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ESG Management and Credit Risk Premia: Evidence from Credit Default Swaps for Japan's Major Companies

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ESG Management and Credit Risk Premia: Evidence from Credit Default Swaps for Japan's Major Companies*

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Highlights

- ✧ The determinants of credit default swap premia are analysed.
- ✧ Panel data for Japan's major firms over the past five years is used.
- ✧ Higher ratings of managing social issues are associated with larger premia.
- ✧ Higher ratings of managing governance issues are associated with smaller premia.
- ✧ Companies' capacity to influence stakeholders is developing.

Abstract

In the credit default swap (CDS) market, Japan's major companies are regarded on average as having weak pathways leading from their stakeholder relationships to reducing their default risks. This assertion is based on panel data analyses to investigate the determinants of companies' CDS premia over the past five years. Reasonably, higher ratings of managing governance (G) issues are associated with smaller CDS premia. Higher ratings of managing social (S) issues, by contrast, are associated with larger CDS premia. Companies' pro-social preferences receive poor evaluations in the CDS market. Moreover, there is a non-significant association between companies' CDS premia and ratings of managing environment (E) issues. No interaction effects are detected between companies' E and G ratings or between their S and G ratings, implying that improving corporate governance does not help companies to align their E and S activities with expanding their own moral and social capitals. During the COVID-19 pandemic period, however, we find significant interaction effects between companies' E and G ratings and between their S and G ratings. Companies' stakeholder influence capacity is likely to have been insufficient in the past, but is likely to be developing.

Keywords Corporate social responsibility • ESG • Stakeholder influence capacity • Credit default swap

JEL Classification G12, G32, G34, M14, Q51

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1 Introduction

Recently, a prevailing issue for corporate managers has been the need to address environment (E), social (S), and governance (G) issues, what we call "ESG management." How a company's ESG management is associated with the company's securities price in the financial market is a question drawing much attention from securities-issuers (or corporate managers), financial investors and creditors, as well as from scholars. Using widely accepted measurements of individual companies' ESG management as developed by Sustainalytics, this article is the first to answer the question specifically for credit default swap (CDS) premia for major Japanese companies. ESG management is the process of engaging in "corporate social responsibility" (CSR), which refers to "serving people, communities, society, and the environment in ways that go above and beyond what is legally required of a firm" – a definition that we derive from two recent definitions by Jo and Harjoto (2011, p.352) and Cui et al. (2018, p.549). We note that the unique definition of CSR is not shared among business scholars.

Financial investment based not only on financial information released by a securities-issuer, but also on a company's ESG management, or ESG investing, has been promoted by Principles for Responsible Investment (PRI) – an international forum established in 2006 under the initiative of the United Nations (U.N.) to propose six principles of ESG investing. The number of institutional investors adopting the PRI has been skyrocketing since then. As of 28th December 2021, 4,666 investors have adopted PRI globally. A contemporary (and possibly rosy) desire is that ESG management, promoted by ESG investing, will contribute towards achieving the sustainable development of economic society, more specifically the 17 Sustainable Development Goals (SDGs) by the target deadline of 2030, which were endorsed by U.N. member countries in 2015.[1]

Business scholars have long supported the importance of CSR for corporate management by espousing a "stakeholder" view (Freeman 1984; Jones 1995; Mitchell et al. 1997). In this view, to survive, a company attempts to meet the interests of its wide-ranging stakeholders, including financial ones, such as shareholders and debtholders, as well as non-financial stakeholders, such as consumers, suppliers, employees, and community residents. Godfrey (2005) formulates that a company engaged in CSR will create positive "moral capital" among its stakeholders. To

[1] In relation to SDG 13 ("take urgent action to combat climate change and its impacts"), for instance, Krueger et al. (2020) conduct a massive survey with respect to institutional investors and report that (i) the investors regard climate risks as important for their portfolios due to both financial and non-financial motivations, the latter of which include reputation building as well as moral/ethical considerations, (ii) the investors recognise that the risks are materialising mainly in the form of regulation changes, (iii) and that, in order to address climate risks, the investors like risk management in their portfolios and engagement with their portfolio firms than de-investment.

translate that plainly, moral capital is the positive reputation of a company cherished by the company's stakeholders. Such a positive reputation may benefit corporate risk management and sustainability for the following reasons. Firstly, and most comprehensively, a positive reputation is likely to be inextricably linked with the company's excellent compliance behaviour, suggesting low risks of causing scandals or being sued.

Secondly, a positive reputation helps to enrich the company's intangible assets. The positive reputation spreads via word of mouth among the company's stakeholders and grows the loyalty of its consumers, suppliers, and employees. The increased loyalty is likely to be followed by reducing transaction costs incurred by the company (Jones 1995) and enabling the company to recruit and retain quality workers (Greening & Turban 2000).

Intangible assets enriched by a positive reputation also include the company's improved access to finance (Cheng et al. 2014). Because stakeholder engagement by a company with stronger CSR includes transparent information disclosure, the company tends to publish higher-quality financial reports and be less willing to engage in earnings management (Kim et al. 2012). Stocks issued by such a company experience price crashes less often (Kim et al. 2014) and tend to exhibit smaller differences in analysts' forecasts and have higher market liquidity (Cui et al. 2018), signifying that the company is more informationally transparent. A company's informational transparency enhanced by CSR engagement contributes towards reducing the cost of equity that the company incurs, as surveyed by Benlemlih (2017).

Lastly, a positive reputation suggests that the company interacts with social networks in a way benefiting the company itself, or it has social capital. When a company's stakeholders lay trust in the company, for example, they are willing to engage in economic and financial transactions with that company. Social capital contributes towards developing the society's economy and finance by facilitating those transactions among society members (Putnam 1993; Knack & Keefer 1997; La Porta et al. 1997; Guiso et al. 2004, 2008). Lins et al. (2017) utilize United States (U.S.) listed companies' CSR engagement as a proxy for the quality of social capital held by the companies. They find that companies with higher measures of CSR engagement tended to have higher stock returns during the Global Financial Crisis in 2008 and 2009, a time when trust was damaged in the stock market. Similarly, Godfrey (2005) finds that a company with a positive reputation can mitigate damages of future negative incidents and accidents on corporate value – an insurance-like effect that is beneficial for shareholders as well.

Thus, we interpret the "stakeholder" view as claiming that a company's CSR engagement will enhance the sustainability of the company's future profit-making by increasing regular customers, improving access to business resources, and hedging risks, thanks to strengthened moral and social capitals. However, on the above-mentioned insurance-like effect of moral capital, Shiu and Yang (2017) analyse corporate stock and bond prices and find that, when negative events occur, the effect exists but tends to disappear shortly. In addition, managing relationships with numerous and a diverse set of stakeholders requires corporate managers to incur additional expenses and increases the managerial complexity for them, both of which can be factors in pushing down corporate profits (Aupperle et al. 1985). Some of such costs are fixed and augmenting them can make corporate profits more volatile over time, thereby increasing default risks (Alexander & Buchholz 1978). Moreover, it is difficult to fully justify the stakeholder view in economics. Placing a focus upon the negative externalities generated by corporate decisions with respect to specific kinds of stakeholders, Magill et al. (2015) demonstrate that making the stakeholder equilibrium Pareto optimal calls for unrealistic institutional setups, such as the introduction of new property rights regarding labour and consumption, the number of firms being one, and the homogeneity of economic agents. Finally, the stakeholder view conflicts with a neo-classical economic view – a "shareholder" view.

Taking this view, Friedman (1970) defines that CSR is "to conduct the business in accordance with shareholders' desires, which generally will be to make as much money as possible while conforming to the basic rules of society, both those embodied in law and those embodied in ethical custom."[2] Following this doctrine, if CSR engagement does not help profit maximisation, then doing so will be a waste of business resources, or "overinvestment." When corporate managers have weak governance, they risk this overinvestment perhaps for personal interests, vanity's sake, and warm glow (Barnea & Rubin 2010).[3] To justify Friedman's doctrine, however, a stringent condition needs to be satisfied; that is, (i) a company's activities make profits which accrue to financial stakeholders and (ii) those causing damages to non-financial stakeholders (or breaching "the basic rules of society" quoted above) need to be sufficiently separated that authorities are able to detect and regulate the (ii) above (Hart & Zingles 2017). When this separation condition is not satisfied, the market value of the company cannot be equal to the welfare of its shareholders.

[2] Friedman (1970) argues that a corporate manager who "takes seriously its responsibilities for providing employment, eliminating discrimination, avoiding pollution and whatever else may be the catchwords of the contemporary crop of reformers" as part of its professional job is an "unwitting puppet(s) of the intellectual forces that have been undermining the basis of a free society."

[3] In this regard, Tirole (2001, p.26) sounds a warning by stating, "management can almost always rationalise any action by invoking its impact on the welfare of *some* stakeholder. An empire builder can justify a costly acquisition by a claim that the purchase will save a couple of jobs in the acquired firm; a manager can choose his brother-in-law as supplier on the grounds that the latter's production process is environmentally friendly."

A conflict between the shareholder and stakeholder views makes the meaning of good G elusive. Asymmetric information, information costs, and managerial incentives erode the functioning of G in publicly-traded companies (Jensen, 1986). The agency theory tells that the strength of G will affect the diligence of corporate managers working for the interests of their principals. In the shareholder view, the principals are shareholders exclusively, and good G discourages corporate managers from investing in ESG-related projects because these projects are supposed to erode firm value more or less. In the stakeholder view, the principals are shareholders inclusively, and good G encourages the managers to invest in ESG-related projects because these projects are supposed to increase firm value more or less.

Complicating things further in relation to G, the interests of stakeholders differ. For instance, a large steel plant can be good for its local residents because it enhances the community by creating jobs and making the flow of people. Closing it would be bad for S considerations. Conversely, closing the plant would be good for E considerations because of the reduction in CO_2 emissions. The divergent interests can also be applied to financial stakeholders, or shareholders and debtholders, because of asymmetric payoffs with respect to net assets of a company issuing securities in the market. Good G that is oriented towards the interests of shareholders has the risk of alienating those of debtholders, and vice versa. In line with this reasoning, companies with stronger shareholder rights tend to have higher share values (Gompers et al. 2003) but lower credit ratings (Ashbaugh-Skaife et al. 2006). On recently increasing corporate cash which should look inefficient to shareholders, Inaba (2021) finds a global tendency that weaker investor protection as well as corporate managers' worse business ethics and lower accountability allow the managers to be less sensitive to the cost of hoarding cash and have weaker precautionary motives for keeping cash.[4]

As ESG investing has a global reach, there is a growing literature on the salience of corporate securities prices for ESG management companies – a strand of literature into which this study falls. The enhanced sustainability of companies' future profit-making, if in line with the stakeholder view, is likely to be positive for their securities prices. Presumably, it will push up companies' stock prices by increasing the availability of future dividends paid by them and

[4] Dittmar et al. (2003), Harford et al. (2008), Huang et al. (2013), and Inaba (2021) provide evidence that managers with weaker G may more easily hoard money by reducing dividends (possibly for their future private consumption) or neglecting to find and invest in good investment opportunities, at the expense of their principals' wealth; that is, companies with weaker G tend to have higher cash-to-assets ratios. Corporate managers' inefficient holding of cash may look different to shareholders and debtholders. It should look negative to the former because doing so not only bears some opportunity costs but also has the risk of curbing the growth of corporate assets. By contrast, such excess corporate cash may look positive to the latter because it can reduce the riskiness of corporate assets.

decreasing the likelihood of future failures, the latter of which should also contribute towards pushing up their bond prices.

Apart from the stakeholder and shareholder views, within a finance-theoretic framework, ESG investing has the potential to cause a persistent appreciation for ESG management companies' securities prices, or a mispricing which is not easily corrected. When there are limits on arbitrages, the upsurge of ESG investing may continue to raise ESG management companies' securities prices if it increases the scarcity of the companies' securities (Gromb & Vayanos 2010; Greenwood & Vayanos 2014) or if it encourages investors to ride a bullish market generated by other investors (Abreu & Brunnermeier 2002, 2003). When investors preferences for securities issued by ESG management companies are based on misinformation, price appreciation has the potential to disappear at some stage when they learn that they are misinformed (Fama & French 2007). This potential is little when the preferences are based on investors' exogenously-formed erroneous beliefs (Fama & French 2007).

Thus, a question meriting empirical investigation is whether or not companies with better ESG management enjoy higher securities prices in the financial market. An answer to this question for stock prices is previously "yes" but more recently "no" as examined in Section 2. An answer to the question for bond prices appears to be "yes" in recent times. That is, corporate bonds issued by companies with measurements of better ESG management tend to be associated with metrics representing lower credit risk premia, including (i) better credit ratings (Bhojraj & Sengupta 2003; Oikonomou et al. 2014; Sun & Cui 2014; Stellner et al. 2015), (ii) smaller yield spreads with respect to sovereign bonds (Bhojraj & Sengupta 2003; Schneider 2011; Oikonomou et al. 2014; Ge & Liu 2015; Stellner et al. 2015; Henke 2016; Okimoto & Takaoka 2021), and (iii) smaller CDS premia (Höck et al. 2020).[5]

To contribute towards this credit-risk strand of the literature, we address a niche topic found at the intersection of Okimoto and Takaoka (2021) and Höck et al. (2020). To be concrete, we place a focus upon credit risks of Japanese companies as in Okimoto and Takaoka (2021) while measuring the risks with reference to CDS premia as in Höck et al. (2020). Section 2 explains CDSs in more detail and reviews existing studies on a separate hot topic in recent corporate bond research – yield gaps between green bonds and straight bonds.

In our empirical study, to investigate the driving forces behind CDS premia for major Japanese companies, we apply an extended Merton-like structural model to monthly averaged daily premia values of liquid 5-year CDS for 57 companies over the period of December 2018–

[5] Exceptionally, Menz (2010) reports that the state of ESG management did not affect bond prices of European companies over the period 2004–2007.

March 2021. A longer sample period, January 2016–March 2021, is also used for a robustness check. We find the following. Firstly, on average, we find a non-significant association between companies' environment (E) scores and CDS premia.

Secondly, better company governance (G) scores were associated with smaller CDS premia. This association sounds reasonable, being in line with Bhojraj and Sengupta's (2003) finding that the bond prices (or yields) of a company with better G tend to be higher (or lower). It also suggests that G scores should be fair in the sense that the scores consider not only the interests of shareholders but also of bondholders.

Thirdly, better company social (S) scores were associated with larger CDS premia. Matching the shareholder view, companies' pro-social preferences received poorer evaluations in the CDS market.

Fourthly, we find no significant interaction effects between companies' E and G scores or between their S and G scores. We interpret this as meaning that G was not well-orientated for helping them to align their E and/or S considerations with expanding their moral and social capitals. Based on the stakeholder view, considering this implication with the above-mentioned findings that the better company E and S scores were not associated with smaller CDS premia, we argue that companies were regarded, on average, as having insufficient capacity to improve their stakeholder relationships and increase the sustainability of profit-making.

Fifthly, during fiscal year (FY) 2020 in Japan, or the first year of the COVID-19 pandemic, better G as well as better E scores were associated with diminishing CDS premia while better S scores were associated with expanding CDS premia. Significant interaction effects were found between companies' E and G scores and between their S and G scores.

Lastly, E, S, and G scores were solid pricing-factors of companies' CDS premia in the sense that the scores' marginal impacts compared favourably with those of conventional determinants of CDS premia, such as leverage, volatility, risk-free rates, and profitability. The most impactful determinant was an indicator representing CDS company-specific market liquidity over the period January 2016–March 2021 as well as over the period of December 2018–March 2021. It was a leverage indicator specifically in FY2020.

This article proceeds as follows. Section 2 reviews the related literature. Section 3 discusses the data after constructing a panel-data regression model. Section 4 shows the results of estimating the baseline model, checks its robustness in three ways, and extends it in three ways. Section 6 concludes.

2 Related Literature

2.1 Integrating the stakeholder and shareholder views

Instead of concluding whether the stakeholder or shareholder view is the victor, we discuss here channels through which the two views can be integrated. Without such integration, it appears difficult to verify the prevailing PRI (Principles for Responsible Investment). PRI obviously favours the stakeholder view but is intended to affect the behaviour of institutional investors that are important stockholders for publicly traded companies. Dimson et al. (2015) illustrate that institutional investors encouraging their investing companies to work harder to deal with ESG issues is effective.[6]

The first integration channel is the length of time in shareholders' perspectives. The moral and social capitals discussed above, presumably, will be more useful intangible resources for shareholders who evaluate their investment performance from a longer-term perspective.

The second channel is the makeup of shareholders' utility function. For Friedman, their desires are "to make as much money as possible" as quoted in Section 1. Morgan and Tumlinson (2019) challenge this identification. They do theoretical reasoning that, in a situation where shareholders derive happiness not only from obtaining income and capital gains but also from getting involved with solving ESG-related problems, the problems merit solutions attained by corporate managers even though doing so is costly or it scarifies part of the monetary gains attributable to the shareholders.

The last integration channel is the capacity of a company to identify and engage in ESG-related projects that will both improve the company's stakeholder relationships and increase profits accruing to the company and its shareholders. Barnett (2007) calls this capacity a company's "stakeholder influence capacity" (SIC). We draw attention to this channel because, given a company's functioning SIC, good G (governance) may serve to (i) positively affect the company's CSR engagement as found by Jo and Harjoto (2012) and (ii) help the company to align its CSR activities with increasing its corporate value as found by Jo and Harjoto (2011) and Dimson et al. (2015). Moreover, one may speculate that G oriented for non-financial stakeholders has the risk of alienating financial stakeholders' interests, and vice versa. On this speculation, Harjoto and Jo (2011) find that the possibility of a company keen to engage in CSR is positively related to G characteristics, such as board leadership, board independence, institutional ownership, analyst following, and anti-takeover provisions.

[6] Dimson et al. (2015) find that stock prices of companies improving ESG management in response to institutional investors' encouragements come up with abnormal returns, and that such a consequence is likely to take place mainly thanks to improvements in taking care of a specific E factor (climate change) and G factors.

2.2 Preceding empirical fact-findings

While there is a great amount of empirical studies on the link between CSR and corporate financial performance (CFP), existing meta-analysis studies show that the evidence on whether the link is positive or negative is mixed (Orlitzky 2011), and that a linearly positive correlation between the two, if any, will be weak (Friede et al. 2015).[7] The lack of clear evidence for the CSR-CFP nexus appears to be partly due to the difficulty of measuring a company's CSR engagement accurately. Additionally, there are intervening factors which need to be controlled for separately (Ullman 1985).[8] Based on our discussion so far, such factors include the characteristics of G and the quality of SIC under the influence of these characteristics. It is not until a company forms sufficient SIC as a result of improving its CSR engagement that the company's CSR can contribute towards enhancing its CFP (Barnet 2007). Barnett and Salomon (2012) find that the CSR-CFP relationship tends to be U-shaped; that is, a company with low CSR has a higher CFP than a company with moderate CSR, but a company with high CSR has the highest CFP.

We contribute towards the growing literature on the relationship between companies' ESG management and the prices of their securities by investigating CDS premia for major Japanese companies. Section 1 reviews existing articles addressing credit risk pricing and indicates that our study is closely related to Okimoto and Takaoka (2021) and Höck et al. (2020). The former analyses Japanese companies' corporate bond yield spreads vis-à-vis sovereign bonds, and finds that better G and S (social) scores are associated with smaller spreads while no association between E (environment) scores and the spreads. The latter analyses European companies' CDS premia, and finds that better E scores are associated with smaller premia.

We also add a brief survey of empirical studies on another two kinds of securities prices: stock prices and prices of bonds that we call "sustainable development bonds" (SD bonds, hereinafter). Over 85% of studies on the relationship between companies' ESG management and the prices of their securities look into stock prices (Friede et al. 2015). Kempf and Osthoff

[7] Conducting vote-count studies and meta-analyses of about 2,200 empirical articles which are available as of December 2014, Friede et al. (2015) find that roughly 90% of studies find non-negative CSR-CFP relationships, and report that sample-size weighted correlation coefficients are 0.146 in the vote-count study and 0.118 in their meta-analysis. Because these coefficients are statistically significantly different from zero, it would be safe to state that several CSR measurements are weakly positively correlated with several CFP indicators. That said, the coefficients do not necessarily read that good CSR has caused CFP to improve.

[8] Ullman (1985) discusses that these factors are (i) the controlling power that specific stakeholders have with respect to important resources for a company, (ii) the interdependence of a company with its stakeholders which affects the necessity for the company to take care of them, and (iii) the situation of a company's business and financial conditions which affects the company's available capacity to invest in ESG-related projects.

(2007) report that U.S. companies with measurements of better ESG management tended to have higher stock returns, using a dataset whose sample period ranges from 1992 to 2004. They also find that such a tendency was likely to be generated through specific S factors (community and employee relationships) while another S factor, or human rights, and E factors were irrelevant to the tendency. The tendency, however, is refuted by Borgers et al. (2013) and Halbritter and Dorfleitner (2015) with reference to more recent data.[9] In this context, Lee and Faff (2009) find that a portfolio consisting of companies with measurements of worse ESG management tended to outperform a benchmark market index while a portfolio consisting of companies with better ones did not. They interpret this tendency as meaning that companies with better (worse) ESG management carry fewer (more) idiosyncratic risks. This interpretation, however, does not match a later finding by De Spiegeleer et al. (2021). They show that the performance of portfolios in which allocation rates to companies with measurements of better/worse ESG management are increased/decreased from those in representative market portfolios in the U.S. and Europe is not stably different from the performance of the original benchmark portfolios over the period 2009–2019.

Recently, the issuance of SD bonds has been increasing rapidly. These bonds include corporate bonds issued to finance projects dealing with E issues specifically (referred to as green bonds in the market), those issued to finance projects dealing with S issues specifically (referred to as social bonds), and those issued to finance projects dealing with both E and S issues (referred to as sustainability bonds). The credit risk of a conventional SD bond does not depend on the performance of the project for which raised funds are spent, but on its issuer's creditworthiness. Because this can be said of a straight bond too, if a company's investing in E projects by financing with a green bond reduces the company's creditworthiness, not only yields on the green bond but also those on its straight bond will decrease. Therefore, when yields on SD bonds are lower than those on straight bonds, these yield gaps should relate not to the difference in creditworthiness between the two different types of bonds but to the difference in market liquidity between the two. Alternatively, those yield gaps should relate to mispricing because of bond market imperfections, including the lack of arbitragers as well as investors' partiality to ESG management companies, riding a bullish market on their SD bonds, and exogenously-formed erroneous beliefs on ESG management, as discussed in Section 1. Investigating the yield gaps proceeds for green bonds, and the gaps are called a "greenium." Tang and Zhang (2020) refute this with respect to issuance yields on green bonds with third-

[9] The sample period of data ends in 2009 and 2012 in Borgers et al. (2013) and Halbritter and Dorfleitner (2015), respectively.

party certifications. As for their yields in the secondary market, Zrbib (2019) finds that greeniums were 0.02% points over the period of 2013–2017, controlling for the liquidity gap between green bonds with the certifications and comparable straight bonds. He interprets such a greenium (price appreciation) as reflecting bond investors' non-monetary pro-environmental preferences, rather than some consequence of the above-mentioned bond market imperfections. His interpretation appears to mean that the makeup of debtholders' utility function alters so as to derive happiness not only from collecting principals and interests but also from getting involved with E issues. Greeniums are observed for those with third-party certifications but not for green bonds without them (Baker et al. 2018; Hyun et al. 2020).

Finally, this article is a CDS study. A CDS is a kind of insurance contract against the cost of default of a reference entity. The insured, or a buyer of "protection," pays a fixed insurance fee, or a premium, at regular intervals to a counterpart insurer, or a seller of "protection." If the reference entity defaults, or if a "credit event" occurs, the insured will be compensated by the insurer for the difference between the actual value and face value of debt claims on the defaulted entity. In this sense, a CDS premium is the market price of credit risk of the reference entity. As a proxy for credit risks, we use CDS premia, not yield spreads between corporate bonds and sovereign bonds, for the following two reasons. Firstly, CDSs can be more liquid than corporate bonds due to the fact that they are derivatives: no principals need to be exchanged in CDS trading, thereby making it easy for investors to create both long and short positions on underlying credit risks. Reflecting this, market liquidity spills over from the CDS market to the corporate bond market (Czech 2021). Lastly, as found by Blanco et al. (2005), Zhu (2006), and Inaba (2018), more liquid CDSs are superior to less liquid corporate bonds in terms of price discovery, which Lehmann (2002) defines as the process by which efficient and timely incorporation of new information implicit in investors' trades is priced into market prices.

3 Model and Data

3.1 Panel-data regression: a baseline model

There are two major views on the causes of corporate defaults. One view is that they occur in response to exogenous shocks (Hall & White 2001). Models based on this view cannot show an economic rationale for corporate defaults. The other is Merton's (1974) view: that is, corporate defaults have endogenous elements because a default of debt claim is supposed to occur when the asset value of its issuer falls below some threshold. Models based on this view are called "structural models."

We set up the following structural model. The dependent variable is CDS premia for 5-year senior-debt claims in major Japanese companies (*CDSP*). According to Ericsson et al. (2009), conventional regressors in the Merton-like structural models are (i) leverage (*LEV*), (ii) the volatility of the underlying asset (*Vola*), and (iii) the level of risk-free interest rates (*RFIR*). Because the threshold for corporate default is an increasing function of leverage, the larger *LEV* is, the higher the default risk. *Vola* is important because investing in a corporate debt claim can be regarded as investing in a risk-free bond and selling equity holders an option to sell the corporate debt at the value of the risk-free bond. The value of such an option is expensive when the value of underlying corporate asset changes in a volatile fashion. *RFIR* is the risk-neutral drift of the value of the underlying corporate asset (Longstaff & Schwartz 1995). Higher *RFIR* is expected to accompany greater growth of underlying corporate assets, thereby reducing credit risk premia, or *CDSP*. Our proxy for *RFIR* is yields on 5-year zero-coupon sovereign bonds.

We add seven regressors. One is individual companies' profitability (*Profit*): higher profitability could mean higher creditworthiness. We apply this factor based on Das et al.'s (2009) finding that accounting earnings influence CDS pricing.

Another two regressors are related to the market liquidity of individual companies' CDSs, to follow Corò et al. (2013) and Inaba (2018), both of which show that an illiquid CDS is required a compensation by investors – the more illiquid a CDS the larger its premium. In accordance with Inaba (2018), we divide the market liquidity of individual companies' CDSs into two parts: market-wide market liquidity (*MWL*) and company-specific liquidity (*CSL*). *MWL* is the simple average of bid-ask spreads (*BAS*, hereinafter) on the sample CDS premia, and *CSL* is residuals gained by, for individual companies' CDSs, regressing their *BAS* onto a constant term and *MWL* as shown below:

$$BAS_{i,\tau} = a_0 + a_1 MWL_\tau + CSL_{i,\tau}, \qquad (1)$$

where i stands for an individual company, τ stands for a monthly point of time, and as are coefficients. Meanwhile, *BAS* do not need to be divided by mid-spreads to compare with each other because *BAS* is already proportional measures (Bongaerts et al. 2011; Pires et al. 2015).

Based on our research interest, the last four regressors are related to third-party ratings of the state of individual companies' ESG management. All industries as a whole are exposed to a specific amount of E, S, and G issues, and different industries are exposed to different amounts of the issues. $ESG\text{-}ISSUE^{Indu}$ is a measure of exposure to these issues for an industry to which company i belongs. A larger value of $ESG\text{-}ISSUE^{Indu}$ means that company i's industry is riskier in terms of ESG management. *ScoreE*, *ScoreS*, and *ScoreG* are performance scores which measure how well company i is prepared for and manages E, S, and G issues, respectively, compared to i's sector-peer companies. Smaller values of *ScoreE*, *ScoreS*, and *ScoreG* mean that company i is riskier in terms of E, S, and G management, respectively.

Thus, our baseline panel-data regression equation is:

$$
\begin{aligned}
CDSP_{i,\tau} = {} & h_0 + IE_i + \varepsilon_{i,\tau} \\
& + h_1 Lev_{i,\tau} + h_2 Vola_{i,\tau} + h_3 RFIR_{\tau} + h_4 Profit_{i,\tau} + h_5 MWL_{\tau} + h_6 CSL_{i,\tau} \\
& + h_7 ESG\text{-}ISSUE^{Indu}{}_{i,\tau} + h_8 ScoreE_{i,\tau} + h_9 ScoreS_{i,\tau} + h_{10} ScoreG_{i,\tau},
\end{aligned}
\tag{2}
$$

where i, τ, and all regressors are explained above, and hs are coefficients, IE is heterogeneity attributable to omitted variables and unobservable factors, and ε is the residual.

Notes are as follows. Firstly, depending on the nature of IE, Eq. (2) can take one of three potential forms: a pooling model represented by dropping IE from Eq. (2); a fixed-effects model, in which IE is a country-specific constant; and, a random-effects model, in which IE is a country-specific stochastic variable.[10]

Secondly, the expected signs for estimated hs ($\hat{h}$s) in the second line of Eq. (2) are $\hat{h}_1$: +, $\hat{h}_2$: +, $\hat{h}_3$: –, $\hat{h}_4$: –, $\hat{h}_5$: +, and $\hat{h}_6$: +, as discussed above.

Thirdly, on the expected signs for $\hat{h}$s in the third line of Eq. (2), a positive $\hat{h}_7$, if gained, will suggest that belonging to an industry exposed to more ESG issues should be disadvantageous for the corporate sustainability over the next five years. This suggestion is in line with the stakeholder view, even if ignoring ESG issues is not against the basic rules of society, such as laws and ethical customs. The signs for $\hat{h}_8$ and $\hat{h}_9$ can be positive or negative. As discussed in Section 1, from the stakeholder view, $\hat{h}_8$ and $\hat{h}_9$ should be negative because company i's addressing E and S issues will enhance the sustainability of its profit-making over the next five years, meaning a reduction of credit risk premia. The premia reduction could be a persistent mispricing caused by CDS market imperfections.[11] From the shareholder view, however, $\hat{h}_8$ and $\hat{h}_9$ should not be necessarily negative and could be positive because company i's addressing E and S issues has the risk of being "overinvestment." Both the stakeholder and shareholder views agree that to be exposed to fewer G issues must be better for the future sustainability of corporate profit-making. That is, $\hat{h}_{10}$ can be expected to be negative. A positive $\hat{h}_{10}$, if gained,

[10] When either a fixed-effects model or a random-effects model is selected, four potential characteristics of the residuals (ε) need to be addressed to obtain asymptotically consistent estimates ($\hat{h}$s). These four characteristics are cross-section heteroscedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation. These can reduce the reliability of t-tests of the estimates.

[11] The imperfections include the lack of arbitragers as well as investors' partiality to ESG management companies, riding a bullish market on their CDSs, and exogenously formed erroneous beliefs on ESG management.

will suggest that *ScoreG* is a performance score constructed so as to downplay the interests of debtholders compared to shareholders.

Fourthly, we ignore time effects common to all sample countries (is) in individual sample years (τs) because we regard the two macro-variables, $RFIR_\tau$ and MWL_τ, as including such common effects.

Lastly, because all of the regressors are standardized, the marginal impacts of effective regressors on *CDSP* are comparable with each other using the absolute values of their $\hat{h}$s.

3.2 Data

We collect data for ESG-related regressors ($ESG\text{-}Issue^{Indu}$, *ScoreE*, *ScoreS*, and *ScoreG*) from Sustainalytics and other regressors from Bloomberg. $ESG\text{-}Issue^{Indu}$ is an ESG "risk" score: a component of Sustainalytics' *ESG Risk Ratings*. *ScoreE*, *ScoreS*, and *ScoreG* are ESG "performance" scores which are breakdowns of Sustainalytics' *ESG Ratings*. On the computation and frequency of data, all regressors are the monthly averages of daily data, except for *Vola* which is the monthly standard deviation of daily stock price percentage changes for company i. We use an unbalanced panel dataset covering 57 major companies. These companies are selected because their CDSs are liquid in the sense that they are/were constitutes for Japan's representative CDS market index, Markit i Traxx Japan (MiTJ), and thereby we can obtain time-series data of these 57 CDS premia with few missing values over the sample period from Bloomberg. The MiTJ refers to senior debt claims issued by 40 (previously 50) Japanese investment-grade companies with credit ratings of BBB– or higher. These reference companies are selected by Markit from a list of 1000 liquid corporate CDSs that the Depository Trust and Clearing Corporation makes based on the volumes of transactions on a global basis. All regressors are detailed in Appendix A, and the 57 sample companies are listed in Appendix B.

The baseline sample period ranges from December 2018 to March 2021. The starting coincides with the timing of $ESG\text{-}Issue^{Indu}$ included in Sustainalytics dataset. This ESG risk score is an essential regressor for our regression in order to control for industry-level differences of exposures to E, S, and G issues. We believe that the sample period appropriately captures recently growing ESG investing in debt claims for major Japanese companies. Japan's Government Pension Investment Fund, a gigantic institutional investor in Japan, signed the PRI (Principles for Responsible Investment) in September 2015. It is widely recognized that this signing encouraged major Japanese companies and institutional investors to consider ESG management and ESG investing more seriously. In the Japanese bond market, we believe that

ESG investing became popular in 2019, as is evident in a rapid increase of the issuance of SD (sustainable development) bonds as shown in Table I.

[Table I near here]

We will also look at an earlier period of time, or the period of January 2016–March 2021, as part of our efforts to check the robustness of the result of estimating Eq. (2) over the baseline sample period. As another robustness-check, we use a shorter sample period too: April 2020–March 2021. This coincides with Japan's FY 2020, which precisely matches the first year of the COVID-19 pandemic during which people's mobility declined dramatically, thereby reducing consumer demand for retail and recreation as well as cutting down on corporate sales and labour demand, especially in the face-to-face services industries (Inaba & Matsuo, 2022).

Finally, although Sustainalytics' ESG risk and performance scores are widely used, they are not the only ESG ratings available. We know that there are nine kinds of institutions that rate the state of individual companies' ESG management: Sustainalytics, Bloomberg, MSCI, FTSE Russell, Refinitiv, S&P Global, VigeoEiris, ISS-ESG, and CDP. According to Quick ESG's (2020) survey which had respondents from 54 Japanese institutional investors from July–September 2020, (i) 60% are already using ESG ratings and 13% are thinking of using them, respectively, and (ii) among of these investors, 60% refer to MSCI, 43% to Sustainalytics, and 31% to Bloomberg, respectively. The MSCI and Sustainalytics' ratings are based on their own expert appraisals. These ratings are needed for our study, and we use Sustainalytics' ones due to availability to access their data.[12] Bloomberg's ratings do not fit the need of this study well because these ratings focus on the level of individual companies' ESG-related information disclosures, as compared to its disclosure requirements.

4 Regression Results

4.1 Baseline estimation result

The result of estimating Eq. (2) over the baseline sample period (December 2018–March 2021) with the weighted generalized least squares (weighted GLS) method is shown in the middle column of Table II and summarized below:

$$CDSP_{i,\tau} = -0.006 + 0.009Lev + 0.023^{*}Vola - 0.030^{***}RFIR - 0.006Profit + 0.126^{***}MWL + 0.261^{***}CSL$$

[12] Meanwhile, the differences and similarities in different providers' ESG ratings and what causes the differences are beyond the scope of this article; for critical studies on the makeup of ESG ratings, see Chatterji et al. (2009), Chatterji et al. (2016), and Berg et al. (2019).

$$+\ 0.002\mathit{ESG\text{-}Issue}^{Indu} + 0.010\mathit{ScoreE} + 0.039^{*}\mathit{ScoreS} - 0.056^{**}\mathit{ScoreG}$$

$$(\#\text{ of observations} = 1567,\ R_{adj}^{2} = 0.86),$$

where the superscripts ***, **, and * stand for 1%, 5%, and 10% levels of statistical significance, respectively, and the p-values used are the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. We follow the conventional procedure and select the fixed-effects model. The fixed-effects estimates which are statistically significant are *Vola* (+), *RFIF* (–), *MWL* (+), *CSL* (+), *ScoreS* (+), and *ScoreG* (–). The signs in parentheses are those of the corresponding $\hat{h}$s. Two regular candidate determinants represented by firm-specific financing indicators, or *Lev* and *Profit*, are insignificant.

[Table II near here]

The signs of the six effective regressors – *Vola*, *RFIF*, *MWL*, *CSL*, *ScoreS*, and *ScoreG* – are as expected from the discussion above. The statistically significant and negative estimate of *ScoreG* suggests that, in the market, major Japanese companies' managing G (governance) issues is viewed on average as being helpful for increasing the sustainability of the companies' profit-making or decreasing their default risks over the next five years. This suggestion appears to be acceptable for both the stakeholder and shareholder views. The statistically significant and positive estimate to *ScoreS*, by contrast, suggests that major Japanese companies managing of S (social) issues is viewed on average as being harmful for that. This suggestion appears to be acceptable for the shareholder view, but not for the stakeholder view. Additionally, a result that the $\mathit{ESG\text{-}Issue}^{Indu}$ is not estimated to gain a statistically significant coefficient suggests that belonging to an industry exposed to more ESG issues is not priced disadvantageously in terms of the creditworthiness of individual companies, as far as the future five years are concerned.

Because all variables are standardized, the marginal impacts of the statistically significant regressors on *CDSP* can be compared, by looking at the absolute values of their $\hat{h}$s. *ScoreS* and *ScoreG* are the solid pricing-factors in the sense that their marginal impacts, 0.039 and 0.056, respectively, are larger than that of a conventional pricing factor *RFIF*, 0.030. Taking into account the estimated coefficients' standard errors, it would be safe to state that *ScoreG* is more impactful than *RFIF*, and that *ScoreS* is impactful as much as *RFIF*. Their marginal impacts, nevertheless, are much smaller than those of market liquidity factors: 0.387. This value is a sum of 0.126 for *MWL* and 0.261 for *CSL*, the latter of which is the most impactful determinant.

We check the robustness of the baseline estimation result in three ways. The first is by addressing the risk of multicollinearity among *ScoreE*, *ScoreS* and *ScoreG*. We calculate the

VIFs (variance-inflation factors) for all pairs of the three for all sample countries, following Snee and Marquardt (1984). Looking at the VIFs in Appendix Table B, we judge that almost all are too small to cause multicollinearity.

The second robustness check is to extend the sample period by adding previous points of time. To this end, we assume that $ESG\text{-}Issue^{Indu}$ is carried by *IE*. We regard this assumption as being expedient but excusable not only because $ESG\text{-}Issue^{Indu}$ is not available before December 2018 but also because it is estimated not here to gain a statistically significant coefficient in the baseline estimation. The result of estimating Eq. (2) without $ESG\text{-}Issue^{Indu}$ over the period January 2016–March 2021 with the weighted GLS method is shown in the middle column of Appendix Table C and summarized below:

$$
\begin{aligned}
CDSP_{i,\tau} = {} & 0.001 + 0.086^{*}Lev + 0.063^{***}Vola - 0.006RFIR - 0.011Profit \\
& + 0.087^{***}MWL + 0.269^{***}CSL \\
& - 0.007ScoreE + 0.029^{*}ScoreS - 0.026^{**}ScoreG
\end{aligned}
$$

(# of observations = 3419, $R_{adj}^2 = 0.77$),

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the p-values used are the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. We follow the conventional procedure and select the fixed-effects model. The fixed-effects estimates which are statistically significant are *Lev* (+), *Vola* (+), *MWL* (+), *CSL* (+), *ScoreS* (+), and *ScoreG* (–). The signs in parentheses are those of the corresponding $\hat{h}$s.

Over the extended sample period, among the conventional firm-specific financing indicators, *Profit* is a statistically insignificant determinant of *CDSP* as in the baseline estimation while *Lev* is its statistically significant determinant, differently from that estimation. In line with that estimation, the two market liquidity factors (*MWL* and *CSL*) are statistically significant determinants with substantial marginal impacts, with *CSL* being the most impactful determinant of *CDSP*. As for the ESG performance scores, the estimation result is the largely same as that of the baseline estimation. *ScoreE* is not associated with *CDSP*, larger *ScoreS* is associated with a larger *CDSP*, and larger *ScoreG* is associated with a smaller *CDSP*. Although the marginal impacts of *ScoreS* and *ScoreG* are smaller than those in the baseline estimation, these gaps are not significantly different from zero, taking into account the estimated coefficients' standard errors.

The last robustness check is to shorten the sample period. We do this with an aim to illustrate the CDS market's pricing in crisis time such as during the COVID-19 pandemic. The result of estimating Eq. (2) for FY2020 with the weighted GLS method is shown in the middle column of Appendix Table D and summarized below:

$$CDSP_{i,\tau} = -\,0.080^{*} + 0.518^{***}Lev + 0.023^{**}Vola + 0.042RFIR - 0.045^{***}Profit$$
$$+\ 0.124^{***}MWL + 0.213^{***}CSL$$
$$+\ 0.001ESG\text{-}Issue^{Indu} + 0.032ScoreE + 0.015ScoreS - 0.045^{*}ScoreG$$
$$(\#\text{ of observations} = 677,\ R_{adj}^{2} = 0.91),$$

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the p-values used are the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. We follow the conventional procedure and select the fixed-effects model. The fixed-effects estimates which are statistically significant are *Lev* (+), *Vola* (+), *Profit* (–), *MWL* (+), *CSL* (+), and *ScoreG* (–). The signs in parentheses are those of the corresponding $\hat{h}$s. *ScoreG* is an significant regressor as in the baseline estimation while *ScoreS* is not. Although the marginal impact of *ScoreG* is smaller than that in the baseline estimation, this gap is not significantly different from zero, taking into account the estimated coefficients' standard errors. Finally, the most impactful determinant is *Lev* during the crisis period as opposed to *CSL* in the baseline estimation.

Thus, these three robustness checks support the results of the baseline estimation and add three findings. First, the relevance of *ScoreS* and *ScoreG* to pricing *CDSP* has not significantly increased since January 2016. Second, *ScoreS* wat not an effective pricing factor during the FY2020 COVID-19 pandemic period. Last, not *CSL* but *Lev* was the most impactful determinant then.

4.2 Three extensions

To get a better understanding of the baseline estimation result, we make three extensions. First, we analyse the explanatory power of the statistically significant regressors. Following Graham and Leary's (2018) approach, we compare R_{adj}^{2}s obtained by estimating regression equations that increase the number of regressors one by one until we have the full model of Eq. (2). We start with an equation in which *CDSP*s are regressed on a constant term and fixed *IE*s (individual effects). The R_{adj}^{2} obtained by estimating this simple equation is 90.5 per cent. Strikingly, company fixed effects have the greatest explanatory power. Next, we add the four non-significant regressors, resulting in a R_{adj}^2 of 85.5 per cent. In the final stage, we add each of the six effective regressors one-by-one (while keeping the previously added regressors). Beginning with adding *Vola*, we obtain a R_{adj}^2 of 86.1 per cent. The change in the R_{adj}^2 in response to this addition is 0.6 (= 86.1 – 85.5) percentage points (pp). We add other regressors in the following order: *RFIR* (–0.6pp), *MWL* (+2.9pp), *CSL* (–2.4pp), *ScoreS* (+0.1pp), and *ScoreG* (+0.3pp). The figures in parentheses indicate the increase in R_{adj}^2 in response to adding the given regressor. For details, see Table III. Apart from country fixed effects, *MWL* (market-wide liquidity) is likely to have the largest explanatory power of *CDSP*.

[Table III near here]

The second extension is to consider the dependence of the company-specific regressors on the strength of corporate G, or *ScoreG*. We do so mainly because *ScoreG* has the potential to mitigate the *CDSP*-enhancing effect of *ScoreS*, based on both the stakeholder and shareholder views. As discussed in Section 1, according to the shareholder view, good G will prevent corporate managers from engaging in "overinvestment." As discussed in Section 2, stretching the stakeholder view, one may argue that good G will help to grow a company's SIC (stakeholder influence capacity). Since we add only one interaction term in order to preserve the interpretability of its coefficient, we conduct two panel-data regressions using the same sample over the period of December 2018–March 2021. The left panel of Table IV shows that *ScoreG*×*ScoreS* is estimated to gain an non-significant coefficient. The state of G is irrelevant to the *CDSP*-enhancing effect of *ScoreS*. *ScoreG* also has a non-significant interaction with *ScoreE*. Conducting the same interaction-term analyses for FY2020, by contrast, both *ScoreG*×*ScoreE* and *ScoreG*×*ScoreS* are estimated to gain statistically significant negative coefficients as in the middle panel of Table IV. This finding suggests that during the FY2020 Covid-19 pandemic period, good G is useful for mitigating the *CDSP*-enhancing effect of *ScoreS*, and that good G helps a company's addressing E issues to be viewed as benefiting the company's creditworthiness.

[Table IV near here]

The last extension is to investigate the FY2020 Covid-19 pandemic period, not by using the performance scores (*ScoreE*, *ScoreS*, and *ScoreG*), but risk scores: *E-Issue*, *S-Issue*, and *G-Issue*. These scores consist of Sustainalytics' $\textit{ESG-Issue}^{Indu}$ measure. Sustainalytics provided us with these risk scores whose sample period starts in March 2019, as well as a special permission to analyse them in this study. Larger values of *E-Issue*, *S-Issue*, and *G-Issue* represent worse management of E, S, and G issues, respectively. Because they are comparable across industries, $\textit{ESG-Issue}^{Indu}$ is not needed as a regressor.

Using the GLS method, we estimate Eq. (2) without $ESG\text{-}Issue^{Indu}$ and with *E-Issue, S-Issue,* and *G-Issue* for FY2020. The result is shown in the middle column of Appendix Table E and summarized below:

$$CDSP_{i,\tau} = -\,0.084^{*} + 0.524^{***}Lev + 0.021^{**}Vola + 0.050RFIR - 0.041^{***}Profit$$
$$+\,0.123^{***}MWL + 0.206^{***}CSL + 0.069^{*}E\text{-}Issue - 0.054^{*}\,S\text{-}Issue + 0.030^{**}G\text{-}Issue$$

(# of observations = 676, $R_{adj}^{2} = 0.89$),

where the superscripts ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance, respectively, and the p-values used are the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. We follow the conventional procedure and select the fixed-effects model.

All weighted-GLS fixed-effects estimates are statistically significant, except for *RFIR*. As in the above-mentioned last robustness check for the FY2020 Covid-19 pandemic period, *Lev*, *Vola*, *Profit*, *MWL*, and *CSL* are estimated to gain significant coefficients with reasonable signs. Because both this last extension and that last robustness check use data standardized with reference to the same period March 2019–March 2021, we can adequately compare the size of the estimated coefficients for those regressors between the two regressions. Although the coefficients are different a bit from each other regression, such gaps are not significantly different from zero, taking into account the estimated coefficients' standard errors.

Even during the crisis period, smaller *E-Issue* and *G-Issue*, or focusing more on E (environment) and G issues, were associated with tightening *CDSP*, in line with the stakeholder view. By contrast, smaller *IusseS*, taking care of more S issues, was associated with expanding *CDSP*, in line with the baseline estimation result and the shareholder view.

We make interaction-term analyses again for FY2020, using *E-Issue, S-Issue,* and *G-Issue*. As shown in the right panel of Table IV, good G is useful for mitigating the *CDSP*-enhancing effect of good S, and that good G helps a company's addressing E issues to be viewed as benefiting the company's creditworthiness. These interactions are the same as those in the above-mention results for *ScoreE, ScoreS,* and *ScoreG*.

5 Concluding Remarks

Through panel-data analyses over the period of 2016–2021, this article is the first to show how major Japanese companies' ESG is associated with their CDS premia. Depending on estimation periods, E (envitonemnt), S (society), and G (governance) ratings were solid pricing-factors of their CDS premia in the sense that the ratings' marginal impacts compared favourably with those of conventional factors, such as leverage, volatility, risk-free rates, and profitability. Although market liquidity factors were the most impactful determinants over the period of 2016–2021 and over the period of 2018–2021, so was leverage specifically in FY2020, the first year of the COVID-19 pandemic in Japan.

Major Japanese companies are regarded, on average, as having insufficient SIC (stakeholder influence capacity) in the CDS market. In line with both the stakeholder and shareholder views, a company's focus on G issues receives a good evaluation in the CDS market; that is, higher ratings of addressing G issues are associated with tightening CDS premia over the period of 2016–2021 and over the period of 2018–2021. The market evaluation of a company's focus on E issues is inconclusive over the two time periods. In line with the shareholder view, a company's focus on S issues receives a poor evaluation in the CDS market; that is, higher ratings of addressing S issues are associated with larger CDS premia over the two time periods. This association also held true over the pandemic period. There are no significant interaction effects between the companies' E and G ratings or between their S and G ratings over the period of 2018–2021. Good G does not appear to have helped companies to align their E and/or S activities with expanding their moral and social capitals.

That said, major Japanese companies are likely to have been further developing their SIC recently. Higher G ratings as well as higher E ratings were associated with tightening CDS premia in FY2020. More importantly, there were significant interaction effects between companies' E and G ratings as well as between their S and G ratings. To be specific, in FY2020, good G was useful for mitigating the positive association between company CDS premia and addressing S issues, and that good G helped a company's addressing E issues to be viewed as benefiting the company's creditworthiness. The findings will not tell us why such positive changes in the interaction effects took place during the year. Nevertheless, it would be safe to assume that as major Japanese companies continue developing their SIC after FY2020, addressing S issues has the potential to accompany not widening but tightening CDS premia.

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Appendix A

This appendix discusses the data used.

<1> Sample companies

- The sample companies are 57 well-known Japanese companies whose single-name CDSs are/were constitutes of the representative CDS market index for Japanese company CDSs, or Markit iTraxx Japan.
- The names of the sample companies are shown in Appendix B.

<2>Definitions and sources

- *CDSP* stands for the premia of sample companies' single-name CDSs for five-year senior debt. It is defined as the simple average of bid and ask premia. The monthly averages of daily data are used. The data source is Bloomberg (BLM, hereinafter). The unit is basis points (bps, herein after).
- *Lev* stands for leverage. The book value of liabilities is divided by the market value of net

worth. The monthly averages of daily data are used. The data source is BLM. The unit is per cent (%, hereinafter).

- *Vola* stands for uncertainty. It is defined as the one-month standard deviations of daily stock price percentage changes. The data source is BLM. The unit is %.
- *RFIR* stands for the five-year, risk-free rate. It is five-year, zero-coupon sovereign bond yields estimated by BLM with reference to the sovereign yield curve in the market. The monthly averages of daily data are used. The data source is BLM. The unit is %.
- *Profit* stands for corporate profitability. It is the average of equity analysts' forecasts of return on assets (ROA) for a current year. The monthly averages of daily data are used. The data source is BLM. The unit is %.
- *MWL* stands for the market-wide liquidity of Japanese companies' single-name CDSs. It is defined as the simple average of bid-ask spreads (*BAS*), or ask (selling) premia minus bid (buying premia), on individual single-name CDSs for the 57 sample companies. The monthly averages of daily data are used. The data source is BLM. The unit is bps.
- *CSL* stands for company-specific market liquidity of the 57 sample companies' single-name C DSs. It is defined as residuals gained by regressing *BAS* onto *MWL*; to be concrete, see Eq. (1) in the text. These regressions are made by using the monthly averages of daily data for the individual single-name CDSs over the period January 2010–March 2021. The data source is BLM. The unit is bps.
- *ESG-Issue* stands for industry-specific risks unmanaged with respect to environmental, social, and governance issues, compared to such unmanaged risks in all industries. It is constructed by dividing *ESG Risk Score Average-Subindustry* by *ESG Risk Score Average-Universe*. These are risk scores increasing from zero (no risk) and is open-ended. They include two series of scores which refer to same given dates in early individual months. These data series are simply transformed into daily-frequency data with a normal date format, and then the monthly averages of these two daily scores are calculated and used, respectively. The data source is Sutainalytics' *ESG Risk Ratings*.
- *ScoreE* measures how well a sample company is prepared for and manages environmental issues, compared to its sector-peer companies. The issues include environmental policy, greenhouse gas reduction programme, renewable energy programmes, and green procurement policy. *ScoreE* is created by subtracting a company's *Comparative Group Average Environment* from its own *Environment Score*. These are performance scores ranging from 0 (worst) to 100 (best). They include two series of scores which refer to the same given dates in early individual months. These data series are simply transformed into daily-frequency data with a normal date format, and then the monthly averages of these two daily scores are calculated and used, respectively. The data source is Sutainalytics' *ESG Ratings*.
- *ScoreS* measures how well a sample company is prepared for and manages social issues, compared to its sector-peer companies. The issues include social supplier standards and freedom of association policy, such as working hours policy, discrimination policy, and diversity programmes. *ScoreS* is created by subtracting a company's *Comparative Group Average Social* from its own *Social Score*. These are performance scores ranging from 0 (worst) to 100 (best). They include two series of scores which refer to the same given dates in early individual months. These data series are simply transformed into daily-frequency data with a normal date format, and then the monthly averages of these two daily scores are calculated and used, respectively. The data source is Sutainalytics' *ESG Ratings*.
- *ScoreG* measures how well a sample company is prepared for and manages governance issues,

compared to its sector-peer companies. The issues include board independence, separation of Chair & CEO, gender diversity of board, audit committee independence, tax disclosure, board remuneration disclosure, bribery and corruption policy, whistle-blower programmes, and ESG reporting standards. *ScoreG* is created by subtracting a company's *Comparative Group Average Governance* from its own *Governance Score*. These are performance scores ranging from 0 (worst) to 100 (best). They include two series of scores which refer to the same given dates in early individual months. Such two series of data are simply transformed into daily-frequency data with a normal date format, and then the monthly averages of these two daily scores are calculated and used, respectively. The data source is Sutainalytics' *ESG Ratings*.

- *E-Issue* stands for risks unmanaged by a company with respect to environmental issues. This is an ingredient of *E/S/G Cluster Score*, or *Environment-Risk Score* – a risk score increasing from zero (no risk) and being open-ended. This is a series of scores which refers to given dates in early individual months. The series of data is simply transformed into a daily-frequency series of data of normal date format, and then the monthly averages of the daily scores are calculated and used. The data source is Sutainalytics' *ESG Risk Ratings*.
- *S-Issue* stands for risks unmanaged by a company with respect to social issues. This is an ingredient of *E/S/G Cluster Score*, or *Social-Risk Score* – a risk score increasing from zero (no risk) and being open-ended. This is a series of scores which refers to given dates in early individual months. The series of data is simply transformed into a daily-frequency series of data of normal date format, and then the monthly averages of the daily scores are calculated and used. The data source is Sutainalytics' *ESG Risk Ratings*.
- *G-Issue* stands for risks unmanaged by a company with respect to governance issues. This is an ingredient of *E/S/G Cluster Score*, or *Governance-Risk Score* – a risk score increasing from zero (no risk) and being open-ended. This is a series of scores which refers to given dates in early individual months. The series of data is simply transformed into a daily-frequency series of data of normal date format, and then the monthly averages of the daily scores are calculated and used. The data source is Sutainalytics' *ESG Risk Ratings*.

<3>Standardization

- The data are standardized in regression analyses in this study. Thanks to this, the marginal impacts of significant regressors are comparable with each other using the absolute values of their estimated coefficients. The standardized value of an indicator X is determined by dividing X's deviation by X's standard deviation.
- The standardization refers to the period of March 2019–March 2021 in the two regressions for FY2020, or the last regression of the three robust checks and the last regression of the three extensions. This can be said to the interaction-term analyses for FY2020. In all other regressions, the standardization refers to the period of January 2016–March 2021.

Appendix B

[Appendix Table B here]

Appendix C

[Appendix Table C here]

Appendix D

[Appendix Table C here]

Appendix E

[Appendix Table E here]

Tables

Table I

The Issuance of SD (sustainable development) bonds in Japan

(bil. yen)

	Green bonds	Social bonds	Sustainability bonds	Others	Total
2016	10.0	35.0	0.0	0.0	45.0
2017	40.0	65.0	0.0	0.0	105.0
2018	236.6	120.0	0.0	0.0	356.6
2019	565.0	461.8	147.0	0.0	1173.8
2020	755.4	883.0	443.5	20.0	2101.9
2021	1032.8	1157.2	520.5	146.0	2856.5

This table reports the annual issuance amount of SD bonds by type in Japan. The data are collected and announced in the bond market by Mizuho Securities.

Table II

Results of Estimating Eq. (2) over the Period Dec. 2018–Mar. 2021

Dependent variable: *CDSP*.   # of observations = 1567.

Model		A: Pooling	B: Fixed effect			C: Random effect	
Specification of *IE*		No	Yes: Constant			Yes: Stochastic	
Estimation method		OLS	LSDV	Weighted GLS		GLS	
Adjustments on residuals (ε)		-	-	White period	White cross-section	White period	White cross-section
				CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	PH & SC are adjusted for.	CSH & CCE are adjusted for.
Regressors	Estimates	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant term	*C*	-0.086 [0.000]	-0.006 [0.486]	-0.006 [0.283]	-0.006 [0.738]	-0.006 [0.954]	-0.006 [0.974]
Leverage	*Lev*	0.106 [0.000]	0.124 [0.001]	0.009 [0.871]	0.009 [0.858]	0.118 [0.238]	0.118 [0.055]
Uncertainty	*Vola*	0.314 [0.000]	0.033 [0.007]	0.023 [0.118]	0.023 [0.069]	0.038 [0.008]	0.038 [0.088]
Risk-free interest rates	*RFIR*	-0.111 [0.000]	-0.043 [0.000]	-0.030 [0.000]	-0.030 [0.005]	-0.045 [0.000]	-0.045 [0.003]
Profitability	*Profit*	-0.072 [0.000]	-0.050 [0.000]	-0.006 [0.698]	-0.006 [0.753]	-0.050 [0.165]	-0.050 [0.008]
Market-wide CDS liquidity	*MWL*	0.012 [0.692]	0.194 [0.000]	0.126 [0.000]	0.126 [0.000]	0.191 [0.000]	0.191 [0.000]
Company-specific CDS liquidity	*CSL*	0.216 [0.000]	0.432 [0.000]	0.261 [0.000]	0.261 [0.000]	0.423 [0.000]	0.423 [0.000]
Industry risk-exposure to ESG issues	*ESG-Issue* ^{Indu}	0.001 [0.886]	-0.003 [0.370]	0.002 [0.334]	0.002 [0.033]	-0.003 [0.503]	-0.003 [0.136]
Preparedness for and management of E issues	*ScoreE*	0.084 [0.002]	0.000 [0.991]	0.010 [0.702]	0.010 [0.349]	0.005 [0.922]	0.005 [0.888]
Preparedness for and management of S issues	*ScoreS*	0.074 [0.004]	0.073 [0.006]	0.039 [0.110]	0.039 [0.003]	0.069 [0.198]	0.069 [0.001]
Preparedness for and management of G issues	*ScoreG*	-0.287 [0.000]	-0.035 [0.202]	-0.056 [0.025]	-0.056 [0.068]	-0.065 [0.209]	-0.065 [0.141]
R_{adj}^2		0.301	0.902	0.862		0.442	
F-test on H_0: Pooling model > Fixed-effect model		170.461 [0.000]					
Hausman test on H_0: Random-effect model > Fixed-effect model			90.429 [0.000]				

This table shows the results of estimating Eq. (2): $CDSP_{i,\tau} = h_0 + IE_i + \varepsilon_{i,\tau} + h_1Lev_{i,\tau} + h_2Vola_{i,\tau} + h_3RFIR_\tau + h_4Profit_{i,\tau} + h_5MWL_\tau + h_6CSL_{i,\tau} + h_7ESG\text{-}ISSUE^{Indu}{}_{i,\tau} + h_8ScoreE_{i,\tau} + h_9ScoreS_{i,\tau} + h_{10}ScoreG_{i,\tau}$. Notes are as follows. First, ***, **, and * stand for one per cent, five per cent, and ten per cent levels of statistical significance. Second, we follow the conventional procedure in specifying the nature of *IE*. We estimate the pooling model using the OLS method and we estimate the fixed-effects model using the Least Square Dummy Variables (LSDV) method. We justify the addition of constant *IE*s by using the F-test to check how much and how significantly that addition reduces the residual sum of squares. If the fixed-effects model is selected, then, to compare it with the random-effects model, it is necessary to use the Hausman test to test the null hypothesis that *IE*s are uncorrelated with explanatory variables. Third, shading indicates regressors with statistically significant estimates and a specification of *IE* with statistical adequacy. We select the fixed-effects model. Fourth, CSH stands for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors. Using the statistical software package, *EViews 10*, we address these potential irregular aspects of the residuals ($\varepsilon_{i,\tau}$) by using two kinds of adjusted standard errors. *EViews 10*'s option for a panel-data regression, *White period*, is used to obtain standard errors adjusted for the risks of PH and SC, while *White cross-section* is used to obtain those adjusted for the risks of CSH and CCE. In estimating the fixed-effects model, we also use its option *Cross-section weights*, which also makes it possible to control for the risk of CSH. Reed and Ye (2011) demonstrate that estimators gained by using this weighted-GLS method together with each of the two options for adjusted standard errors are excellent in terms of the estimators' asymptotical efficiency and the accuracy of confidence intervals across them. Lastly, the random-effects estimators depend on the Swamy-Arora method which uses residuals gained in the within (fixed-effects) and between-means regressions.

Table III

Changes in R_{adj}^2 in Response to the Addition of Regressors

	Regression equations	Economic implications of the added regressors	R_{adj}^2
(1)	$CDSP_{i,\tau} = a_0 + IE_i + \varepsilon_{i,\tau}$	A constant and individual effects	90.5%
(2)	$Lev_{i,\tau}$, $Profit_{i,\tau}$, $ESG\text{-}Issue^{Indu}_{i,\tau}$, and $ScoreE_{i,\tau}$ are added to (1) above.	Insignificant regressors in the baseline estimation	85.5%
(3)	$Vola_{\tau}$ is added to (2) above.	Risk-free interest rates	86.1%
(4)	$RFIR_{\tau}$ is added to (3) above.	Risk-free interest rates	85.5%
(5)	MWL_{τ} is added to (4) above.	Market-wide liquidity	88.4%
(6)	$CSL_{i,\tau}$ is added to (5) above.	Company-specific liquidity	85.9%
(7)	$ScoreS_{i,\tau}$ is added to (6) above.	Preparedness for and management of S issues	86.0%
(8)	$ScoreG_{i,\tau}$ is added to (7) above.	Preparedness for and management of G issues	86.2%

This table shows the changes in R_{adj}^2 when major Japanese companies' CDS premia are regressed on a different sets of variables ranging from a coarse set (1) to a full set (8). Notes are as follows. First, we estimate the fixed-effects models by the weighted GLS method for all equations so as to maintain the comparability. Last, in all estimations, to control for the potential of residuals' cross-section heteroskedasticity, period heteroskedasticity, and serial correlation, we use *EViews 10*'s two options: *White period* and *Cross-section weights*.

Table IV

Estimated Coefficients on 6 Interaction Terms (*X*×*Y*) Added One-by-One to Eq. (2)

	Dec. 2018–Mar. 2021		Apr. 2020–Mar. 2021		Apr. 2020–Mar. 2021	
X \ *Y*	*ScoreE*	*ScoreS*	*ScoreE*	*ScoreS*	*E-Issue*	*S-Issue*
ScoreG	-0.002 [0.906]	-0.013 [0.292]	-0.071 [0.006]	-0.033 [0.016]	*Not applicable (n.a.)*	*n.a.*
G-Issue	*n.a.*	*n.a.*	*n.a.*	*n.a.*	0.085 [0.017]	0.050 [0.018]

This table shows the estimated value and statistical significance of coefficients on each of 6 interaction terms separately added one-by-one to Eq. (2). When we use as regressors *Issue-E, Issue-S*, and *Issue-G*, we drop $ESG\text{-}Issue^{Indu}$ on the right-hand side of Eq. (2). Notes are as follows. First, we follow the conventional procedure and select the fixed-effects model, and estimate them with the weighted GLS method. Second, figures in [ ] are p-values: the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation, separately. For example, in the case where *ScoreG*×*ScoreS* is added to Eq. (2) over the April 2020–March 2021 period, the estimated coefficient is –0.033 and its p-value is 0.016. Third, shading indicates interaction terms with statistically significant estimates based upon a 10 per cent level of statistical significance. The p-values used are the averages of two cases in which we adjust for ε's cross-section heteroskedasticity, period heteroscedasticity, contemporaneously correlation, and serial correlation separately. Using the statistical software package, *EViews 10*, we address these potential irregular aspects of the residuals by using two kinds of adjusted standard errors. *EViews 10*'s options for panel-data regressions, *White period* and *White cross-section*, are used.

Appendix Table B

The Risk of Multicollinearity among ESG Performance Scores: *ScoreE*, *ScoreS*, and *ScoreG*

	E vs S	S vs G	G vs E
Chubu Electric Power Company, Incorporated	1.62	5.88	1.30
Daiwa Securities Group Inc.	1.04	1.99	1.01
Fujitsu Limited	1.08	1.03	1.09
The Kansai Electric Power Company, Incorporated	1.31	4.26	1.90
ITOCHU Corporation	1.34	1.03	1.18
Kawasaki Kisen Kaisha Ltd.	1.04	1.04	9.35
Kajima Corporation	1.08	1.12	3.79
Kawasaki Heavy Industries, Ltd.	1.07	1.00	1.09
JFE Holdings, Inc.	3.51	2.66	2.00
Kobe Steel Ltd	27.80	3.62	2.82
Hitachi Ltd	1.06	1.54	1.15
Marubeni Corporation	1.02	1.06	1.79
Komatsu Ltd.	1.30	1.82	1.00
Mitsubishi Corporation	3.00	1.53	1.96
Mitsubishi Estate Co., Ltd.	3.24	1.46	1.05
Mitsubishi Heavy Industries, Ltd.	1.01	1.01	1.09
Mitsubishi Electric Corporation	2.31	1.18	1.03
Mitsubishi Materials Corporation	1.60	1.45	2.50
Mitsui & Co., Ltd.	1.00	18.47	1.02
Mitsui Fudosan Co., Ltd.	2.34	1.22	1.01
Mitsui Chemicals, Inc.	2.14	1.54	1.69
Mitsui O.S.K. Lines, Ltd.	1.07	4.96	1.08
NEC Corporation	1.01	3.18	1.05
Nippon Yusen Kabushiki Kaisha	2.56	2.31	7.69
ORIX Corporation	2.34	8.65	1.86
Ricoh Company, Ltd.	1.78	1.63	1.09
Sharp Corp	1.23	1.47	1.08
Sony Corp	2.42	1.01	1.22
Sumitomo Corp	1.00	1.33	1.03

	E vs S	S vs G	G vs E
Sumitomo Chemical Company, Limited	1.15	1.67	2.36
Taisei Corporation	2.38	1.30	1.94
Tokyu Corporation	9.66	4.17	1.99
Toshiba Corp.	13.49	3.92	5.32
Toyota Motor Corporation	1.81	3.20	1.17
ANA Holdings Inc.	1.75	1.85	1.01
East Japan Railway Company	1.13	1.14	1.27
Japan Tobacco Inc.	18.36	1.00	1.02
Kintetsu Group Holdings Co., Ltd.	1.17	1.57	2.00
Nippon Steel & Sumitomo Metal Corporation	1.00	3.99	1.00
Nomura Holdings Inc	2.30	3.63	1.92
Odakyu Electric Railway Co., Ltd.	1.02	1.00	9.56
Obayashi Corporation	2.84	6.98	1.41
Oji Holdings Corporation	1.19	1.01	2.04
Hankyu Hanshin Holdings, Inc.	1.70	2.49	3.95
Panasonic Corporation	1.10	1.00	2.16
Shimizu Corporation	1.29	2.62	1.63
SoftBank Group Corp	29.33	4.67	6.92
Tokyo Electric Power Company Holdings, Incorporated	1.69	1.11	1.31
ACOM Co., Ltd.	5.02	7.05	9.96
AEON Co., Ltd.	1.26	1.25	1.22
Honda Motor Co., Ltd	2.62	1.08	1.28
Nissan Motor Co., Ltd.	1.07	1.03	1.07
Rakuten Group, Inc.	3.51	4.43	3.89
Sumitomo Realty & Development Co., Ltd.	1.12	7.72	1.02
Takeda Pharmaceutical Company Limited	1.10	1.41	1.02
IHI Corporation	1.01	3.72	1.02
Central Japan Railway Company	1.01	1.64	1.54

This table shows VIFs (variance-inflation factors) among *ScoreE*, *ScoreS*, and *ScoreG*. Notes are as follows. First, a VIF is defined as $1/\{1-(\text{correlation coefficients})^2\}$. Last, all the VIFs are much smaller than 10, the criterion proposed by Snee and Marquardt (1984) as defining negligible risk of multicollinearity caused by the independent variables. Among 171 cases, we ignore the five exceptions shadowed above.

Appendix Table C

Results of Estimating Eq. (2) over the Period Jan. 2016–Mar. 2021

Dependent variable: *CDSP*. # of observations = 3419.

Model		**A: Pooling**	**B: Fixed effect**			**C: Random effect**	
Specification of *IE*		**No**	**Yes: Constant**			**Yes: Stochastic**	
Estimation method		**OLS**	**LSDV**	**Weighted GLS**		**GLS**	
Adjustments on residuals (ε)		-	-	**White period** **CSH, PH, & SC are adjusted for.**	**White cross-section** **CSH & CCE are adjusted for.**	**White period** **PH & SC are adjusted for.**	**White cross-section** **CSH & CCE are adjusted for.**
Regressors	**Estimates**	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant term	*C*	-0.003	0.003	0.001	0.001	-0.001	-0.001
		[0.837]	[0.582]	[0.534]	[0.905]	[0.992]	[0.996]
Leverage	*Lev*	0.131	0.192	0.086	0.086	0.183	0.183
		[0.000]	[0.000]	[0.172]	[0.004]	[0.202]	[0.000]
Uncertainty	*Vola*	0.288	0.120	0.063	0.063	0.123	0.123
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Risk-free interest rates	*RFIR*	-0.031	-0.008	-0.006	-0.006	-0.008	-0.008
		[0.017]	[0.226]	[0.020]	[0.540]	[0.355]	[0.610]
Profitability	*Profit*	-0.109	-0.034	-0.011	-0.011	-0.035	-0.035
		[0.000]	[0.000]	[0.542]	[0.160]	[0.034]	[0.034]
Market-wide CDS liquidity	*MWL*	0.029	0.119	0.087	0.087	0.117	0.117
		[0.043]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Company-specific CDS liquidity	*CSL*	0.436	0.407	0.269	0.269	0.407	0.407
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Industry risk-exposure to ESG issues	*ESG-Issue* ^{Indu}	*Not applicable*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Preparedness for and management of E issues	*ScoreE*	0.122	-0.056	-0.007	-0.007	-0.047	-0.047
		[0.000]	[0.004]	[0.774]	[0.548]	[0.530]	[0.126]
Preparedness for and management of S issues	*ScoreS*	0.070	0.027	0.029	0.029	0.027	0.027
		[0.000]	[0.116]	[0.130]	[0.000]	[0.447]	[0.005]
Preparedness for and management of G issues	*ScoreG*	-0.296	-0.023	-0.026	-0.026	-0.032	-0.032
		[0.000]	[0.096]	[0.061]	[0.000]	[0.405]	[0.058]
R_{adj}^2		0.476	0.874	0.768		0.639	
F-test on H_0: Pooling model > Fixed-effect model		194.119 [0.000]					
Hausman test on H_0: Random-effect model > Fixed-effect model			72.341 [0.000]				

This table shows the results of estimating Eq. (2) without $ESG\text{-}ISSUE^{Indu}_{i,\tau}$: $CDSP_{i,\tau} = h_0 + IE_i + \varepsilon_{i,\tau} + h_1Lev_{i,\tau} + h_2Vola_{i,\tau} + h_3RFIR_\tau + h_4Profit_{i,\tau} + h_5MWL_\tau + h_6CSL_{i,\tau} + h_7ScoreE_{i,\tau} + h_8ScoreS_{i,\tau} + h_9ScoreG_{i,\tau}$. For notes, see those in Table 2.

Appendix Table D

Results of Estimating Eq. (2) over the Period Apr. 2020–Mar. 2021

Dependent variable: *CDSP*.   # of observations = 677.

Model		**A: Pooling**	**B: Fixed effect**			**C: Random effect**	
Specification of *IE*		**No**	**Yes: Constant**			**Yes: Stochastic**	
Estimation method		**OLS**	**LSDV**	**Weighted GLS**		**GLS**	
Adjustments on residuals (ε)		-	-	**White period** **CSH, PH, & SC are adjusted for.**	**White cross-section** **CSH & CCE are adjusted for.**	**White period** **PH & SC are adjusted for.**	**White cross-section** **CSH & CCE are adjusted for.**
Regressors	**Estimates**	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant term	*C*	-0.019	-0.131	-0.080	-0.080	-0.111	-0.111
		[0.919]	[0.032]	[0.000]	[0.142]	[0.375]	[0.408]
Leverage	*Lev*	0.084	0.783	0.518	0.518	0.379	0.379
		[0.024]	[0.000]	[0.000]	[0.004]	[0.026]	[0.002]
Uncertainty	*Vola*	0.390	0.037	0.023	0.023	0.051	0.051
		[0.000]	[0.040]	[0.010]	[0.033]	[0.014]	[0.080]
Risk-free interest rates	*RFIR*	-0.184	0.094	0.042	0.042	0.035	0.035
		[0.449]	[0.225]	[0.009]	[0.552]	[0.422]	[0.686]
Profitability	*Profit*	-0.085	-0.025	-0.045	-0.045	-0.063	-0.063
		[0.010]	[0.341]	[0.002]	[0.000]	[0.309]	[0.018]
Market-wide CDS liquidity	*MWL*	0.113	0.160	0.124	0.124	0.181	0.181
		[0.013]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Company-specific CDS liquidity	*CSL*	0.230	0.326	0.213	0.213	0.329	0.329
		[0.000]	[0.000]	[0.000]	[0.000]	[0.006]	[0.000]
Industry risk-exposure to ESG issues	*ESG-Issue* ^{Indu}	-0.009	0.000	0.001	0.001	-0.001	-0.001
		[0.244]	[0.980]	[0.263]	[0.191]	[0.777]	[0.399]
Preparedness for and management of E issues	*ScoreE*	0.095	-0.029	0.032	0.032	0.003	0.003
		[0.044]	[0.627]	[0.129]	[0.094]	[0.968]	[0.958]
Preparedness for and management of S issues	*ScoreS*	0.043	0.090	0.015	0.015	0.088	0.088
		[0.381]	[0.110]	[0.379]	[0.493]	[0.100]	[0.084]
Preparedness for and management of G issues	*ScoreG*	-0.297	-0.041	-0.045	-0.045	-0.138	-0.138
		[0.000]	[0.529]	[0.100]	[0.013]	[0.079]	[0.063]
R_{adj}^2		0.310	0.932	0.907		0.512	
F-test on H_0: Pooling model > Fixed-effect model		109.871 [0.000]					
Hausman test on H_0: Random-effect model > Fixed-effect model			161.248 [0.000]				

This table shows the results of estimating Eq. (2): $CDSP_{i,\tau} = h_0 + IE_i + \varepsilon_{i,\tau} + h_1 Lev_{i,\tau} + h_2 Vola_{i,\tau} + h_3 RFIR_\tau + h_4 Profit_{i,\tau} + h_5 MWL_\tau + h_6 CSL_{i,\tau} + h_7 ESG\text{-}ISSUE^{Indu}{}_{i,\tau} + h_8 ScoreE_{i,\tau} + h_9 ScoreS_{i,\tau} + h_{10} ScoreG_{i,\tau}$. For notes, see those in Table 2.

Appendix Table E

Results of Estimating Eq. (2) with E, S, G Risk Scores over the Period Apr. 2020–Mar. 2021

Dependent variable: *CDSP*.   # of observations = 677.

Model		A: Pooling	B: Fixed effect			C: Random effect	
Specification of *IE*		No	Yes: Constant			Yes: Stochastic	
Estimation method		OLS	LSDV	Weighted GLS		GLS	
Adjustments on residuals (ε)		-	-	White period: CSH, PH, & SC are adjusted for.	White cross-section: CSH & CCE are adjusted for.	White period: PH & SC are adjusted for.	White cross-section: CSH & CCE are adjusted for.
Regressors \ Estimates		$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant term	*C*	-0.029	-0.142	-0.084	-0.084	-0.120	-0.120
		[0.881]	[0.019]	[0.000]	[0.110]	[0.353]	[0.379]
Leverage	*Lev*	0.079	0.797	0.524	0.524	0.395	0.395
		[0.046]	[0.000]	[0.000]	[0.005]	[0.025]	[0.001]
Uncertainty	*Vola*	0.400	0.036	0.021	0.021	0.044	0.044
		[0.000]	[0.044]	[0.006]	[0.041]	[0.013]	[0.098]
Risk-free interest rates	*RFIR*	-0.172	0.115	0.050	0.050	0.056	0.056
		[0.494]	[0.136]	[0.002]	[0.468]	[0.202]	[0.552]
Profitability	*Profit*	-0.112	-0.012	-0.041	-0.041	-0.055	-0.055
		[0.001]	[0.644]	[0.008]	[0.000]	[0.381]	[0.032]
Market-wide CDS liquidity	*MWL*	0.111	0.160	0.123	0.123	0.179	0.179
		[0.018]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Company-specific CDS liquidity	*CSL*	0.241	0.330	0.206	0.206	0.333	0.333
		[0.000]	[0.000]	[0.000]	[0.000]	[0.005]	[0.000]
Risk-exposure to E issues	*E-Issue*	-0.066	0.150	0.069	0.069	0.061	0.061
		[0.105]	[0.088]	[0.096]	[0.042]	[0.489]	[0.349]
Risk-exposure to S issues	*S-Issue*	0.001	-0.123	-0.054	-0.054	-0.066	-0.066
		[0.984]	[0.103]	[0.076]	[0.082]	[0.374]	[0.301]
Risk-exposure to G issues	*G-Issue*	0.046	0.078	0.030	0.030	0.053	0.053
		[0.270]	[0.093]	[0.055]	[0.024]	[0.265]	[0.012]
R_{adj}^2		0.264	0.933	0.909		0.518	
F-test on H_0: Pooling model > Fixed-effect model		119.196 [0.000]					
Hausman test on H_0: Random-effect model > Fixed-effect model			142.282 [0.000]				

This table shows the results of estimating a changed Eq. (2): $CDSP_{i,\tau} = h_0 + IE_i + \varepsilon_{i,\tau} + h_1 Lev_{i,\tau} + h_2 Vola_{i,\tau} + h_3 RFIR_\tau + h_4 Profit_{i,\tau} + h_5 MWL_\tau + h_6 CSL_{i,\tau} + h_7 Issue\text{-}E_{i,\tau} + h_8\ Issue\text{-}S_{i,\tau} + h_9\ Issue\text{-}G_{i,\tau}$. For notes, see those in Table 2.