082)		(0.0105)		(0.0120)
Constant	0.1448***	0.1002***	0.1484***	0.1038***	0.1162***	0.0409***	0.1173***	0.0417***	0.1108***	0.0618***	0.1192***	0.0592**
	(0.0042)	(0.0103)	(0.0043)	(0.0103)	(0.0042)	(0.0135)	(0.0041)	(0.0135)	(0.0097)	(0.0221)	(0.0106)	(0.0262)
Observations	18,678	18,678	18,678	18,678	3,690	3,690	3,690	3,690	1,871	1,871	1,495	1,495
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0686	0.101	0.0686	0.101	0.122	0.209	0.123	0.209	0.131	0.190	0.129	0.182

Panel B: EPU

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
EPU	-0.0443***	-0.3049***	-0.0425***	-0.2898***	-0.0442***	-0.2902***	-0.0443***	-0.2916***	-0.0383***	-0.2515***	-0.0326***	-0.2354***
	(0.0051)	(0.0366)	(0.0051)	(0.0362)	(0.0071)	(0.0471)	(0.0071)	(0.0471)	(0.0096)	(0.0684)	(0.0090)	(0.0672)

CHS-Default Probability	-0.0688***	-0.0604***	-0.0687***	-0.0602***	-0.0666***	-0.0403***	-0.0676***	-0.0408***	-0.0901***	-0.0663***	-0.0945***	-0.0728***
	(0.0044)	(0.0046)	(0.0044)	(0.0046)	(0.0092)	(0.0083)	(0.0093)	(0.0084)	(0.0194)	(0.0179)	(0.0250)	(0.0242)
ESG	0.0002**	0.0001	-0.0036	-0.0092	-0.0018	-0.0025	-0.0017	-0.0018	0.0120	0.0068	-0.0046	-0.0091
	(0.0001)	(0.0001)	(0.0075)	(0.0072)	(0.0045)	(0.0040)	(0.0046)	(0.0041)	(0.0181)	(0.0133)	(0.0200)	(0.0175)
EPU*CHS-Default Probability* ESG	0.0003***	0.0003***	0.0126*	0.0110	0.0255***	0.0193***	0.0276***	0.0201***	0.0450**	0.0322*	0.0308	0.0169
	(0.0001)	(0.0001)	(0.0075)	(0.0074)	(0.0077)	(0.0072)	(0.0077)	(0.0072)	(0.0199)	(0.0191)	(0.0339)	(0.0323)
Cash Flow		-0.0044**		-0.0043**		0.0254***		0.0253***		0.0113**		0.0068
		(0.0019)		(0.0019)		(0.0049)		(0.0049)		(0.0056)		(0.0057)
Market-to-Book		0.0225***		0.0227***		0.0215***		0.0215***		0.0207***		0.0235***
		(0.0022)		(0.0022)		(0.0029)		(0.0029)		(0.0044)		(0.0047)
Leverage		-0.0493***		-0.0491***		-0.0148		-0.0145		-0.0620		-0.0264
		(0.0153)		(0.0153)		(0.0260)		(0.0260)		(0.0457)		(0.0529)
Default Spread		0.5548***		0.5283***		0.5270***		0.5296***		0.4585***		0.4334***
		(0.0671)		(0.0665)		(0.0842)		(0.0842)		(0.1228)		(0.1221)
Recession		-0.4109***		-0.3920***		-0.3785***		-0.3806***		-0.3343***		-0.3151***
		(0.0482)		(0.0477)		(0.0605)		(0.0605)		(0.0888)		(0.0888)
Constant	0.1929***	-0.2738***	0.1947***	-0.2517***	0.1660***	-0.3020***	0.1661***	-0.3041***	0.1590***	-0.2325**	0.1638***	-0.2154**
	(0.0039)	(0.0499)	(0.0040)	(0.0494)	(0.0068)	(0.0630)	(0.0069)	(0.0630)	(0.0109)	(0.0952)	(0.0139)	(0.0980)
Observations	18,285	18,285	18,285	18,285	3,798	3,798	3,798	3,798	1,922	1,922	1,542	1,542
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0674	0.101	0.0670	0.101	0.129	0.209	0.130	0.210	0.142	0.190	0.143	0.194

Panel C: Recession

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
Recession	-0.0334***	-0.1112***	-0.0328***	-0.1037***	-0.0377***	-0.1086***	-0.0379***	-0.1078***	-0.0374***	-0.0707**	-0.0325***	-0.0606*
	(0.0041)	(0.0145)	(0.0041)	(0.0144)	(0.0074)	(0.0252)	(0.0074)	(0.0249)	(0.0092)	(0.0293)	(0.0105)	(0.0351)
CHS-Default Probability	-0.0701***	-0.0597***	-0.0702***	-0.0598***	-0.0663***	-0.0402***	-0.0665***	-0.0404***	-0.0777***	-0.0538***	-0.0874***	-0.0641***
	(0.0034)	(0.0035)	(0.0034)	(0.0035)	(0.0070)	(0.0062)	(0.0071)	(0.0062)	(0.0133)	(0.0120)	(0.0179)	(0.0170)
ESG	0.0000	-0.0000	-0.0038	-0.0103**	-0.0041	-0.0053	-0.0059	-0.0071*	0.0161*	0.0140*	0.0084	0.0054
	(0.0001)	(0.0001)	(0.0051)	(0.0048)	(0.0041)	(0.0038)	(0.0041)	(0.0038)	(0.0097)	(0.0073)	(0.0116)	(0.0091)
Recession*CHS-Default Probability* ESG	0.0004***	0.0003***	0.0179***	0.0159**	0.0270***	0.0295***	0.0273***	0.0294***	0.0178	0.0088	0.0357*	0.0239
	(0.0001)	(0.0001)	(0.0067)	(0.0071)	(0.0086)	(0.0098)	(0.0085)	(0.0097)	(0.0140)	(0.0123)	(0.0202)	(0.0172)
Cash Flow		-0.0044***		-0.0044***		0.0292***		0.0292***		0.0168***		0.0120**
		(0.0015)		(0.0015)		(0.0050)		(0.0050)		(0.0050)		(0.0050)
Market-to-Book		0.0232***		0.0233***		0.0201***		0.0201***		0.0210***		0.0220***
		(0.0017)		(0.0017)		(0.0025)		(0.0025)		(0.0038)		(0.0044)
Leverage		-0.0492***		-0.0493***		-0.0104		-0.0104		-0.0610*		-0.0426
		(0.0116)		(0.0116)		(0.0224)		(0.0224)		(0.0330)		(0.0387)
Default Spread		0.1686***		0.1554***		0.1652***		0.1629***		0.0966**		0.0841
		(0.0235)		(0.0235)		(0.0386)		(0.0379)		(0.0475)		(0.0573)
Constant	0.1639***	-0.0871***	0.1645***	-0.0689**	0.1566***	-0.1163**	0.1577***	-0.1121**	0.1508***	-0.0187	0.1554***	0.0011
	(0.0033)	(0.0297)	(0.0033)	(0.0297)	(0.0069)	(0.0482)	(0.0072)	(0.0471)	(0.0085)	(0.0642)	(0.0105)	(0.0772)
Observations	26,070	26,070	26,070	26,070	5,311	5,311	5,311	5,311	2,702	2,702	2,176	2,176
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0618	0.101	0.0618	0.102	0.121	0.205	0.122	0.206	0.125	0.189	0.128	0.186

Panel D: CSI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ESG	ESG	ESG/No ESG	ESG/No ESG	Mean	Mean	Median	Median	Quartile	Quartile	Quantile	Quantile
CSI	-0.0215***	-0.2095***	-0.0207***	-0.1993***	-0.0129*	-0.1263***	-0.0135*	-0.1236***	-0.0162*	-0.0567	-0.0085	0.0059
	(0.0051)	(0.0319)	(0.0049)	(0.0314)	(0.0073)	(0.0424)	(0.0071)	(0.0411)	(0.0093)	(0.0612)	(0.0086)	(0.0650)
CHS-Default Probability	-0.0588***	-0.0510***	-0.0585***	-0.0508***	-0.0748***	-0.0497***	-0.0762***	-0.0507***	-0.0799***	-0.0583***	-0.0883***	-0.0680***
	(0.0042)	(0.0047)	(0.0043)	(0.0047)	(0.0097)	(0.0082)	(0.0098)	(0.0083)	(0.0180)	(0.0167)	(0.0237)	(0.0222)
ESG	0.0001	0.0000	0.0054	-0.0032	-0.0071	-0.0084	-0.0094*	-0.0108**	0.0163	0.0168	-0.0038	-0.0041
	(0.0001)	(0.0001)	(0.0057)	(0.0054)	(0.0054)	(0.0051)	(0.0055)	(0.0053)	(0.0131)	(0.0104)	(0.0159)	(0.0136)
CSI*CHS-Default Probability* ESG	0.0003***	0.0002***	0.0086	0.0067	0.0349***	0.0300***	0.0381***	0.0319***	0.0559***	0.0404***	0.0552***	0.0409**
	(0.0001)	(0.0001)	(0.0072)	(0.0073)	(0.0086)	(0.0077)	(0.0086)	(0.0077)	(0.0168)	(0.0153)	(0.0200)	(0.0183)
Cash Flow		-0.0048***		-0.0048***		0.0298***		0.0298***		0.0177***		0.0170**
		(0.0018)		(0.0018)		(0.0066)		(0.0066)		(0.0068)		(0.0071)
Market-to-Book		0.0222***		0.0223***		0.0169***		0.0168***		0.0204***		0.0203***
		(0.0022)		(0.0022)		(0.0026)		(0.0026)		(0.0033)		(0.0036)
Leverage		-0.0372***		-0.0371***		-0.0119		-0.0120		-0.0459		-0.0357
		(0.0139)		(0.0139)		(0.0262)		(0.0262)		(0.0427)		(0.0464)
Default Spread		-2.7526***		-2.6313***		-1.7292***		-1.6833***		-0.7895		-0.0485
		(0.3859)		(0.3822)		(0.5089)		(0.4928)		(0.7544)		(0.8213)
Recession		2.6161***		2.4998***		1.6401***		1.5961***		0.7392		0.0309
		(0.3696)		(0.3660)		(0.4876)		(0.4722)		(0.7227)		(0.7863)

Constant	0.1755***	3.1574***	0.1753***	3.0243***	0.1624***	2.0032***	0.1640***	1.9547***	0.1531***	0.9675	0.1558***	0.1568
	(0.0037)	(0.4267)	(0.0038)	(0.4225)	(0.0061)	(0.5597)	(0.0064)	(0.5421)	(0.0077)	(0.8269)	(0.0094)	(0.8970)
Observations	16,509	16,509	16,509	16,509	3,603	3,603	3,603	3,603	1,841	1,841	1,485	1,485
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0552	0.0937	0.0550	0.0935	0.123	0.206	0.125	0.207	0.122	0.183	0.130	0.187

Table A4: ESG and risk-shifting (DiD)

This table reports the DiD estimates of ESG and risk-shifting. The dependent variable, *Investment Intensity*, is estimated by using the ratio of gross capital expenditures in a given year to PP&E at the beginning of the year. We measure ESG by using the overall ESG score in Panel A and Environmental score in Panel B. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (columns 1 and 2) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (columns 3 and 4). *Z score-Dummy* is a dummy variable that equals one for firms with a Z-score below 1.81 at the beginning of the year (classified as firms with higher default probability), and zero otherwise. *CHS-Default Probability* is also a dummy variable that equals one if the CHS-score associated default probability is above the median value in year *t-1* (classified as firms with higher default probability), and zero otherwise. Here, we use the BP oil spill event as a source of uncertainty and an exogenous shock to firms' ESG performance. *ESG Disaster* is a dummy variable that equals one for the firms of the treated industries which are exposed to the BP oil spill in the year of the disaster and afterwards. We consider Oil and Gas Extraction industries (SIC=13) and Petroleum Refining and Related Industries (SIC=29) as the treatment industry. *ESG* is a binary variable that equals one for those firms with an annual ESG score above the median ESG score in year *t-1*, and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Firm and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Overall ESG Score

	(1)	(2)	(3)	(4)
		SIC=13 & SIC=29		
	Investment Intensity	Investment Intensity	Investment Intensity	Investment Intensity
ESG Disaster	-0.0287	-0.0248	-0.0344*	-0.0297
	(0.0185)	(0.0183)	(0.0193)	(0.0189)
ESG	-0.0040	-0.0061	-0.0079*	-0.0091**
	(0.0037)	(0.0039)	(0.0046)	(0.0046)
Z score-Dummy	-0.0557***	-0.0389***		
	(0.0165)	(0.0124)		
ESG Disaster* Z score-Dummy *ESG	0.0394***	0.0297**		
	(0.0125)	(0.0122)		
CHS-Default Probability			-0.0335***	-0.0261***
			(0.0069)	(0.0064)
ESG Disaster* CHS-Default Probability *ESG			0.0131	0.0107
			(0.0187)	(0.0184)
Cash Flow		0.0273*		0.0092
		(0.0140)		(0.0060)
Market-to-Book		0.0173***		0.0181***

		(0.0053)		(0.0039)
Leverage		-0.0942*		-0.0773
		(0.0538)		(0.0513)
Default Spread		-0.0229**		-0.0445***
		(0.0114)		(0.0140)
Recession		0.0134		0.0288**
		(0.0095)		(0.0114)
Constant	0.1129***	0.1297***	0.1221***	0.1672***
	(0.0043)	(0.0204)	(0.0048)	(0.0207)
Observations	2,348	2,348	2,649	2,649
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj R-squared	0.0355	0.0762	0.0426	0.0732

Panel B: Environmental Score

	(1)	(2)	(3)	(4)
		SIC=13 & SIC=29		
	Investment Intensity	Investment Intensity	Investment Intensity	Investment Intensity
ESG Disaster	-0.0287	-0.0250	-0.0343*	-0.0297
	(0.0185)	(0.0183)	(0.0194)	(0.0190)
ESG	-0.0084	-0.0063	-0.0070	-0.0046
	(0.0071)	(0.0071)	(0.0066)	(0.0068)
Z score-Dummy	-0.0553***	-0.0390***		
	(0.0165)	(0.0124)		
ESG Disaster* Z score-Dummy *ESG	0.0438***	0.0302**		
	(0.0141)	(0.0140)		
CHS-Default Probability			-0.0329***	-0.0257***
			(0.0068)	(0.0063)
ESG Disaster* CHS-Default Probability *ESG			0.0104	0.0074
			(0.0199)	(0.0203)
Cash Flow		0.0267*		0.0088
		(0.0136)		(0.0058)
Market-to-Book		0.0173***		0.0180***
		(0.0053)		(0.0039)
Leverage		-0.0922*		-0.0756
		(0.0542)		(0.0517)
Default Spread		-0.0232**		-0.0446***
		(0.0114)		(0.0140)
Recession		0.0137		0.0290**
		(0.0095)		(0.0115)

Constant	0.1151***	0.1299***	0.1214***	0.1647***
	(0.0056)	(0.0198)	(0.0056)	(0.0194)
Observations	2,348	2,348	2,649	2,649
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Adj R-squared	0.0364	0.0761	0.0422	0.0722

Table A5: ESG investment of firms with higher default probability during uncertainty

This table reports the OLS estimates of the ESG investment-volatility sensitivity of the firms with higher default probability. The dependent variable, *ESG Investment*, is estimated by the change in ESG score from year *t-1* to year *t*. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (Panel A) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the CHS-score associated default probability is in the top tercile in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4), Recession (in columns 5 and 6), and Inverted CSI (in columns 7 and 8). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is in the top tercile in year *t* (classified as high volatility), and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Industry and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	-4.1880***	-4.1332***	-1.7379***	-1.7629***	0.7716***	0.7975***	-5.9607***	-5.9308***
	(0.2943)	(0.2963)	(0.3406)	(0.3449)	(0.2956)	(0.2967)	(0.3553)	(0.3616)
Z score-Dummy	-0.5805**	-0.7762***	-0.5060	-0.6565*	-0.4097**	-0.3875**	-1.4589***	-1.4027***
	(0.2493)	(0.2751)	(0.3099)	(0.3413)	(0.1686)	(0.1904)	(0.3401)	(0.3701)
Uncertainty * Z score-Dummy	0.5150*	0.5464**	0.7425**	0.7535**	0.5690	0.5726	1.8055***	1.7936***
	(0.2743)	(0.2749)	(0.3539)	(0.3555)	(0.3816)	(0.3813)	(0.3725)	(0.3737)
Cash Flow		-0.0047		-0.0184		0.0036		0.0030
		(0.0188)		(0.0208)		(0.0174)		(0.0282)
Market-to-Book		0.0146		0.0379		0.0948*		0.0807
		(0.0616)		(0.0715)		(0.0505)		(0.0783)

Leverage		1.1783**		0.9373		0.2221		-0.1775
		(0.5237)		(0.5892)		(0.4428)		(0.6430)
Investment		-0.4932		-0.9393***		-0.2939		-0.7790*
		(0.3485)		(0.3355)		(0.2544)		(0.4208)
Constant	4.4855***	4.2751***	1.7707***	1.6894***	0.6131***	0.4938***	4.0950***	4.0950***
	(0.2367)	(0.2721)	(0.2594)	(0.3204)	(0.1251)	(0.1614)	(0.2496)	(0.3133)
Observations	21,876	21,876	21,311	21,311	30,547	30,547	19,294	19,294
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0241	0.0241	0.0236	0.0236	0.0346	0.0346	0.0392	0.0391

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	Recession	Recession	CSI	CSI
Uncertainty	-4.0333***	-3.9821***	-1.7146***	-1.7415***	1.6974***	1.7095***	-6.2300***	-6.1978***
	(0.3364)	(0.3384)	(0.3828)	(0.3875)	(0.3706)	(0.3705)	(0.4294)	(0.4361)
CHS-Default Probability	-0.3524*	-0.4453**	-0.5568**	-0.6270***	0.1797	0.1910	-1.7227***	-1.6831***
	(0.1933)	(0.1958)	(0.2175)	(0.2203)	(0.1548)	(0.1593)	(0.3017)	(0.3105)
Uncertainty * CHS-Default Probability	1.1191***	1.1239***	1.8091***	1.7994***	-1.0998***	-1.0907***	2.9879***	2.9828***
	(0.2568)	(0.2565)	(0.3080)	(0.3071)	(0.3549)	(0.3549)	(0.3491)	(0.3491)
Cash Flow		-0.0134		-0.0217		0.0043		0.0077
		(0.0152)		(0.0157)		(0.0119)		(0.0180)
Market-to-Book		0.0077		0.0104		0.0428		0.0527

		(0.0453)		(0.0534)		(0.0412)		(0.0695)
Leverage		0.7795		0.4404		-0.0648		-0.6002
		(0.5263)		(0.5932)		(0.4696)		(0.7264)
Investment		-0.8019**		-0.9227***		-0.3167		-0.7267**
		(0.3186)		(0.2989)		(0.2566)		(0.3706)
Constant	3.7644***	3.7354***	1.2966***	1.3829***	0.2262	0.2209	4.2345***	4.3067***
	(0.2621)	(0.2973)	(0.2814)	(0.3472)	(0.1446)	(0.1777)	(0.3127)	(0.3786)
Observations	19,002	19,002	18,614	18,614	26,512	26,512	16,771	16,771
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0215	0.0216	0.0213	0.0214	0.0295	0.0294	0.0379	0.0378

Table A6: ESG investment of firms with higher default probability during uncertainty (uncertainty as a continuous variable)

This table reports the OLS estimates of the ESG investment-volatility sensitivity of the firms with higher default probability. The dependent variable, *ESG Investment*, is estimated by the change in ESG score from year *t-1* to year *t*. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (Panel A) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the CHS-score associated default probability is in the top tercile in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4) and Inverted CSI (in columns 5 and 6). Here, *Uncertainty* is a continuous variable. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Industry and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	CSI	CSI
Uncertainty	-35.7440***	-35.7913***	1.8088***	1.8112***	-113.1498***	-113.2982***
	(1.4721)	(1.4744)	(0.0748)	(0.0749)	(4.6593)	(4.6652)
Z score-Dummy	-1.1778***	-1.1536***	-1.8015***	-1.7624***	-3.4450***	-3.4050***
	(0.1732)	(0.1738)	(0.4408)	(0.4430)	(0.8677)	(0.8693)
Uncertainty * Z score-Dummy	1.7785***	1.7714***	0.0087**	0.0086**	2.1173***	2.1028***
	(0.6419)	(0.6417)	(0.0036)	(0.0036)	(0.6982)	(0.6985)
Cash Flow		-0.0165		-0.0147		-0.0164
		(0.0145)		(0.0146)		(0.0145)
Market-to-Book		0.0323		0.0339		0.0332
		(0.0420)		(0.0420)		(0.0420)

Leverage		-0.4760		-0.4523		-0.4594
		(0.4161)		(0.4167)		(0.4164)
Investment		-0.0401		-0.0469		-0.0510
		(0.2168)		(0.2167)		(0.2167)
Constant	11.1462***	11.1732***	-191.0312***	-191.2738***	128.7193***	128.8994***
	(0.6793)	(0.6797)	(7.9476)	(7.9598)	(5.2944)	(5.2999)
Observations	29,048	29,048	29,048	29,048	29,048	29,048
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0383	0.0382	0.0382	0.0381	0.0383	0.0382

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	CSI	CSI
Uncertainty	-29.0786***	-29.2344***	1.4388***	1.4463***	-91.0687***	-91.5415***
	(1.4930)	(1.4902)	(0.0739)	(0.0737)	(4.6114)	(4.5994)
CHS-Default Probability	-1.4933***	-1.4931***	-3.3283***	-3.3177***	-3.9051***	-3.9118***
	(0.1522)	(0.1522)	(0.3534)	(0.3532)	(0.8190)	(0.8194)
Uncertainty * CHS-Default Probability	1.6488**	1.6647**	0.0190***	0.0189***	2.1905***	2.1976***
	(0.6470)	(0.6482)	(0.0029)	(0.0029)	(0.6595)	(0.6596)
Cash Flow		-0.0232**		-0.0220**		-0.0227**
		(0.0100)		(0.0099)		(0.0100)

Market-to-Book		0.0069		0.0020		0.0084
		(0.0301)		(0.0301)		(0.0302)
Leverage		-0.7395*		-0.6447		-0.7082*
		(0.4120)		(0.4103)		(0.4098)
Investment		-0.2445		-0.2623		-0.2662
		(0.1866)		(0.1868)		(0.1868)
Constant	9.4105***	9.4510***	-151.5364***	-152.3333***	104.0585***	104.5882***
	(0.5302)	(0.5325)	(7.8366)	(7.8146)	(5.2290)	(5.2154)
Observations	25,098	25,098	25,098	25,098	25,098	25,098
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0355	0.0354	0.0365	0.0364	0.0356	0.0356

Table A7: ESG investment of firms with higher default probability during uncertainty

This table reports the OLS estimates of the ESG investment-volatility sensitivity of the firms with higher default probability. The dependent variable, *ESG Investment*, is estimated by the change in ESG score from year *t-1* to year *t*. As a measure of default probability, we use *Z score-Dummy* based on Altman's model (Panel A) and *CHS-Default Probability* based on Campbell et al.'s (2008) CHS-score (Panel B). *Z score-Dummy* is a dummy variable that equals one for firms with higher default probability, having a Z-score below 1.81 at the beginning of the year, otherwise zero. *CHS-Default Probability* is also a dummy variable which is set to one if the CHS-score associated default probability is above the median value in year *t-1* (classified as firms with higher default probability), and zero otherwise. We estimate *Uncertainty* as the expected market volatility at the beginning of the year by using a GARCH (1,1) model (in columns 1 and 2), Economic Policy Uncertainty Index (in columns 3 and 4) and Inverted CSI (in columns 5 and 6). In all specifications, *Uncertainty* is a binary variable that equals one if the uncertainty measurement is above the median value in year *t* (classified as high volatility), and zero otherwise. We report heteroskedasticity robust standard errors in parentheses, which are clustered at the firm level. All firm-level financial control variables are lagged by one year. Industry and year fixed effects are included in all specifications. All continuous variables are winsorized at the 1% and 99% tails. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Panel A: Z score-Dummy

	(1)	(2)	(3)	(4)	(5)	(6)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	CSI	CSI
Uncertainty	-4.7144***	-4.7179***	0.1701	0.1538	0.0270	0.0102
	(0.2566)	(0.2563)	(0.2147)	(0.2184)	(0.2149)	(0.2185)
Z score-Dummy	-0.7012***	-0.6752***	-1.0307***	-1.0041***	-1.4941***	-1.4698***
	(0.1639)	(0.1655)	(0.1591)	(0.1610)	(0.1702)	(0.1724)
Uncertainty * Z score Dummy	-0.1760	-0.1812	0.4712**	0.4616**	1.1508***	1.1457***
	(0.2137)	(0.2137)	(0.2197)	(0.2198)	(0.2103)	(0.2104)
Cash Flow		-0.0156		-0.0149		-0.0155
		(0.0146)		(0.0145)		(0.0144)
Market-to-Book		0.0352		0.0342		0.0336

		(0.0420)		(0.0420)		(0.0420)
Leverage		-0.4814		-0.4542		-0.4457
		(0.4164)		(0.4165)		(0.4158)
Investment		-0.0469		-0.0472		-0.0527
		(0.2166)		(0.2166)		(0.2167)
Constant	4.2163***	4.2323***	-0.4530	-0.4429	-0.3198	-0.3095
	(0.5586)	(0.5593)	(0.5310)	(0.5319)	(0.5307)	(0.5316)
Observations	29,048	29,048	29,048	29,048	29,048	29,048
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0381	0.0380	0.0382	0.0381	0.0386	0.0385

Panel B: CHS-Default Probability

	(1)	(2)	(3)	(4)	(5)	(6)
	Expected Market Volatility	Expected Market Volatility	EPU	EPU	CSI	CSI
Uncertainty	-4.2802***	-4.3020***	0.0987	0.1106	-0.3986**	-0.3903**
	(0.2304)	(0.2308)	(0.2010)	(0.2032)	(0.1967)	(0.1988)
CHS-Default Probability	-0.9096***	-0.9117***	-1.1132***	-1.1166***	-1.7879***	-1.7923***
	(0.1223)	(0.1222)	(0.1176)	(0.1178)	(0.1407)	(0.1411)
Uncertainty * CHS-Default Probability	0.0092	0.0053	0.4328**	0.4298**	1.4237***	1.4236***
	(0.1695)	(0.1694)	(0.1735)	(0.1734)	(0.1785)	(0.1785)
Cash Flow		-0.0217**		-0.0217**		-0.0204**

		(0.0100)		(0.0099)		(0.0098)
Market-to-Book		0.0091		0.0054		0.0092
		(0.0278)		(0.0279)		(0.0279)
Leverage		-0.4446		-0.4237		-0.4291
		(0.3875)		(0.3872)		(0.3858)
Investment		-0.3675**		-0.3722**		-0.3782**
		(0.1755)		(0.1756)		(0.1759)
Constant	4.1173***	4.1324***	-0.0603	-0.0703	0.2639	0.2555
	(0.4800)	(0.4809)	(0.4605)	(0.4615)	(0.4761)	(0.4771)
Observations	37,664	37,664	37,664	37,664	37,664	37,664
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Adj R-squared	0.0378	0.0378	0.0380	0.0380	0.0394	0.0394

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