12-2020

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Amirhossein Fard

Siamak Javadi
The University of Texas Rio Grande Valley

Incheol Kim
The University of Texas Rio Grande Valley, incheol.kim@utrgv.edu

Recommended Citation

Fard, Amirhossein, Siamak Javadi, and Incheol Kim. "Environmental regulation and the cost of bank loans: International evidence." Journal of Financial Stability 51 (2020): 100797. https://doi.org/10.1016/j.jfs.2020.100797

Environmental Regulation and the Cost of Bank Loans: International Evidence[*]

Amirhossein Fard,[†] Siamak Javadi,[‡] and Incheol Kim[§]

Abstract

Using a sample of 27 countries between 1990 and 2014, we find that banks charge higher interest rates and adjust other contractual features of their loans when lending to firms facing more stringent environmental regulations. Our evidence suggests that lenders' concerns about the increase in environmental liabilities resulting from regulations is driving the results. Specifically, we show that firms facing such regulations have fewer participants in their loan syndicates, higher bankruptcy risk, and lower credit ratings, despite reducing their leverage. Overall, our results indicate that the observed higher loan spread is the result of environmentally sensitive lending practices by banks.

JEL Classification: G21; G32; Q51
Keywords: Environmental Regulations; Business Risk; Bank Loan Contracting

[*] We thank Bin Wang, Omrane Guedhami, Mahdi Rastad, Mohsen Mollagholamali, Walid Syed Reza, seminar participants at the University of Texas Rio Grande Valley, the 2018 Southwest Finance Association meeting, and the 2018 Financial Management Association meeting for their helpful comments. All remaining errors are ours. Declarations of interest: none.
[†]Department of Business and Economics, Texas Lutheran University 1000 W Court St. Seguin, TX 78155 afard@tlu.edu, (830) 372- 6870. Corresponding author.
[‡]Department of Economics and Finance, Robert C. Vackar College of Business & Entrepreneurship, University of Texas Rio Grande Valley. siamak.javadi@utrgv.edu, (956) 882-8858.
[§]Department of Economics and Finance, Robert C. Vackar College of Business & Entrepreneurship, University of Texas Rio Grande Valley. incheol.kim@utrgv.edu, (956) 665-3354.

Many companies no longer see corporate responsibility as a moral issue, but as core business risks and opportunities. More and more investors accept that environmental and social factors put company value at stake. This leads to the question of what the potential financial impacts of those risks and opportunities could be…

- The KPMG Survey of Corporate Responsibility Reporting (2013)

1. Introduction

In recent years, we have witnessed governments around the world ramping up their environmental regulations to curb carbon emissions in order to combat climate change.[1] Moreover, anecdotal evidence (recent reports by KPMG, for example) reveals that companies themselves increasingly view such issues as financial rather than nonfinancial and therefore treat them as meaningful risk factors and internally develop policies to address them. These new developments have revived researchers' interest in an old question: how do environmental policies affect firms?

Ever since the establishment of the Environmental Protection Agency (EPA) by the Nixon Administration in the early 1970s, businesses, policymakers, and academics have debated the impact of environmental regulations on firms. Two main opposing views dominate this debate. On the one hand, advocates of corporate environmental responsibility (CER hereafter) argue that the costs associated with complying with these regulations should be viewed as a tool to manage risk or as an investment in intangible assets such as human capital and reputation. Studies in this camp generally focus on firms' social and environmental profiles and document a significantly positive (negative) effect on firms with a good (concerning) profile (Chava, 2014; Clarkson et al., 2011; El Ghoul et al., 2011; El Ghoul et al., 2018; Flammer, 2013; Goss and Roberts, 2011; Guenster et al., 2011; Jiao, 2010; Oates et al., 1993; Sharfman and Fernando, 2008). On the other

[1] For example, the 2015 Paris Climate Accord, a multilateral agreement that involves 175 parties (174 states and the European Union), requires a long-term commitment by the signatory parties to reduce their CO_2 emission and their carbon footprints to assure that the increase in global average temperature is kept below 2°C.

hand, critics view these costs as a drain on firms' resources. They view these costs as a manifestation of the agency conflict similar to the self-dealing problem, as in Yermack (2006). They argue that the costs associated with these policies is a diversion of firm resources, does not benefit investors or lenders, is not rewarded by the market, and could have been invested more profitably. Studies that support this view also focus on firms' social and environmental profiles, and predominantly find little or no evidence of a positive impact of these policies on firms (Brammer et al., 2006; Jaffe and Palmer, 1997; Hamilton et al., 1993; Mahapatra, 1984; Nelling and Webb, 2009).

The mixed results in the literature leave the issue of environmental regulation-firm relation (and more generally the issue of CER-firm relation) an open question. Kempf and Osthoff (2007), Renneboog et al. (2008), and Sharfman and Fernando (2008) call for more research that investigates the impact of these regulations on the cost of capital. In particular, Sharfman and Fernando (2008, p. 589) call for a study to examine the cost of debt in an international setting *"*where the pressure for firms to improve their environmental risk management is potentially stronger (e.g., Europe and Australia), both from regulation and from societal pressure.*"* In this paper, we contribute to this debate by focusing on environmental regulation rather than firms' social and environmental profiles and study its impact on loan contracting and cost of debt in an international setting. Specifically, we examine whether and to what extent lenders view environmental regulation as a relevant risk factor and incorporate it into different dimensions of their loan contracts.

We focus on the cost of borrowing and, more specifically, on bank loans, because parallel to the rise of socially responsible investing, there has been substantial growth in environmentally

sensitive lending as well (Chava, 2014; Cogan, 2008).[2] Evidence suggests that banks are more sensitive to environmental issues than other lenders (Chang et al., 2018). Moreover, bank loans have historically been arguably one of the most important sources of external finance (Houston and James, 1996). Overall, these patterns have continued over time and bank loans remain an important source of external finance (e.g., see Allen et al., 2013). In addition, it is a well-established notion in the banking literature that banks as delegated monitors have access to information that may be unavailable to outsiders, and thus they are in a unique position to assess their borrowers' risk and their ability to repay loans. Therefore, if environmental regulation is a relevant (risk) factor that affects firms, banks are among the best stakeholders, if not the best, to show sensitivity to this risk factor and reflect it in their loan contracts.

Our empirical findings support the view that environmental regulation is relevant to lenders and that they charge higher interest rates on loans issued to firms that face stronger environmental regulations. Using the within-country variation of a measure of environmental policy stringency (EPS hereafter) developed by Botta and Koźluk (2014), for a sample of 27 countries between 1990 and 2014, we find strong evidence that stiffer environmental regulation is associated with higher bank loan spreads. Specifically, we find that a one standard deviation increase in EPS leads to about an 11.2% increase in the cost of bank loans, which is both statistically and economically significant. For an average firm in our sample that has a loan spread of 170.45 basis points, this translates into an increase of about 19 basis points. This result is insensitive to the inclusion of the U.S. firms; survives after addressing endogeneity through a

[2] Chava (2014, p. 2223) reports that *"*a large number of banks, representing approximately 80% of the global lending volume, have adopted the Equator Principles (http://www.equator-principles.com), are signatories to the United Nations Environment Programme's Statement by Banks, and have agreed to consider social and environmental issues in project finance.*"* Cogan's (2008) report also reveals that the global banking sector has a clear agenda to include climate change concerns in their lending decisions and that 72.5% of the banks in the survey are involved in clean and renewable energy lending.

difference-in-difference approach; and is robust to different model specifications, inclusion of year, country, industry, firm, and loan type and purpose fixed effects. Additionally, the impact of strong environmental regulations may not be limited to loan spreads. Lenders have other options beyond increasing loan spreads to mitigate the risk (Dennis et al., 2000; Goss and Roberts, 2011; Graham et al., 2008). For example, they can issue secured loans, shorten maturity, and increase up-front fees. We explore these options and find suggestive empirical evidence consistent with these predictions.

What is the mechanism through which environmental regulation affects firms? We argue that stronger environmental regulation increases firms' environmental liabilities. These liabilities are legally binding, can potentially lead to a substantial and continuous outflow of funds, and failure to comply may lead to downgrades in bond rating (Graham et al., 2001), ultimately resulting in lawsuits or bankruptcy (Chang et al., 2018; Schneider, 2011). In particular, Chang et al. (2018) find a negative relationship between environmental liabilities and financial leverage and conclude that environmental liability is a (an imperfect) substitute for financial liability and that firms with better environmental profiles have enhanced debt capacity and better access to bank loans. Anecdotal evidence also supports the idea that environmental liability risk is relevant and has increased substantially around the world. Due to the oil spill in the Gulf of Mexico in 2010, British Petroleum (BP) was charged $42 billion.[3] To clean up its environmental damage in the Amazon region, Chevron was ordered to pay $9.5 billion in 2011.[4] More recently, in June 2016, the partial settlement of Volkswagen's emission scandal was valued at $14.7 billion.[5] These

[3] *Economist*, 8 February 2014.
[4] *Economist*, 5 March 2014.
[5]In her press conference on June 28, 2016, Sally Yates, U.S. Deputy Attorney General, stated that "while this announcement [of the partial settlement] is an important step forward in achieving justice for the American people, let me be clear, it is by no means the last … Our criminal investigation is active and ongoing." https://www.justice.gov/opa/speech/deputy-attorney-general-sally-q-yates-delivers-remarks-press-conference-announcing-147.

growing examples reveal the significance of environmental liability risk. Therefore, to the extent that environmental liabilities represent a meaningful risk factor to lenders, we expect them to charge higher interest rates on loans issued to firms facing strong environmental regulations.

By raising the regulatory threshold and thereby increasing firms' environmental liabilities, more stringent environmental regulations systematically undermine existing environmental profiles of all firms in a country. Firms that are marginally in compliance with existing regulations may violate the new and stronger regulations once those regulations go into effect. This, in turn, increases their environmental liabilities, reduces their debt capacity, and subjects them to increased risk stemming from future compliance and litigation and to increased costs associated with compliance. Our evidence is consistent with these predictions.

First, focusing on the supply side of loan contracts and consistent with Chava (2014), El Ghoul et al. (2018), Heinkel et al. (2001), and Merton (1987), we provide evidence that loans issued to firms that face stronger environmental regulations have a narrower lenders base as reflected by fewer participants in their loan syndicates. This result implies that as stronger regulations increase firms' environmental liabilities, banks tend to avoid lending to these firms; consequently, these firms have to pay higher interest rates on their loans. Second, similar to the main result in Chang et al. (2018), we find a negative relationship between EPS and firms' debt ratios, indicating that firms maintain lower leverage when facing stronger environmental regulations. This result is also consistent with the findings in Ginglinger and Moreau (2019) and is in line with the idea that environmental liability can substitute for financial leverage and is viewed as a risk a factor very much like debt.

Third, we show a decline in Altman Z-scores and credit ratings as firms face more stringent environmental regulations. To the extent that credit ratings proxy for the demand by creditors,

this result is consistent with the decrease in the number of participants in the loan syndicate and the increase in loan spread; and while this result implies an increase in firms' default risks, the result for leverage, the inverse association between debt ratio and EPS, indicates the opposite. Therefore, these findings combined suggest that higher loan spreads and the reported effects on other contractual features of loans are predominantly the consequence of exposure to the risk associated with tighter environmental regulations, such as future compliance and litigation, rather than conventional factors associated with firms' default risks such as leverage.

We provide more corroborating evidence by conducting a series of subsample analyses. Stronger environmental regulations undercut firms' debt capacity. By undermining firms' environmental profiles, these regulations increase environmental liabilities that are known to have several features in common with leverage (Chang et al., 2018). Thus, the impact of such regulations should be larger for financially constrained firms that already have small or limited debt capacity. Using a measure of financial constraint developed by Kaplan and Zingales (1997), we split our sample into firms with high and low financial constraints and show that financially constrained firms are the main drivers of our results.

Next, we split our sample into firms with high and low environmental litigation risk based on their industries. In addition to increasing firms' business risks, increased environmental liabilities resulting from more stringent regulations can also affect lenders through litigation risk for borrowers (which increases borrowers' credit risk), by lender litigation risk (due to lender liability laws), and through lender reputation risk for being associated with a borrower with environmental concerns (Chava, 2014). This implies that firms in industries with high environmental litigation risk should be affected more by stronger regulations. Consistent with this argument, we find that the effect predominantly exists in firms operating in such industries.

Furthermore, we explore the implication of bank-based *vis-à-vis* market-based economies for our analysis. Our earlier evidence suggests that loans issued to firms that face stronger environmental regulations have a smaller syndicate size. Firms have fewer participants in their loan syndicates and end up paying higher interest rates on their loans if they cannot easily switch to an alternative source of external finance. Firms in bank-based economies that rely heavily on bank loans have a hard time switching to another source of financing relative to firms in market-based economies. Thus, we expect the effect to be stronger for firms in bank-based economies and provide empirical evidence consistent with this prediction. Lastly, in line with the growing sensitivity to environmental issues over time and the resulting shift towards stronger environmental regulations, we find that the effect of EPS is driven by the recent half of our sample time period compared to the earlier half.

Our study makes several contributions to different strands of the literature. We contribute to the law and finance literature that investigates the effects of country-level legal changes on firms' cost of capital (e.g., Bae and Goyal, 2009; Qian and Strahan, 2007). We also add to the voluminous literature on CER-firm relations. Due to lack of a reliable measure of environmental regulation stringency that is comparable across different countries, most of the prior studies focus mainly on U.S. firms and their environmental profiles (Chava, 2014; El Ghoul et al., 2011; Goss and Roberts, 2011; Sharfman and Fernando, 2008, to name a few). Our paper improves upon these studies in multiple dimensions. First, we employ a recently developed measure of stringency of environmental regulation that is comparable across different countries. Due to the difference in the regulatory environment in each country, generalizing the findings in the U.S. to other countries requires more research (Sharfman and Fernando, 2008) that needs such a reliable measure.

To the best of our knowledge, this is the first cross-country study that examines the impact of environmental regulation on the cost of bank loans and provides international evidence on the mechanisms through which these regulations affect lenders and borrowers. Second, using EPS allows us to depart from common practices in the literature (Chava, 2014; El Ghoul et al., 2011; El Ghoul et al., 2018; Goss and Roberts, 2011) by focusing on governments' environmental regulations rather than firms' environmental profiles. This has two advantages. First, it is easy to argue that a firm's environmental profile is endogenous, as it is an internal choice and can be changed.[6] However, environmental regulations are set by governments, and thus it is easier to argue that they are exogeneous to firms. Therefore, focusing on environmental regulation alleviates concerns about endogeneity issues. Second, by exploiting the time series and cross-sectional variation in the stringency of environmental regulation — a property unavailable prior to EPS since we only observed time-series variation of regulations in one country — we employ an empirical design that can be effectively interpreted as the difference-in-difference estimator (Imbens and Woolridge, 2009), which further reduces endogeneity concerns.

Moreover, our paper also contributes to the banking literature. Our results reflect banks' sensitivity to environmental concerns and add to the evidence on environmentally sensitive lending provided by Chang et al. (2018), Chava (2014), and Cogan (2008). We show that in addition to the usual default risk proxies that affect different aspects of loan contracts (see Dennis et al., 2000), the risk associated with environmental regulation also affects the cost and other features of loans.

[6] While most companies can change their environmental profiles, due to their lines of business some companies are, by definition, unable to do so and would be an exception to our argument. Sin stocks are examples of such companies.

The remainder of this paper is organized as follows. Section 2 provides some background, reviews the related literature, and develops our main hypothesis. Section 3 describes the data, their sources, our measure of environmental regulation stringency, and our empirical design. We present and discuss our empirical results in Section 4 and conclude in Section 5.

2. Background and Hypothesis Development

2.1. Background and Literature Review

In the last two decades, there has been a growing trend of governments and firms all around the world actively implementing more stringent environmental regulations and policies. This policy shift on environmental issues by governments and firms is evident in the UN Global Compact-Accenture CEO study conducted in 2010.[7] In a survey of more than 750 CEOs from all over the world, 93% state that sustainability and environmental protection activities are crucial factors in their companies' future success. More recently, the 2015 Paris Climate Accord, a multilateral agreement that involves 175 governments around the world, is committed to curbing firms' CO_2 emission and their carbon footprints through a combination of environmental regulations and market incentives.

The impact of such regulations on firms has been under scrutiny for a couple of decades. Two opposing views have emerged over these years. The advocates of these policies generally find a positive impact on firms of such policies, whereas the critics document no link, weak links, or at times a negative relationship. For example, on the one hand, Sharfman and Fernando (2008) show that firms with improved environmental risk management have a lower cost of capital. Oates et al. (1993) show that firms' motivation to adopt more efficient abatement technologies increase as the level of pollution tax rates increases. El Ghoul et al. (2011) and El

[7]The full reports can be accessed at:https://www.unglobalcompact.org/docs/news_events/8.1/UNGC_Accenture_CEO_Study_2010.pdf

Ghoul et al. (2018) show that firms that are more socially and environmentally responsible have a lower cost of equity, while Chava (2014) finds that firms with environmental concerns have a higher cost of equity. Similarly, firms with social and environmental concerns have a significantly higher cost of bank loans (Chava, 2014; Goss and Roberts, 2011). The evidence in Clarkson et al. (2011), Flammer (2013), Guenster et al. (2011), and Jiao (2010) suggests that firm value and corporate environmental performance are positively associated.

On the other hand, Mahapatra (1984) concludes that pollution control expenditures are suboptimal allocations of firms' resources and are not rewarded by investors. Jaffe and Palmer (1997) find a weak link between compliance costs and innovation as measured by successful patent applications. Similarly, Nelling and Webb (2009) also find no link between corporate social responsibility and firm financial performance. While Hamilton et al. (1993) find no statistical difference between socially responsible funds and conventional funds, Brammer et al. (2006) show that firms that score higher on social performance realize lower returns. Due to these mixed findings, the issue of CER-firm relationship remains an open and pressing question, especially against the backdrop of recent ramped-up regulations to combat climate change. In fact, Kempf and Osthoff (2007), Renneboog et al. (2008), and Sharfman and Fernando (2008) call for more research to study the impact of corporate responsibility on cost of capital. Specifically, Sharfman and Fernando (2008) call for more research to study the cost of debt in an international setting.

2.2. Hypothesis Development

Conducting cross-country studies requires reliable and comparable measures of environmental policy stringency across different countries. Up until recently, the lack of such measures made cross-country studies of the economic impact of environmental regulations

limited and narrow in scope. However, a recently developed environmental policy stringency index (Botta and Koźluk, 2014) fills this void and provides us an opportunity to conduct an international analysis of the economic effect on firms of environmental regulations. Using this index, we specifically analyze the relationship between the stringency of environmental regulations and the cost of bank loans.

We focus on bank loans as a proxy for the cost of debt for several reasons. First, as reported by Chava (2014), similar to socially responsible investing, there has been a dramatic shift towards environmentally sensitive lending practices by a considerable number of lenders. For instance, in his comprehensive assessment of 40 of the world's largest banks, Cogan (2008) finds that banks have conducted more than 100 studies analyzing firms' regulatory strategies regarding climate change. He finds that 23 of those banks include discussions of climate change on their latest annual shareholders reports. Nine of those banks have assigned a board member to observe the company's climate-related policies. Thirty-four of those banks replied to the latest annual survey operated by the carbon disclosure project (CDP). He also reports that 29 of the banks in his survey are involved in clean and renewable energy lending. More recently, consistent with Cogan's (2008) survey, the results in Chang et al. (2018) indicate that banks are more sensitive to environmental issues than other lenders.

Second, bank loans remain one of the most important sources of external finance (Houston and James, 1996; Tirole, 2006). For example, Allen et al. (2013) show that lower and upper middle-income economies have a ratio of bank loan to GDP that is less than 50% by the end of the 2000s, whereas for high income economies (Organization for Economics Cooperation and Development or OECD) this ratio is slightly below 125% (see Allen et al., 2013, Figure 1, p.764). Third, given the fact that banks have access to firms' private information, the banking

literature views them as delegated monitors. These monitors, therefore, have the unique ability to have a more accurate assessment of the risks and exposures of their borrowers. Thus, given that banks are more sensitive to environmental issues relative to other lenders (Chang et al., 2018), it follows that if the stringency of governments' environmental regulations is believed to have a significant impact on borrowers' ability to repay loans, banks would then design their loan contracts to reflect this risk factor.

Nevertheless, why would lenders be concerned about environmental regulations? How could these regulations constitute a risk factor that affects lenders? There are several reasons why stringency of environmental regulations could be a risk factor to lenders. More stringent environmental regulations can increase firms' environmental liabilities. These liabilities have been mainly categorized as "nonfinancial issues." Most firms keep most of their environmental liabilities off their balance sheets. However, over the last two decades, with the ever-growing awareness of the public about corporations' environmental impact, the conventional lines between "financial" and "nonfinancial" issues are increasingly distorted. In its 2017 survey, KPMG (2017) concludes, "environmental and social issues such as climate change, water scarcity, and human rights will increasingly be seen as financial rather than nonfinancial issues." In the same survey, KPMG (2017) reveals that "for the first time in the history of its survey, more than 60% of companies across all industry sectors" release a corporate responsibility (CR) report. In 2017, 78% of Fortune Global 250 companies included CR information in their annual financial reports. The continuous and substantial growth of this practice since 2011 (44% in 2011, 55% in 2013, and 65% in 2015) reflects the fact that investors and lenders find environmental liabilities to be increasingly relevant.

Empirical evidence in academic studies is also consistent with the idea that environmental liability is a meaningful risk factor. Environmental liabilities are legally binding, can potentially lead to a substantial and continuous outflow of funds, and failure to comply may lead to bankruptcy (Chang et al., 2018). Environmental liabilities can increase bankruptcy risk (Schneider, 2011) and adversely affect bond ratings (Graham et al., 2001). Results in Bauer and Hann (2010) suggest that adverse environmental events represent a risk factor to nonsecured bondholders. Studies by Barth and McNichols (1994), Clarkson et al. (2011), and Li et al. (2014) show how substantial and consequential these liabilities can be. Chang et al. (2018) show that environmental and financial liabilities have several important features in common and that environmental liabilities increase firms' business risk. This discussion leads to our main hypothesis.

H_1: Firms facing more stringent environmental regulations pay larger spreads on their bank loans.

In the next section, we turn to data and the empirical methodology that we use to confront the foregoing hypothesis with the data.

3. Data and Empirical Design

3.1. Data

In this study, we focus on the cost of bank loans for firms in 27 countries over 25 years. We obtain syndicated loan data from Thomson Reuters Loan Pricing Corporation, DealScan. Specifically, we study loans that originated between January 1990 and December 2014. Following the literature (Diamond and Rajan, 2000; Flannery, 1994), we exclude financial and quasi-public firms (SIC code, 6000-6999, 9000-9999). DealScan includes data on loan prices, terms, and detailed information related to the lenders and borrowers. Each loan is identified as a

distinct observation, facility level, to which the price and nonprice terms are fixed. For each facility, we collect the all-in-spread-drawn variable (the total annual spread, paid over London Interbank Offered Rate (LIBOR)) as a proxy for bank loan cost as well as the nonpricing features of loans, including the number of participants in the loan syndicate, up-front fees, and loan size and maturity. Firms' accounting information is from Global COMPUSTAT. Companies are assigned to a country using the firms' headquarters, as reported in Global COMPUSTAT. Country-level variables are collected from the World Bank website. After matching the DealScan loan data with the firm-level accounting information and country-level variables, our final sample includes 6,347 observations from 1990 to 2014. This sample excludes U.S. firms. We report the results with and without U.S. firms separately because DealScan is heavily skewed towards U.S. firms; therefore, their inclusion raises the concern that our findings are biased towards U.S. firms and making an inference about the impact of these regulations on firms in an international setting less reliable. Nevertheless, throughout the paper, we report all our analyses with and without U.S. firms as a robustness check. After applying the same procedure, the final sample that includes U.S. firms has 42,630 observations.

Our primary variable of interest is EPS, an environmental policy stringency index. Created by Botta and Koźluk (2014), this index is constructed by scoring and aggregating a combination of individual countries' selected environmental policy instruments that are largely related to climate and air pollution. EPS is the first quantitative indicator to measure the level of stringency of countries' environmental regulations at the international level. The index is scored on a zero-to-six scale, where six is the most stringent regulation. The EPS is highly and significantly correlated with other alternative proxies for environmental policy stringency that have been used in the literature. Those measures are based on surveys, environmental outcomes, and other

policy-based measures. (See Botta and Koźluk, 2014, for more detail.) However, while other measures mainly focus on the U.S., the EPS index covers a wide range of countries and does so over a relatively long period (between 1990 to 2012 with some exceptions for countries that have data up to 2015). This measure is publicly available on the OECD website and has been widely used in the literature for research related to environmental regulation, environmental management, energy economics, and policy (Andersson, 2018; Criscuolo and Menon, 2015; Fabrizi et al., 2018; Verdolini et al., 2018; Wang et al., 2019; Witajewski-Baltvilks et al., 2015). [8]

[Table 1 & Figure 1 here]

Table 1 reports the average EPS and loan spread (in basis points) by country. In our sample, South Korea has the most stringent environmental regulations, with an average EPS score of 2.78. Denmark and Australia follow it with average EPS scores of 2.64 and 2.57, respectively. Brazil, with an average EPS of 0.45, has the least stringent environmental regulations. Russia and South Africa, with average EPS scores of 0.62 and 0.65, respectively, rank second and third among countries with the least stringent environmental regulations. The last column indicates that Indonesia, with 329 bps, has the highest cost of bank loans, while Finland, with a loan spread of approximately 40 bps, has the lowest average cost of bank loans for the sample period. Furthermore, Figure 1 depicts the time series behavior of EPS for each country in our sample. EPS of each country during our sample period is reported in Table A.1 in the internet Appendix. Consistent with the anecdotal evidence reported in news media outlets, we see that, by and large, countries have increased the stringency of their environmental regulation. There are, however, a few notable exceptions, such as Brazil and Russia. Table 2 provides the summary statistics of all the variables that we use in our analysis. The mean EPS score for our sample is 1.77. The

[8] https://stats.oecd.org/Index.aspx?DataSetCode=EPS

average firm in our sample has financed 32% of its assets with debt and pays a spread of 170.45 bps on its loan. Forty-three percent of the loans in our sample are term loans, and the average size of a loan facility is about $2,330 million and matures in 53 months.

[Table 2 here]

3.2. Empirical Design

To investigate the effect of environmental policy stringency on the cost of bank loans, we employ the following regression model.

$$\begin{aligned} \text{Ln(Spread)} = f\ (&\text{EPS Index; Borrower Characteristics;} \\ &\text{Loan Characteristics; Country Characteristics;} \\ &\text{Country, Industry, and Year Fixed Effects)} \end{aligned} \tag{1}$$

Ln(Spread) is our proxy for the cost of bank loans. It is the natural log of the all-in-spread-drawn variable in DealScan, which is the spread that a borrower pays annually over the LIBOR in basis points. The main independent variable is the EPS index. It is the measure of environmental policy stringency of a borrower's country. Following the literature (e.g., Graham et al., 2008; Qian and Strahan, 2007), we also include a wide range of control variables that could potentially affect the cost of bank loans. These control variables include borrower, loan, and country characteristics. While we formally address endogeneity concerns later in the paper, to mitigate endogeneity-related biases related to simultaneity and omitted variables, we lag all the independent variables by one year (t - 1) relative to the year of loan origination (t).

The first set of these variables controls for borrower characteristics and includes asset size, profitability, tangibility, and leverage. It is important to control for size because on the one hand, larger firms have less trouble accessing external financing and have fewer information asymmetry problems. Therefore, they are likely to have a lower cost of bank loans. On the other hand, due to their sheer size, larger firms face greater litigation and reputational risks, which could lead to higher borrowing costs. We also control for firms' profitability because profitable

firms have a lower chance of default and are expected to pay a lower spread on their loans. Leverage is another firm-level control variable. It is one of the main inputs in Merton's (1974) distance-to-default formula; thus, firms with a higher leverage ratio have higher default risk. All else equal, these firms are expected to have a higher cost of bank loans, making it imperative to control for leverage.

The second set of control variables is related to loan characteristics. The first variable is the size of the loan. The riskiness of a borrower and the size of a loan issued to such a borrower are connected. All else equal, riskier borrowers receive relatively smaller loans. We also control for the loan maturity and term loan. The former is the number of months between the loan issuance date and loan end date, and the latter is a dummy variable that equals 1 if the loan is a term loan and 0 otherwise. Finally, we control for all loan types and purposes in our analysis. Loan purposes are generally categorized into capital expenditures, backup lines, general purposes, recapitalization, refinancing, acquisitions, and other purposes. The final sets of controls are related to country characteristics. These controls include countries' GDP growth rates (to control for countries' economic growth), inflation, and indexes related to countries' political stability and anticorruption. Detailed information about all variables, their sources, and measurements are provided in Appendix A.

All regressions also include country, industry, and year fixed effects. Results in Del Maso et al. (2020) indicate that accounting enforcement is negatively related to bank risk-taking. In another study, Mourouzidou-Damtsa et al. (2019) examine the relationship between national cultural values and bank risk and find that individualism and hierarchy (trust) are positively (negatively) associated with bank risk-taking. Thus, it is imperative to include country fixed effects to take into account any (un)observed time-invariant country-specific features that could

potentially affect the cost of bank loans. The simultaneous inclusion of industry, year, and country fixed effects guarantees that the coefficient on EPS captures the effect of within-country changes in environmental regulations over time and not just cross-sectional correlations. With this empirical design, each year, a given country could be classified either as treatment or control, allowing us (as shown by Imbens and Woolridge, 2009) to interpret the coefficient on EPS as the difference-in-difference estimator.[9] Essentially, this empirical design allows us to measure the average within-country changes in the cost of bank loans for firms in countries that revise their environmental regulations relative to concurrent changes in the cost of bank loans to firms in countries that do not revise their environmental regulations. Moreover, using the EPS index allows us to move our focus away from firms' environmental profiles, the common practice in the literature, and focus on environmental regulations. Unlike a firm's environmental profile that is the firm's choice and an endogenous decision that can be changed, environmental regulations are set by governments and are arguably exogeneous to firms. Thus, in addition to the advantages of our empirical design discussed above, using the EPS index rather than firms' environmental profiles has the benefit of making our analysis less susceptible to endogeneity issues such as reverse causality.

4. Empirical Results

4.1. Baseline Results: EPS and Loan Spread

We present our first evidence on the impact of environmental regulation stringency on the cost of bank loans in Table 3. We group our data into loan portfolios based on EPS quartiles and report the mean loan spread for each portfolio. As pointed out by Bali et al. (2016), the main benefit of portfolio analysis is that it is a nonparametric technique that unlike other

[9] This empirical design is also used by other researchers. (See Alimov, 2015.)

methodologies does not rely on any assumptions about the functional form of the variables under investigation and is, therefore, useful for understanding the cross-sectional relations. Average loan spread is about 141 bps in the bottom quartile (Q1) and increases almost monotonically, particularly in Panel B that also includes U.S. firms, to 237.5 bps in the top quartile (Q4). The difference, 96.6 bps, is statistically significant. While the main setback of this technique is the difficulty to control for a large number of variables, Bali et al. (2016) argue that if the pattern emerging from a portfolio analysis is monotonic or near monotonic, which happens to be the case here, it is a strong indication that the result of the difference portfolio (Q4-Q1) is not spurious. Thus, this result suggests that loans issued to borrowers who face more stringent environmental regulations carry a significantly higher interest rate.

[Table 3 here]

We report the baseline results of our regression model in Table 4. All specifications include year, industry, and country fixed effects as well as dummies controlling for loan type and purpose. Khan et al. (2016) argue that the inclusion of both firm and time fixed effects resembles a generalized difference-in-differences approach, which improves the causal interpretation. Therefore, in Models (2) and (4), we include firm fixed effect and remove industry fixed effect from the specification.

[Table 4 here]

We observe that the coefficients on EPS are statistically and economically significant in all models. Focusing on the first two columns that include only non-U.S. firms, we see that EPS coefficients in the two models are 0.112 (*t*-stat of 2.92) and 0.092 (*t*-stat of 2.08), respectively. This implies that for a one standard deviation increase in EPS (it is approximately 1 – see Table 2), the cost of a bank loan increases by about 9% to 11%. This is an economically significant

change. For an average firm in our sample that pays a loan spread of 170.45 bps, this is tantamount to an increase of about 15 bps to 19 bps in the interest it pays on its loan. This result is insensitive to the inclusion of U.S. firms. Models (4) and (5) in the panel on the right side of Table 4 report the result of the same analysis for the sample that includes U.S. firms. That result also paints the same picture.[10]

Most control variables have the expected signs. More profitable firms pay lower interest on their loans. This is reflected by the negative and statistically significant coefficient on this variable. The positive and statistically significant coefficient on leverage shows that the cost of a bank loan rises as the amount of debt in a firm's capital structure increases. Firms with more tangible assets, by definition, have more fixed assets to back their financial obligation, which increases creditors' recovery rate in case of financial distress. Thus, more tangible assets should be associated with a lower cost of borrowing. In a similar vein, larger firms, due to their lower asymmetric information, should have a smaller borrowing cost, all else equal. Consistent with these arguments, the coefficient of asset tangibility is negative. However, the coefficient on firm size is positive. Perhaps, this result can be explained by the fact that larger firms face greater litigation and reputational risks and hence may have higher borrowing costs. The loan amount has a negative coefficient whenever it is statistically significant. This is expected since large loans are usually issued to large firms and to firms with high credit quality. Controlling for firm size and credit risk, banks charge higher spreads on longer-term debt to compensate for higher liquidity risk. Consistent with this notion, the coefficient on loan maturity is positive and statistically significant for the non-U.S. sample. The signs of country-level variables are also

[10] In Table A.2 in the internet Appendix, we regress loan spread on EPS without including the control variables and sequentially add firm-level, loan-level, and country-level controls, building up to the specification reported in Table 4. In all these specifications, EPS is positive and statistically significant.

predominantly consistent with our expectations. A higher GDP growth rate is associated with greater economic output, smaller risk premium, higher recovery rates, and larger investment opportunity set as well as lower default rates in the economy. Therefore, the cost of bank loans should be negatively related to GDP growth. Further, the Fisher effect suggests that nominal interest rates provide compensation for inflation risk since nominal interest rates should, at the very least, maintain the purchasing power of creditors. This means that there should be a positive relationship between inflation rate and loan spread. Consistent with prior findings in the literature (e.g., Ashraf and Shen, 2019; Liu and Zhong, 2017) that show credit risk and cost of borrowing increase in political and policy uncertainty, we also find that an increase in political stability and anticorruption indices is associated with a lower cost of bank loans.

4.2. Influence of Corporations on Environmental Regulations

Large and powerful corporations around the world, particularly in the United States, could influence many government policies and regulations, including those related to environmental issues. This is evident by the substantial growth in corporations' lobbying expenditures to tilt the regulations and policies in their favor. These efforts by corporations are documented by both major news organizations as well as academic studies (e.g., Hill et al., 2013; Unsal et al., 2016). For instance, Gittsham (2015) reports in *The Guardian* that businesses spend about €44 million to block regulations on climate change that were being instituted in the EU.[11]

This influence of corporations suggests that these environmental regulations are probably more lax than they would have been otherwise. This in turn can increase the possibility that the stringency of environmental policy, as measured by EPS in our sample, could be systematically lowered. Nonetheless, following the method in Kim et al. (2019), we address this issue by

[11] https://www.theguardian.com/sustainable-business/2015/feb/04/business-manifesto-sustainability-guidelines-climate-policy

orthogonalizing EPS to corporate influence. Specifically, given that the potential influence of a corporation on government policies is highly correlated with its size, we regress EPS on firm size and firm size squared (to capture nonlinear relations) and use the residuals. Having been purged of any potential confounding effect of corporate influence, the residuals of this regression, EPS_resid, represent a cleaner measure of environmental policy stringency. We conduct our analysis using EPS_resid, instead of EPS, and report the results in the last columns, Models (3) and (6), of each of the panels in Table 4. The coefficients on EPS_resid are positive and statistically significant, and their magnitudes are similar to those reported in other models. Overall, these results confirm our earlier findings and alleviate concerns about the influence of corporations on the estimated effect of EPS on loan spreads.

4.3. Endogeneity: Difference-in-Difference Approach

Endogeneity, particularly in the form of the omitted variable problem, is a valid concern with our findings. Imbens and Woolridge (2009) argue that inclusion of country, year, and industry fixed effects assures that our EPS estimate is reflecting within-country changes in EPS and not just cross-sectional correlation and can be interpreted as the difference-in-difference estimator. Similarly, Khan et al. (2016) argue that the inclusion of both firm and time fixed effects resembles a generalized difference-in-differences approach and improves the causal interpretation. Our specifications control for these fixed effects. Therefore, we believe it is unlikely that our results suffer from endogeneity. However, to alleviate these concerns more convincingly, we also employ a difference-in-difference approach.

Implemented in 2005 as a strict tool to reduce pollution, the European Union Emission Trading System (EU ETS) is the world's first and major international trading system, which covers over three-quarters of international carbon trading. Eighteen European countries (out of

the 27 countries in our sample) are among those that employed the cap-and-trade program set by the European Union. Using the EU ETS as a natural experiment, we run a difference-in-difference (DiD hereafter) model to compare the effects of EU ETS on treated firms and the control group. This analysis confirms our earlier findings.

The EU ETS regulation was enacted to mitigate the impact of climate change by cost-effectively reducing greenhouse gas emissions. The goal of the EU ETS is to reduce carbon emissions cost effectively and to spur the growth and development of new low-carbon technologies. When regulated firms are faced with a higher price of emissions relative to all the other costs of production, they are then expected to make operational changes and investments to reduce their emissions. This cap-and-trade program allows companies to emit a certain amount of greenhouse gas every year. If a company's emission is more than its allowance at the end of the year, it has to either buy the extra level from another company or pay the fine. This assigned cap will decrease in time to reduce the total level of greenhouse gas emissions. This market-based emission program will give firms the flexibility to work towards reducing the total level of emission.

Following Calel and Dechezlepretre (2016), we use the launch of EU ETS as a quasi-natural experiment and conduct a DiD analysis. As illustrated in Figure 2, there is a parallel trend between the two groups from 1990 to 2005, the time frame prior to the launch of the program. During this time, the treated countries (those who adopted the EU ETS) have had a lower average cost of bank loans. This trend changes after 2005. First, there is a spike in 2006, and then the average cost of loans remains higher for the treated group for the rest of the sample period except for the last year when the cost of loans for both treated and control groups becomes virtually the same.

[Figure 2 here]

DiD results are reported in Table 5. Our findings in this table show that subsequent to the implementation of the ETS, firms in countries that adopted the program experienced a significantly larger increase in their loan spreads relative to firms in countries that did not adopt the program. The coefficients on *Treated*Post* are positive and highly significant for both samples (with and without U.S. firms), indicating that this result is insensitive to the inclusion of U.S. firms. While this result confirms our earlier findings, it alleviates endogeneity concerns, improves the identification of the effect, and facilitates a causal interpretation of our results.[12]

[Table 5 here]

4.4. EPS and Other Loan Features

Our results up to this point provide evidence that lenders view stringent environmental regulations as a risk factor and therefore charge a higher spread on loans issued to firms that are exposed to such regulations. However, as pointed out in prior research (Dennis et al., 2000; Goss and Roberts, 2011; among others) in addition to directly increasing the cost of loans, lenders have the option to change other contractual features of their loans to mitigate the risk associated with their borrowers. Those options include issuing secured loans, shortening maturity, increasing upfront fees, and including restrictive covenants in the loans. For example, results in

[12] Like Table A.2, in Table A.3 in the internet Appendix, we estimate our DiD model without including the control variables and sequentially add firm-level, loan-level, and country-level controls, building up to the specification reported in Table 5. In all these specifications, EPS is positive and statistically significant. Further, while these environmental regulations are imposed on firms by governments and in that sense can be viewed as exogenous to companies, an argument can be made that firms in countries that make their environmental regulations more stringent might be fundamentally different from others. Therefore, we may face a selection bias. To address this concern, in the spirit of propensity score matching, we conduct our analysis on a matched sample. Using a set of observable covariates, including cash, FCF, sales growth, firm size, leverage, 2-digit industry SIC code, market-to-book ratio, firm age, dividend dummy, R&D, and operating profit, we matched firms associated with EPS scores in the top 30th and 20th percentiles of EPS distribution with those in the bottom 30th and 20th percentiles. Conducting the analysis on the matched sample, we confirm our earlier finding that stronger environmental regulation is associated with higher cost of bank loans. (Results are reported in Table A.4 in the internet Appendix.)

Graham et al. (2008) indicate that loans issued to borrowers with questionable quality of financial information have higher spreads, shorter maturities, higher likelihood of being secured, and include more debt covenants. Similarly, Datta et al. (2019) show that during periods of heightened policy uncertainty, firms shorten their debt maturity. In this subsection, we test these predictions and report the results in Table 6.

[Table 6 here]

Our regression Model (1) is augmented in each specification by replacing the dependent variable, *Ln(Spread)*, with a different nonpricing feature of loan contracts. In the first column, we run a logit model where the dependent variable is a dummy that is equal to 1 if the issued loan is secured and 0 otherwise. In Panel A, the coefficient on EPS is positive and statistically significant ($\beta = 0.556$; *t*-stat = 2.22), indicating that an increase in the stringency of environmental regulations makes the issuance of secured loans more likely. Specifically, a one standard deviation increase in EPS leads to about a 6.3% increase in the likelihood of issuance of a secured loan (based on the marginal value of the EPS coefficient at the mean). In the second column, we test our prediction about the increase in the up-front fees. The dependent variable in this model is *Ln(upfront fees)*. The positive and statistically significant coefficient on EPS ($\beta = 0.173$; *t*-stat = 2.18) implies that lenders charge their borrowers a higher up-front fee if the firm is exposed to a more stringent environmental regulation. A one standard deviation increase in EPS raises the up-front fees by about 17%.

In specification (3), we see that while the direction of effect of EPS on loan maturity is as expected, the effect is nonetheless statistically insignificant, and neither do we find a link between loan covenant count and EPS for the non-U.S. sample. The EPS coefficient in the specification (4) is highly insignificant and has the wrong sign. As discussed by Chava et al.

(2010), according to the contracting efficiency hypothesis developed by Smith and Warner (1979), covenants are included if (1) there is an agency risk for lenders from shareholders or managerial entrenchment, and (2) mitigating the risk through other mechanisms is more costly. Thus, as a plausible explanation for this insignificant result, we argue that it is likely that in the case of environmental regulation, lenders are able to reduce the risk more (cost) effectively through other mechanisms, such as increasing the spread, issuing secured loans, increasing up-front fees, and reducing maturity; consequently they find no reason to mitigate this risk by including more covenants.

Results reported in Panel B show that the inclusion of U.S. firms changes the results to some extent. While EPS no longer affects the likelihood of issuing secured loans when U.S. firms are included, it significantly increases the number of covenants included in the loan, raises upfront fees, and reduces loan maturity. This result shows that while EPS affects nonprice features of loans of U.S. firms differently compared to those of non-U.S. firms, the general direction of the effects, with or without U.S. firms, is consistent with our conjecture. Overall, this set of results provides suggestive evidence that in addition to requiring higher risk premium (e.g., loan spreads), creditors also do alter the nonpricing contractual features of loans to mitigate their risk exposure.

4.5. Why Are Lenders Concerned About Environmental Regulations?

Our results thus far show that to compensate for the risk stemming from a borrower who is facing more stringent environmental regulation, lenders not only charge a higher spread on loans but also adjust other contractual features of their loans accordingly. However, these results do not explain the mechanism through which these regulations affect lenders. There are several reasons why lenders would view the stringency of environmental regulations as a risk factor. The

key to understanding the mechanism with which environmental regulation affects lenders is that a more stringent regulation increases firms' environmental liability. While these liabilities are mainly categorized as "nonfinancial issues" and are usually kept off balance sheets (Chang et al., 2018), they are increasingly viewed as financial issues and reported in annual financial reports of a rapidly growing number of firms (KPMG Report, 2017).

Moreover, these liabilities are legally binding, would drain the firm's cash flows, and could potentially lead to bankruptcy (Chang et al., 2018). Prior research also provides consistent evidence that these liabilities could have serious financial implications for a firm (Barth and McNichols, 1994; Bauer and Hann, 2010; Clarkson et al., 2011; Graham et al., 2001; Li et al., 2014; Schneider, 2011). Similarly, anecdotal evidence highlights the significance of environmental liabilities: BP was charged $42 billion for its oil spill in the Gulf of Mexico. Chevron and Volkswagen were fined $9.5 billion in 2011 and $14.7 billion in 2016, respectively, for their environmental violations. Increased environmental liabilities resulting from more stringent environmental regulations can directly affect lenders through different means such as increasing litigation risk and compliance costs to their borrowers, which increases the borrowers' credit risk; through lender reputation risk, which emanates from lending to a borrower with environmental concerns (Chava, 2014); and finally through lender litigation laws, which directly expose the lenders to litigation risk. In this section, we explore these mechanisms and report the results in Table 7.

[Table 7 here]

4.5.1. Participants in the Loan Syndicate

Due to lender liability laws, lenders themselves are also exposed to lender litigation risk. According to the Comprehensive Environmental Response, Compensation, and Liability Act in

the United States (CERCLA, commonly referred to as Superfund) and Environmental Liability Directive in Europe, lenders can be directly responsible for polluting activities of their borrowers. Stricter environmental regulation makes lenders more concerned about firms' flexibility in dealing with new rules and the potential risk of litigation. According to Chapter 25 of the Guide to Commercial Banking Law (Gotcher, 2011, p. 25-1), "… Although most bankers initially think they have no stake in environmental issues, these issues can expose lenders to liability… Because banks do not discharge toxic wastes and are not directly involved in business that harms the environment, bankers often assume that environmental laws do not apply to them. They are absolutely wrong." Thus, focusing on a supply-side perspective, we argue that if for all or one of the reasons above a sufficiently large number of lenders avoid a borrowing firm, this firm would have fewer participants in its loan syndicate and, as demonstrated in prior research (Chava, 2014; Heinkel et al., 2001; Merton, 1987), would have to pay a higher spread on its loan. Our result confirms this prediction.

In the first Model of Panel A of Table 7, we show that firms facing more stringent environmental regulations have fewer participants in their loan syndicates and provide evidence consistent with this conjecture. We use an augmented version of the regression Model (1), where the dependent variable is the number of participants in a firm's loan syndicate. The coefficient on EPS is negative and statistically significant (β = -1.012; *t*-stat = -2.32). For an average firm in our sample that has about nine participants in its loan syndicate, this coefficient is equivalent to approximately an 11% drop in loan syndicate participation. This result is stronger in Panel B that also includes U.S. firms.

4.5.2. Leverage

Chang et al. (2018) demonstrate that environmental liabilities and leverage have several features in common and that environmental liabilities can intensify business risk. They also show that firms with higher environmental liabilities have lower leverage ratios and take that as evidence that environmental liabilities can be a (an imperfect) substitute for financial leverage. This insight suggests that since borrowers aim to maintain a target level of firm risk, increasing the level of environmental liabilities/risk should be offset by a decrease in financial leverage, indicating a negative link between EPS and leverage. We find supporting empirical evidence for this prediction. In Model (2), we follow the literature on capital structure and regress leverage (defined as a debt-to-asset ratio; see Appendix A) on a set of known determinants and EPS. The coefficient on EPS is negative and statistically significant (β = -0.038; *t*-stat = -4.37). This result implies that for a one standard deviation increase in EPS, firms' leverage decreases by about 4%. For an average firm in our sample that has a leverage ratio of 32%, a four percentage-point decrease represents a 12.5% decline in leverage. As shown in Panel B, this result is insensitive to the inclusion of U.S. firms.

Like Chang et al. (2018), this result implies that firms facing more stringent environmental regulations that increase their environmental liabilities maintain lower leverage, suggesting the same substitution effect. This result is also consistent with Ginglinger and Moreau (2019), who show that leverage decreases with more exposure to climate risk. This finding is particularly important because leverage is one of the main inputs to Merton's (1974) distance-to-default formula that determines default probability. Merton's distance-to-default model implies that default probability increases in leverage. The fact that firms maintain lower leverage when facing more stringent environmental regulations not only shows that increased environmental liabilities

resulting from these regulations is viewed as a risk factor very much like debt, but also establishes more confidence that the observed increase in the cost of bank loans and other adjustments to contractual features of loans are driven by environmentally sensitive lending practices by banks that screen out borrowers exposed to such environmental regulation risk.[13]

4.5.3. Altman Z-Score

In the next step, following Altman (2000), we use modified Altman Z-score to examine whether the stringency of environmental regulation affects firms' bankruptcy risk. EPS coefficient is negative and statistically significant (β = -0.089; *t*-stat = -3.29). A one standard deviation increase in EPS reduces the modified Altman Z-score by about 0.09. For an average firm in our sample that has a modified Z-score of 1.2, a 0.089 reduction is equivalent to about a 7.5% increase in bankruptcy risk.[14] The fact that an increase in EPS leads to a decline in leverage on the one hand and an increase in bankruptcy risk on the other adds more credibility to our argument that the documented higher loan spreads and other reported effects on different contractual features of loans are mainly driven by environmentally sensitive lending practices by banks and the risk associated with stronger environmental regulations, rather than conventional measures of financial distress such as leverage. We find similar results in Panel B that also includes U.S. firms.

[13] Oil & Gas industry is usually characterized by high leverage and environmental lawsuits. Therefore, there is a concern that our leverage result may be heavily influenced by this industry. While we control for industry fixed effects, in an unreported analysis we show that our leverage result holds even after excluding this industry from our sample (β = -0.036; *t*-stat = -3.95). Consistent with idea that firms in this industry are very sensitive to environmental regulation, we also show that these firms reduce their leverage almost two times more than other firms in our sample (β = -0.064; *t*-stat = -3.54).

[14] We obtain similar result (β = -0.29; *t*-stat = -3.59) when using original Altman Z-score (Altman, 1968) instead of the modified version. Average Altman Z-score of our sample is 2.89, which means that a 0.29 reduction in the score is equivalent to about an 8% increase in bankruptcy risk.

4.5.4. Credit Rating

Our results suggest that environmental liabilities resulting from more stringent regulation increase firm risk to the extent that their Z-score deteriorates and that they reduce their leverage. These findings would then indicate that borrowers' credit ratings should also reflect this dynamic. In other words, to the extent that credit ratings proxy for the demand by investors in the bond market, we expect higher values of EPS, more stringent regulations, to be associated with lower quality of credit ratings. Our empirical evidence supports this assertion.

We collect the Standard and Poors long-term issuer credit ratings from COMPUSTAT for U.S. firms (variable: SPLTICRM—S&P Domestic Long-Term Issuer Credit Rating). We then linearize these ratings from 1 to 9 by combining each rating notch and its plus and minus variation into one group. For example, AAA is coded 1, AA+, AA, and AA- are coded 2, and so on. Investment-grade ratings are coded between 1 (AAA) and 4 (BBB, BBB+, BBB-), whereas speculative ratings are coded between 5 and 9. The average credit rating in our sample is 4.79 with a standard deviation of 1.25.

We begin the analysis by regressing credit rating index (of the U.S. sample) on EPS and a set of control variables known to be related to credit rating, such as profitability, size, leverage, market-to-book ratio, cash, and asset tangibility (e.g., see Ginglinger and Moreau, 2019). The result of this analysis, reported in Table A.5 in the internet Appendix, suggests that for a sample of U.S. firms whose credit ratings are available, there is a positive and statistically significant association between EPS and credit rating index ($\beta = 0.151$; *t*-stat = 3.73). This result is consistent with our prior findings and further confirms that environmental liabilities resulting from more stringent regulations increase firm risk despite the fact that firms reduce their leverage.

Since we do not have access to non-U.S. firms' credit ratings, to examine the relationship between EPS and credit ratings for the non-U.S. sample, we resort to estimating their credit ratings. Specifically, we first estimate a multinomial logit model on the U.S. data with available credit rating information. This estimation is based on the same variables mentioned in the analysis above. We then use the predicted probabilities of the multinomial logit model to assign a credit index from 1 to 9 to each of the non-U.S. observations. A particular rating value is assigned to a non-U.S. firm observation if the probability of that rating value is the largest compared to the other eight categories. We use this estimated credit rating index and regress it on EPS and a set of other control variables. The results of this regression are reported in the last panel of Table 7. The statistically significant positive coefficient on EPS is consistent with the result reported in Table A.5 in the internet Appendix and provides further supporting evidence for our argument on the risk consequences of environmental liabilities resulting from more stringent environmental regulations.[15] As reported in Panel B, the inclusion of U.S. firms with available credit rating does not change the result.

4.6. Subsample Analysis

Collectively, results in the previous subsections suggest that lenders charge a higher spread on their loans and adjust other loan features to reflect the environmental regulation risk associated with their borrowers. In this subsection, conducting a series of subsample analyses, we provide more corroborating evidence from the cross-section.

[15] Since credit rating index, the dependent variable, is estimated, we also bootstrap the standard errors instead of clustering them by country-year. However, standard errors are smaller with the bootstrap approach, and we thus chose to report the clustered standard errors.

4.6.1. Financial Constraint

Chang et al. (2018) show that firms with better environmental profiles have larger debt capacity and better access to bank loans. By raising the regulatory threshold, more stringent environmental regulations effectively undermine firms' environmental profiles across the board. Those firms that are marginally in compliance with the existing regulations will no longer comply after the stronger regulations go into effect. Therefore, as their environmental liabilities increase, their debt capacity decreases given their existing financial leverage. This adverse effect of stronger environmental regulations should be more pronounced for financially constrained firms that already have low or limited debt capacity. Our evidence in Columns (1) and (2) in Table 8 is consistent with this prediction. Using the median of the Kaplan-Zingales (1997) measure of financial constraint, we split our sample into high and low financially constrained firms. Conditioning the sample on the financial constraint index, we find that financially constrained firms drive the results. In Panel A, the EPS coefficient is positive and statistically significant ($\beta = 0.186$; *t*-stat = 4.53) for these firms, whereas the effect is insignificant for firms with low financial constraints and the difference between the two coefficients is statistically significant. Specifically, a one standard deviation increase in EPS leads to an 18.6% rise in loan spread, which translates into an increase of about 32 bps in the cost of bank loans for an average firm in our sample. As shown in Panel B, including U.S. firms leads to a similar result.[16]

[Table 8 here]

[16] Oil & Gas industry is highly capital intensive, and financial constraints for firms in this industry may have particularly severe consequences. Given the sensitivity of this industry to environmental regulation, there is a concern that our result may be heavily influenced by these firms. However, while our specifications include industry fixed effects, we examine the sensitivity of this result with respect to Oil & Gas industry in Table A.6 in the internet Appendix and show that our results still hold even after excluding that industry.

4.6.2. Environmental Litigation Risk

In addition to undercutting firms' environmental profiles and their debt capacity, stronger environmental regulations subject borrowers to litigation risks. As we discussed earlier, lenders themselves are also directly exposed to litigation risk due to lender liability laws. Thus, we expect that the adverse effect of stringent environmental regulations on the cost of bank loans to be stronger for firms that, due to the nature of their line of business and industry, are more exposed to litigation risk. We condition our sample on environmental litigation risk. [17] Firms are categorized into high and low environmental litigation risks based on their industries. Firms in industries with more environmental litigation cases than the sample mean are considered high risk. Our results in Columns (3) and (4) of Panel A confirm this conjecture. We show that our results are predominantly driven by firms that belong to industries with high environmental litigation risk. For these firms, the EPS coefficient is positive and highly significant ($\beta = 0.191$; *t*-stat = 4.62), whereas for firms in low litigation risk industries, this coefficient is insignificant and the difference between the two coefficients is statistically significant. However, with the inclusion of U.S. firms, we see in Panel B that while the size of the EPS coefficient and its statistical significance are larger for the high litigation risk sample, the difference between the two coefficients in high and low categories is statistically insignificant.

4.6.3. Bank versus Market Orientation

In the third pair of columns in Panel A, we compare the impact of stronger environmental regulations on loan spread between bank-based and market-based economies. As we showed

[17] A list of industries (SIC2) with the highest and lowest environmental litigation cases from 1980 to 2016 in the U.S. is provided in Appendix B. We determine high and low litigation risk industries based on the U.S. data, assuming that industries' environmental litigation cases in the U.S. can be extended internationally. We use mean percentage of industries' environmental litigation cases rather than the median because the sample is heavily skewed and using median would include industries with small percentage of litigation cases in the high litigation risk category.

earlier, if switching to another source of external financing is difficult for a borrower, the firm would have fewer lenders participating in its loan syndicate, which leads to higher loan spreads. Finding an alternative source of external financing is more difficult for firms in bank-based economies relative to those in market-based economies. In bank-based economies, the main source of external financing is bank loans, and obtaining financing through capital markets is less viable. Firms in these economies mainly depend on banks for financing. Thus, we expect that the adverse effect of stronger environmental regulations is more pronounced for firms in bank-based economies. Consistent with this prediction, we find that our results are much stronger for companies in bank-based economies. The classification of countries into the bank- or market-based economies is based on Demirguc-Kunt and Levine (2001). For the countries that are not in this classification, we use the classification introduced by Levine (2002). We show that increasing the stringency of environmental regulations by one standard deviation leads to about a 28% increase in loan spreads for firms in bank-based economies ($\beta = 0.279$; *t*-stat = 2.74). For firms in market-based economies, on the other hand, where they can switch to another source of financing relatively more easily, this impact is 10% ($\beta = 0.100$; *t*-stat = 2.39), and the difference between these two coefficients is statistically significant. As reported in Panel B, the inclusion of U.S. firms leads to an increase in the EPS coefficient for the market-based sample. Therefore, while the size of the coefficient is still larger for the bank-based sample, the difference between the coefficients in the two categories is no longer statistically significant.

4.6.4. Growth in Sensitivity to Environmental Issues

Public awareness about the environmental impact of corporations and the sensitivity of investors to environmental issues have grown substantially over the past two decades and have resulted in the passage of tighter and stronger environmental regulations around the world. This

pattern is also evident in Figure 1, which illustrates that environmental regulations have become more stringent during the more recent years of our sample. As we discussed earlier, there has been a tremendous increase in socially responsible investing and environmentally sensitive lending (Chava, 2014; Cogan, 2008). This shift towards stronger environmental policies and in investors' preferences for socially and environmentally sensitive investments suggests that the effect of EPS should be stronger during the latter time period of our sample compared to the early part.

We analyze this issue by dividing the sample period in half: from 1990 to 2002 and from 2003 to 2014. The results, reported in the last pair of columns in Table 8, indicate that the EPS is not significantly related to the cost of bank loans during the first half of the sample period. In contrast, in the second half of the sample period, the coefficient on EPS is positive and statistically significant, and its magnitude is comparable to that reported in Table 4. The difference between the EPS coefficients of the first and second parts of the sample is statistically significant, suggesting that the effect of EPS on loan spreads is mainly driven by the recent half of the sample. This result is insensitive to the inclusion of the U.S. firms, and the difference between the EPS coefficients in the two categories remains statistically significant.

4.7. Short-Term versus Long-Term

A legitimate concern with our analysis is that the reported adverse effects of stringent environmental regulations can be short-lived. In fact, according to the views and conclusions expressed in the Porter Hypothesis (Porter and van der Linde, 1995), it can be argued that as these regulations become more stringent, firms innovate, adapt, or update their production technology. This may be costly in the short-term, but it may benefit the firm in the long-term. Therefore, it is important to check how long the effects of these regulations last. In the spirit of

Lanoie et al. (2008), who introduce lags of three to four years to capture the dynamic dimension of regulations, we include lags of EPS in our regression model. The results are reported in Table 9.

[Table 9 here]

We introduce lags of EPS for up to four years in our model. Unlike the previous analyses in our study that are based on loan-level data, this analysis requires firm-level observation. Therefore, we aggregate our loan-level data to firm-level by taking the average of loan-level data across all the observations of an individual firm (gvkey) in a given year. In Models (1) to (4) in Panel A of Table 9, we separately include first, second, third, and fourth lags of EPS in our model. Model (5) includes all the lags of EPS in one model. Results show that the adverse effect of stringent environmental regulation lasts for two years (three years if U.S. firms are included) and is not going to be reversed in the long-term.[18]

5. Conclusion

In this paper, we study the impact of the stringency of environmental regulations on the cost of bank loans in an international setting. Using bank loan data for 27 countries from January 1990 to December 2014, we find that lenders charge higher interest on the loans issued to firms facing such regulations. Moreover, consistent with prior research, we find that lenders also adjust other contractual features of their loans. Loans issued to firms facing more stringent environmental regulations not only have higher spreads, but are also more likely to be secured, are associated with higher up-front fees, and have a shorter maturity. Moreover, we show that firms facing stiffer environmental regulations have fewer banks participating in their loan

[18] We also tried lags of five and six years. Since the results are insignificant, we report the result only for the first four lags to save space.

syndicates and maintain lower leverage while their bankruptcy risk increases and their credit ratings deteriorate.

Our subsample analyses also paint the same picture. We find that the adverse impact of these regulations on loan spreads is more pronounced for financially constrained firms, for firms in industries that are more susceptible to environmental litigation risk, and for firms in bank-based economies. Overall, our results suggest that the adverse effect on the cost of bank loans is the consequence of environmentally sensitive lending practices by banks and the risk associated with stronger environmental regulations.

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Table 1

Sample Distribution by Country

Country Name	Obs.	EPS	Spread
Australia	96	2.55	246.15
Belgium	28	1.41	156.07
Brazil	176	0.45	215.79
Canada	1,268	1.93	209.77
China	273	1.25	157.39
Denmark	27	2.64	160.37
Finland	67	1.57	39.80
France	267	1.72	122.12
Germany	209	2.42	147.78
Greece	122	1.82	144.29
Hungary	27	1.16	115.65
India	236	0.95	198.73
Indonesia	25	0.75	328.72
Ireland	90	1.44	214.46
Italy	61	1.74	90.92
Japan	67	1.98	80.20
Netherlands	251	2.18	155.71
Norway	117	1.72	154.28
Poland	30	1.22	79.00
Russia	230	0.63	241.68
South Africa	83	0.66	173.92
South Korea	203	2.78	138.07
Spain	147	2.26	116.78
Sweden	129	1.85	79.29
Switzerland	197	2.34	105.41
Turkey	30	1.09	254.21
United Kingdom	1,891	1.83	167.64
United States	36,283	1.50	202.49
Total	42,630	1.55	197.72
Total without USA	6,347	1.77	170.45

This table reports the average EPS and bank-loan spread by country.

Table 2

Descriptive Statistics

	Panel A: Without U.S. Firms						Panel B: With U.S. Firms					
	Obs.	Mean	Median	p25	p75	SD	Obs.	Mean	Median	p25	p75	SD
Spread	6,347	170.450	130.400	55.000	250.000	142.410	42,630	197.717	175.000	100.000	275.000	132.935
EPS	6,347	1.770	1.580	0.810	2.580	1.020	42,630	1.547	1.210	1.090	2.130	0.765
Firm Size	6,347	0.012	$0.4e^{-4}$	$0.8e^{-5}$	$0.1e^{-3}$	0.220	42,630	$1.80e^{-03}$	$8.96e^{-06}$	$2.61e^{-06}$	$3.55e^{-05}$	$8.63e^{-02}$
Operating Profit	6,305	0.080	0.070	0.040	0.110	0.070	42,476	0.084	0.082	0.045	0.125	0.084
Leverage	6,337	0.320	0.300	0.190	0.430	0.190	42,503	0.346	0.310	0.169	0.476	0.253
Cash	6,344	0.090	0.060	0.030	0.120	0.090	42,606	0.083	0.043	0.015	0.109	0.107
Altman Z-Score	6,224	1.210	1.170	0.640	1.780	0.930	40,780	1.530	1.510	0.750	2.320	1.350
Loan Amount	6,334	2.330	0.200	0.080	0.550	36.840	42,617	0.617	0.150	0.050	0.375	14.230
Maturity	6,114	53.000	60.000	36.000	60.000	29.340	41,077	49.561	60.000	36.000	60.000	23.793
Upfront Fee	2,349	3.500	3.400	2.700	4.280	1.010	10,074	3.567	3.624	2.862	4.317	1.049
GDP growth%	6,325	3.210	2.870	1.980	4.080	2.790	42,607	2.860	2.810	1.920	4.040	1.780
Inflation Rate	6,347	3.080	2.160	1.460	3.190	4.130	42,630	2.630	2.670	2.070	3.040	1.790
Term Loan	6,347	0.428	0.000	0.000	1.000	0.495	42,630	0.325	0.000	0.000	1.000	0.469
Political Stability	5,854	0.530	0.791	0.253	0.995	0.698	35,134	0.539	0.632	0.205	0.871	0.445
Anti-Corruption	5,854	1.401	1.862	0.991	2.121	0.992	35,134	1.521	1.560	1.339	1.766	0.451

This table presents descriptive statistics for the sample used in the analysis based on the variables from 27 countries from 1990 to 2014. *Spread* is the interest rate that borrowers pay on their loan facility, and it is measured by the All-In-Spread-Drawn variable from Dealscan. *EPS* is the score ranging from 0 to 6 and measures the level of environmental policy stringency from each sample country. *Firm Size* is the book value of total assets in U.S. dollars expressed in hundreds of millions. *Operating Profit* is the return on total assets calculated as *EBIT/Assets*. *Leverage* is the long-term debt of the borrower scaled by assets (Debt/Assets). *Cash* is firm cash holdings scaled by the total asset. *Altman Z-Score* is the modified version of Altman Z. *Loan Amount* is the size of loans in billions of dollars. *Maturity* is the number of months that represent the duration of the loan. *Upfront Fee* is the log of upfront fee as reported in DealScan. *GDP* is the natural logarithm of a country's real GDP. *Term Loan* refers to an installment loan in which the funds are typically drawn down all at once. Variable definitions and their sources are reported in Appendix A.

Table 3

EPS Portfolio Sorts

	Q1	Q2	Q3	Q4	Q4 - Q1	*p*-value of diff.
Panel A: Without U.S. Firms						
lspread	4.59	4.56	4.74	5.21	0.62***	0.00
Spread	140.86	139.95	168.39	237.50	96.63***	0.00
EPS	0.67	1.21	2.04	3.31	2.64***	0.00
N	1,667	1,621	1,539	1,520	--	--
Panel B: With U.S. Firms						
lspread	4.82	4.95	4.97	5.37	0.55***	0.00
Spread	163.65	183.37	194.77	257.31	93.66***	0.00
EPS	0.87	1.17	1.59	2.78	1.90***	0.00
N	11,061	14,210	7,257	10,102	--	--

This table reports the average spread and natural log of loan spread, lspread, of loan portfolios that are constructed based on sorting EPS into quartiles. Average EPS for each quartile is also reported. Q1 to Q4 represent each quartile of EPS.

Table 4

Environmental Policy Stringency and Cost of Bank Loan

	Without U.S. Firms			With U.S. Firms		
	(1)	(2)	(3)	(4)	(5)	(6)
EPS	0.112***	0.092**	0.109***	0.190***	0.092***	0.188***
	(2.920)	(2.080)	(2.910)	(5.280)	(3.500)	(5.270)
Borrower Characteristics						
Firm Size	0.023	0.188***	0.016	-0.039	0.115**	-0.048
	(0.280)	(2.780)	(0.190)	(-0.580)	(1.970)	(-0.580)
Operating Profit	-1.750***	-0.950***	-1.749***	-2.210***	-1.413***	-2.210***
	(-9.430)	(-3.680)	(-9.430)	(-18.240)	(-14.360)	(-18.240)
Leverage	0.668***	0.589***	0.669***	0.631***	0.397***	0.631***
	(8.470)	(5.380)	(8.480)	(19.320)	(12.940)	(19.330)
Asset Tangibility	-0.231***	-0.084	-0.232***	-0.225***	-0.081	-0.225***
	(-3.500)	(-0.580)	(-3.510)	(-6.260)	(-1.470)	(-6.270)
Loan Characteristics						
Loan Amount	0.000	-0.002***	0.000	-0.000	-0.002***	-0.000
	(0.180)	(-2.680)	(0.190)	(-1.010)	(-2.820)	(-1.000)
Loan Maturity	0.101***	0.084***	0.101***	-0.019	0.008	-0.019
	(4.640)	(3.980)	(4.630)	(-0.760)	(0.570)	(-0.760)
Term Loan	0.296**	-0.017	0.296**	0.138***	0.028	0.138***
	(2.410)	(-0.160)	(2.400)	(3.230)	(0.750)	(3.230)
Country Characteristics						
GDP Growth%	-0.036***	-0.013	-0.036***	-0.010	-0.003	-0.010
	(-3.120)	(-1.250)	(-3.130)	(-0.910)	(-0.390)	(-0.950)
Inflation Rate	0.029***	0.039***	0.029***	0.030***	0.044***	0.029***
	(4.240)	(4.030)	(4.200)	(3.630)	(4.680)	(3.600)
Political Stability	-0.226**	-0.109	-0.228**	-0.373***	-0.195***	-0.375***
	(-2.360)	(-1.110)	(-2.380)	(-4.990)	(-3.450)	(-5.000)
Anti-Corruption	-0.117	-0.159	-0.116	-0.187*	-0.197**	-0.188*
	(-0.970)	(-1.240)	(-0.970)	(-1.760)	(-2.480)	(-1.770)
Constant	5.032***	4.945***	5.236**	5.382***	5.504***	5.683***
	(15.480)	(13.720)	(17.400)	(24.410)	(32.190)	(27.640)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	Yes	No
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,616	5,616	5,616	33,548	33,548	33,548
Adj. R^2	0.541	0.794	0.541	0.454	0.751	0.454

This table presents our OLS regression results, where the dependent variable is *Ln(Spread)*, the natural logarithm of *Spread*. *EPS* is the score ranging from 0 to 6 where the higher the number, the more stringent regulations are in a country. The left panel excludes U.S. firms from the sample, whereas the right panel includes U.S. firms. The main independent variable in Models (3) and (6) is EPS_resid, which is the residual of regressing EPS on firm size and firm size squared. Definitions of all control variables are provided in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. The numbers in parentheses are *t*-statistics. Standard errors are clustered by year and country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5

Difference-in-Differences

	Without U.S. Firms	With U.S. Firms
Treated	-0.299**	-0.464***
	(-2.390)	(-7.480)
Post	0.461***	0.314***
	(3.400)	(6.590)
Treated*Post	0.248***	0.385***
	(3.820)	(7.340)
Borrower Characteristics		
Firm Size	0.027	-0.025
	(0.330)	(-0.350)
Operating Profit	0.641***	0.622***
	(8.270)	(18.810)
Leverage	-0.225***	-0.214***
	(-3.400)	(-5.940)
Asset Tangibility	-1.754***	-2.212***
	(-9.320)	(-18.280)
Loan Characteristics		
Loan Amount	0.000	-0.001
	(0.060)	(-1.050)
Loan Maturity	0.104***	-0.017
	(4.760)	(-0.650)
Term Loan	-0.034***	-0.012
	(-2.940)	(-1.130)
Country Characteristics		
GDP growth%	0.029***	0.030***
	(4.320)	(3.780)
Inflation Rate	0.259*	-0.228***
	(1.940)	(-3.360)
Political Stability	-0.109	-0.105
	(-1.120)	(-1.110)
Anti-Corruption	-0.024	5.359***
	(-0.190)	(26.050)
Constant	4.624***	-0.228***
	(14.310)	(-3.360)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Loan Type & Purpose FE	Yes	Yes
Observations	5,616	33,548
Adj. R^2	0.542	0.455

This table presents the results of the difference-in-difference regressions that examine the effect of a change in environmental regulations climate action in European countries on the cost of bank loans. The dependent variable in all models is *Ln(Spread)*. *Treated*Post* is an interaction term showing the effects of adopting the Emission Trading System on firms' cost of loans in countries that adopted the program in 2005. All control variables are defined in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but omitted for brevity. Numbers in parentheses are *t*-statistics computed using standard errors that are clustered at the year-country level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6

EPS and Other Contractual Feature of a Loan

Panel A: Without U.S. Firms	(1) Secured Loans	(2) Ln(Upfront Fees)	(3) Ln(Maturity)	(4) Covenant-Index
EPS	0.535**	0.173**	-0.033	-0.079
	(2.320)	(2.180)	(-1.130)	(-0.760)
Borrower Characteristics				
Firm Size	3.370	0.127***	-0.009	-0.071
	(0.280)	(4.690)	(-0.170)	(-1.070)
Operating Profit	-5.031***	-1.383***	-0.053	-0.697
	(-3.480)	(-4.010)	(-0.330)	(-1.000)
Leverage	2.791***	0.506***	0.180***	0.227
	(5.070)	(3.470)	(3.370)	(1.090)
Asset Tangibility	-0.719	-0.035	-0.140**	-1.117***
	(-1.480)	(-0.240)	(-2.110)	(-3.800)
Loan Characteristics				
Loan Amount	-0.113*	0.001	-0.000	0.000
	(-1.780)	(1.240)	(-0.840)	(0.820)
Loan Maturity	0.566***	0.218***	--	0.051
	(3.860)	(4.800)	--	(0.730)
Term Loan	1.291	0.544***	0.110	0.733*
	(1.160)	(3.600)	(1.400)	(1.710)
Country Characteristics				
GDP growth%	-0.129*	-0.027	0.013	-0.040
	(-1.830)	(-1.340)	(1.360)	(-1.250)
Inflation Rate	0.042	0.031***	-0.003	-0.009
	(1.140)	(3.600)	(-0.710)	(-0.890)
Political Stability	0.209	-0.245*	-0.030	0.053
	(0.330)	(-1.650)	(-0.440)	(0.150)
Anti-Corruption	0.062	-0.118	-0.167*	-0.720**
	(0.070)	(-0.540)	(-1.870)	(-2.070)
Constant	-0.888	3.623***	4.362***	0.703
	(-0.350)	(6.140)	(18.080)	(0.730)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes
Observations	1,932	2,119	5,616	5,616
(Pseudo or Adj.) R^2	0.310	0.474	0.381	0.136

Panel B: With U.S. Firms	(1) Secured Loans	(2) Ln(Upfront Fees)	(3) Ln(Maturity)	(4) Covenant-Index
EPS	0.100	0.381***	-0.069***	0.382**
	(0.440)	(5.970)	(-3.060)	(2.370)
Borrower Characteristics				
Firm Size	19.573	0.067**	0.031	-0.069
	(1.610)	(2.310)	(0.600)	(-0.410)
Operating Profit	-6.238***	-2.254***	0.519***	-0.386
	(-13.600)	(-12.500)	(7.940)	(-1.090)
Leverage	2.683***	0.407***	0.117***	1.575***
	(19.940)	(4.910)	(4.470)	(7.230)
Asset Tangibility	-0.361***	-0.011	-0.059***	-0.523***
	(-2.730)	(-0.130)	(-2.690)	(-3.620)
Loan Characteristics				
Loan Amount	-1.296***	-0.195***	0.015	-0.332***
	(-12.370)	(-8.030)	(1.370)	(-6.690)
Loan Maturity	0.116	0.089***	--	0.853***
	(1.170)	(3.140)	--	(7.750)
Term Loan	0.383**	0.141	0.241***	0.092
	(2.570)	(1.170)	(5.820)	(0.570)
Country Characteristics				
GDP growth%	0.019	-0.012	0.014*	-0.060
	(0.270)	(-0.640)	(1.810)	(-1.570)
Inflation Rate	0.045	0.019**	-0.006	0.020
	(1.410)	(2.280)	(-1.280)	(0.780)
Political Stability	0.183	-0.101	-0.060	-0.994***
	(0.290)	(-0.920)	(-1.010)	(-3.300)
Anti-Corruption	0.667	-0.078	-0.145*	-0.195
	(0.910)	(-0.530)	(-1.920)	(-0.500)
Constant	0.576	2.926***	4.145***	-0.952
	(0.340)	(8.640)	(27.770)	(-1.150)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes
Observations	22,470	7,558	33,548	33,548
(Pseudo or Adj.) R^2	0.270	0.341	0.440	0.309

This table presents regression of other loan features on the EPS score ranging from 0 to 6 where the higher the number, the more stringent are regulations. In the first model, the dependent variable is an indicator if the loan is secured. In the second model, the dependent variable is the natural log of upfront fees. In the third model, the dependent variable is the natural log of loan maturity. In the last model, the dependent variable is the total number of covenants that a loan contract has at the time of origination. Panel A excludes U.S. firms from the sample. Panel B includes U.S. firms. More information on these variables and other control variables are provided in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. The numbers in the parentheses are *t*-statistics. Standard errors are clustered by year-country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7
Potential Channels

Panel A: Without U.S. Firms

	No. of Syndicate Participants	Leverage	Altman-Z	Credit Rating
EPS	-1.012**	-0.038***	-0.089***	0.124**
	(-2.320)	(-4.370)	(-3.290)	(2.290)
Other Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	No	No	No
Observations	5,473	5,048	1,462	4,601
Adj. R^2	0.183	0.244	0.875	0.529

Panel B: With U.S. Firms

	No. of Syndicate Participants	Leverage	Altman-Z	Credit Rating
EPS	-1.533***	-0.021**	-0.091***	0.127***
	(-4.290)	(-2.360)	(-4.210)	(2.610)
Other Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	No	No	No
Observations	33,272	35,386	28,677	15,678
Adj. R^2	0.0762	0.171	0.607	0.416

This table reports the regression results analyzing the potential channels through which EPS affects loan spreads. Dependent variables are the *number of participants in a loan syndicate*, *leverage*, *modified Altman-Z*, and *Credit ratings* in Models (1), (2), (3), and (4), respectively. Full version of the table is reported in the internet Appendix. All control variables, their sources, and definitions are described in Appendix A. Panel A excludes U.S. firms from the sample. Panel B includes U.S. firms. All models include loan type and purpose dummies, year, industry, and country fixed effects. The numbers in parentheses are *t*-statistics. Standard errors are clustered by country-year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

Table 8

Subsample Analyses

Panel A: Without U.S. Firms

	Financial Constraint		Env. Litigation Risk		Bank- vs Market-Based		First half vs second half	
	High	Low	High	Low	Bank-Based	Mkt-Based	Prior 2002	Post 2002
EPS	0.186***	-0.004	0.191***	-0.020	0.279***	0.100**	-0.214	0.105**
	(4.530)	(-0.080)	(4.620)	(-0.400)	(2.740)	(2.390)	(-1.290)	(2.080)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,343	2,273	2,660	2,956	1,741	3,823	1,630	3,986
Adj. R^2	0.632	0.639	0.630	0.629	0.674	0.604	0.545	0.497
p-value of χ^2 test of Coeff diff		0.000		0.000		0.020		0.020

Panel B: With U.S. Firms

	Financial Constraint		Env. Litigation Risk		Bank- vs Market-Based		First half vs second half	
	High	Low	High	Low	Bank-Based	Mkt-Based	Prior 2002	Post 2002
EPS	0.219***	0.062	0.201***	0.172***	0.279***	0.178***	0.125	0.104**
	(5.650)	(1.300)	(5.320)	(3.890)	(2.740)	(4.530)	(0.740)	(2.590)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,273	14,275	12,906	20,642	1,741	31,755	12,656	20,892
Adj. R^2	0.442	0.478	0.448	0.459	0.608	0.448	0.474	0.439
p-value of χ^2 test of Coeff diff		0.000		0.410		0.190		0.000

In this table, we compare the effect of EPS between the pairs of categories. In all models, the dependent variable is *Ln(Spread)*. In the first two columns, we use the median of the Kaplan-Zingales Index (1997) to split samples into firms with high and low financial constraints. In the next two columns, firms in industries with the percentage of environmental litigation cases more than (below) the sample average are categorized as a high (low) risk. Columns 5 and 6 compare the impact of EPS on loan spreads between bank-based and market-based economies. Classification of countries is based on Demirguc-Kunt and Levine (2001). For the countries that are not in that classification, we use the classification introduced by Levine (2002). In the last two columns, we split the sample in the midpoint of the sample period. From 1991 to 2002 and from 2003 to 2014. Panel A excludes U.S. firms from the sample. Panel B includes U.S. firms. Full version of the table is reported in the internet Appendix. All control variables are defined in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. Numbers in parentheses are *t*-statistics computed using standard errors that are clustered at the country-year level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9

Long-Term and Short-Term Effects of Environmental Policy Stringency on Cost of Bank Loan

Panel A: Without U.S. Firms					
	(1)	(2)	(3)	(4)	(5)
EPS_{t-1}	0.098**				0.357*
	(2.530)				(1.920)
EPS_{t-2}		0.177***			0.074
		(3.440)			(0.650)
EPS_{t-3}			0.042		-0.100
			(0.860)		(-0.750)
EPS_{t-4}				-0.031	0.160
				(-0.690)	(1.050)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes
Observations	3,296	803	775	647	154
Adj. R^2	0.567	0.625	0.614	0.585	0.611

Panel B: With U.S. Firms					
	(1)	(2)	(3)	(4)	(5)
EPS_{t-1}	0.198***				0.183*
	(5.710)				(1.690)
EPS_{t-2}		0.103**			-0.005
		(2.300)			(-0.070)
EPS_{t-3}			0.129***		0.045
			(3.140)		(0.460)
EPS_{t-4}				-0.013	-0.018
				(-0.280)	(-0.180)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes
Observations	20,193	7,183	7,220	6,604	1,883
Adj. R^2	0.494	0.570	0.554	0.578	0.626

This table presents the long-term and short-term impact of environmental regulation on the cost of bank loans. The dependent variable, *SPREAD*, is the average ln(spread) of all loans issued to a firm in a given year. *EPS* is the score ranging from 0 to 6 where the higher the number, the more stringent regulations are in a country. Panel A excludes U.S. firms from the sample. Panel B includes U.S. firms. Full version of the table is reported in the internet Appendix. Definitions of all control variables are provided in Appendix A. All loan-level variables are averaged across loans issued in a given year to an individual firm. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. The numbers in parentheses are *t*-statistics. Standard errors are clustered by year and country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Fig. 1.
Timeseries Graph of EPS by Country

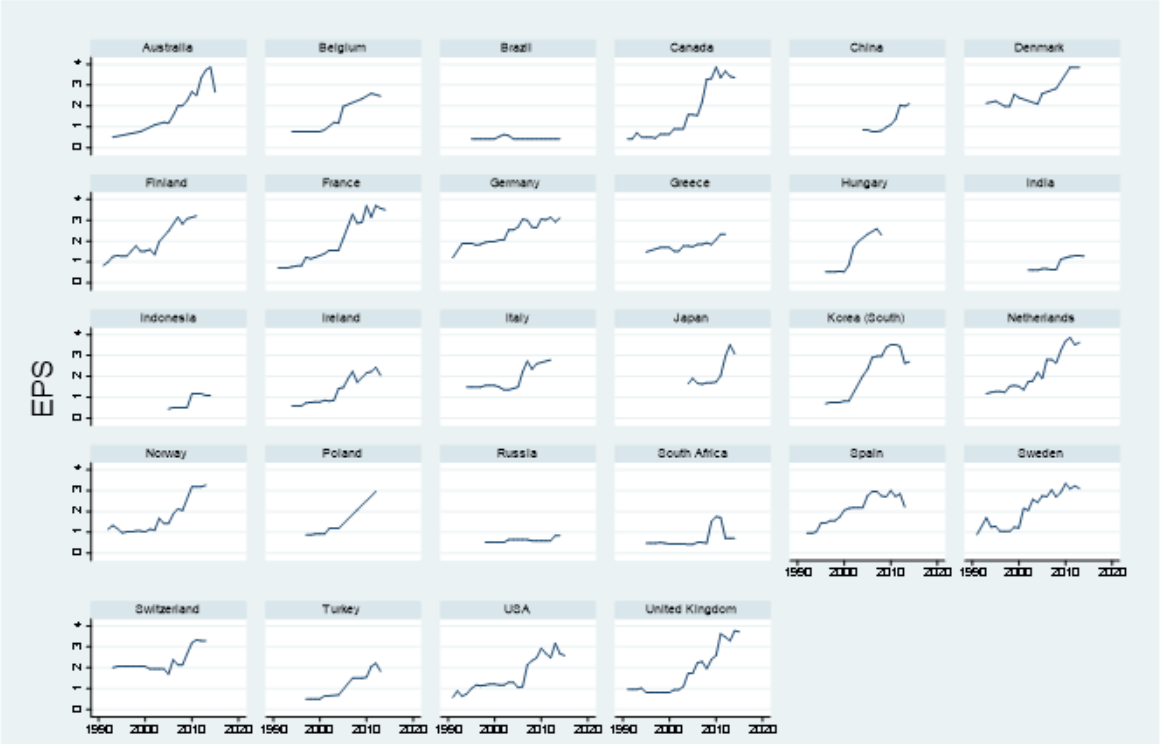
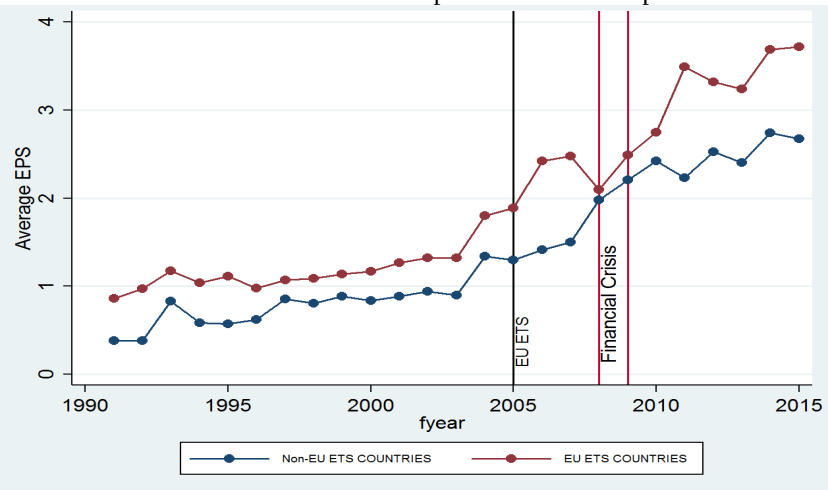
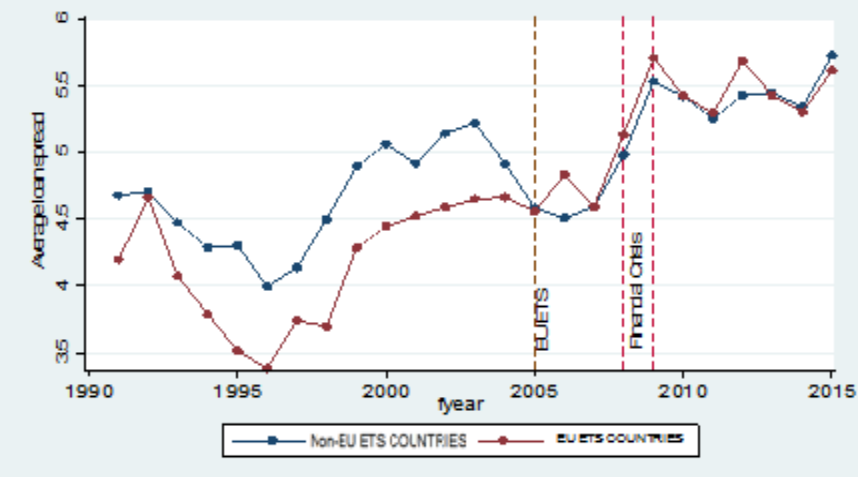


Fig. 2.
Time-Series EPS and Bank Loan Spreads.

Panel A. EPS Score Between European and Non-European Firms



Panel B. Average Loan Spread Between European and Non-European Firms



This figure describes time-varying EPS scores and average bank loan spreads between European and non-European firms.

Appendix A. Definitions of Variables

Variables	Description	Data Source
EPS	EPS Index constructed from OECD, which shows the level of environmental policy stringency in countries and ranges from 0 to with 6 indicates the most stringent laws.	OECD
Spread.	The interest rate that the borrower pays on its loan facility; it is measured by the All-in-Spread-Drawn variable from DealScan	Dealscan
lspread	Natural log of Spread	Computed
Covenant Index	Total number of covenant terms in the loan facility	Dealscan
Loan Amount	Loan facility amount in billions of U.S. dollars	Dealscan
Term Loan	Installment loan in which the funds are typically drawn down all at once	Dealscan
Maturity	Represents the duration of the loan in a number of months	Dealscan
Secured Loans	Indicator variable equals 1 if the loan is secured and 0 otherwise	Dealscan
Upfront Fee	A fee paid by the borrower once the loan is closed	Dealscan
Firm Size	Book value of total assets in U.S. dollars expressed in hundreds of millions	Global Compustat
Operating Profit	Defined as EBIT/Assets; return on total assets and measures the effectiveness of company is using its assets in order to generate earnings before interests and taxes. [ebit/at]	Global Compustat
Leverage	Debt/Assets is the debt ratio and indicates the level of assets that companies generated using debts	Global Compustat
Market/Book	Firm value representing by the ratio of its market and book value	Global Compustat
HHI	Herfindahl index based on sales in a given industry, first two digits of SIC code	Global Compustat
Sales Growth	Annual sales' growth rate ($(sale_t/sale_{t-1}) - 1$)	Global Compustat
Firm Age	The natural logarithm of the number of years since the firm was included in the Compustat database	Global Compustat
Dividend	Dummy variable equals 1 if a firm pays dividends in year *t*, 0 otherwise	Global Compustat
R&D	Research and development normalized by total asset [xrd/at]	Global Compustat
Cash	Firm cash holdings scaled by total asset	Global Compustat
FCF	Sum of operating and investing cash flow scaled by total asset	Global Compustat
Nemployee	Natural logarithm of the number of firms' employees	Global Compustat
Country Exchange Rate	Country exchange rates to $U.S.	Global Compustat
Tangibility	Ratio of fixed assets to book assets [ppent/at]	Global Compustat
GDP	Represents the real GDP of a country in a specific year transformed in logarithm function	WorldBank
KZ Index	Measure of firms' financial constraints, represents the level of firms' reliance on external financing	Kaplan and Zingales (1997)
Altman Z-score	(1.2*working capital + 1.4*retained earnings + 3.3*EBIT + 0.999*sales) / total assets	Global Compustat
Political Stability	Measures level of government stability and safety and ranges from -2.5 (weak) to 2.5 (strong)	Kaufmann, Kraay, Mastruzzi (2010)
Anticorruption	Measures the level of public power efforts for private gains, including different forms of corruption; it ranges from -2.5 (weak) to 2.5 (strong)	Kaufmann, Kraay, Mastruzzi (2010)

Appendix B. Industries with the Highest and Lowest Environmental Litigation Cases from 1980 to 2016 in the U.S.

SIC2	% of Total Env Litigation	Industry Name	Subindustry
49	**19.11**	**Electric, Gas, & Sanitary Services**	**Transportation & Public Utilities**
28	**13.09**	**Chemical & Allied Products**	**Manufacturing**
29	**8.48**	**Petroleum & Coal Products**	**Manufacturing**
37	**6.70**	**Transportation Equipment**	**Manufacturing**
13	**5.65**	**Oil & Gas Extraction**	**Mining**
36	**5.59**	**Electronic & Other Electric Equipment**	**Manufacturing**
35	**5.47**	**Industrial Machinery & Equipment**	**Manufacturing**
33	**4.67**	**Primary Metal Industries**	**Manufacturing**
38	**3.81**	**Instruments & Related Products**	**Manufacturing**
26	**2.89**	**Paper & Allied Products**	**Manufacturing**
10	**2.21**	**Metal, Mining**	**Mining**
40	1.78	Railroad Transportation	Transportation & Public Utilities
12	1.66	Coal Mining	Mining
99	1.66	Nonclassifiable Establishments	Nonclassifiable Establishments
48	1.66	Communications	Transportation & Public Utilities
34	1.41	Fabricated Metal Products	Manufacturing
73	1.11	Business Services	Services
30	0.98	Rubber & Miscellaneous Plastics Products	Manufacturing
20	0.74	Food & Kindred Products	Manufacturing
14	0.74	Nonmetallic Minerals, Except Fuels	Mining
32	0.68	Stone, Clay, & Glass Products	Manufacturing
50	0.61	Wholesale Trade – Durable Goods	Retail Trade
53	0.49	General Merchandise Stores	Retail Trade
42	0.49	Trucking & Warehousing	Transportation & Public Utilities
25	0.43	Furniture & Fixtures	Manufacturing
44	0.43	Water Transportation	Transportation & Public Utilities
16	0.37	Heavy Construction, Except Building	Construction
1	0.31	Agricultural Production – Crops	Agriculture, Forestry, & Fishing
15	0.31	General Building Contractors	Construction
51	0.31	Wholesale Trade – Nondurable Goods	Retail Trade
80	0.31	Health Services	Services
24	0.25	Lumber & Wood Products	Manufacturing
27	0.25	Printing & Publishing	Manufacturing
31	0.25	Leather & Leather Products	Manufacturing
39	0.25	Miscellaneous Manufacturing Industries	Manufacturing
54	0.25	Food Stores	Retail Trade
87	0.25	Engineering & Management Services	Services
23	0.18	Apparel & Other Textile Products	Manufacturing
58	0.18	Eating & Drinking Places	Retail Trade
59	0.18	Miscellaneous Retail	Retail Trade
2	0.12	Agricultural Production – Livestock	Agriculture, Forestry, & Fishing
17	0.12	Special Trade Contractors	Construction
55	0.12	Automotive Dealers & Service Stations	Retail Trade
75	0.12	Auto Repair, Services, & Parking	Services
47	0.12	Transportation Services	Transportation & Public Utilities
22	0.06	Textile Mill Products	Manufacturing
52	0.06	Building Materials & Gardening Supplies	Retail Trade
56	0.06	Apparel & Accessory Stores	Retail Trade
70	0.06	Hotels & Other Lodging Places	Services
72	0.06	Personal Services	Services
79	0.06	Amusement & Recreation Services	Services
45	0.06	Transportation by Air	Transportation & Public Utilities
46	0.06	Pipelines, Except Natural Gas	Transportation & Public Utilities

Texts in bold font denote high litigation risk industries. The percentage of total environmental litigation cases for these industries is more than the sample average of 1.8%. This data is obtained from Audit Analytics.

Internet Appendix for
"Environmental Regulation and the Cost of Bank Loans: International Evidence"

July 2020

Abstract

In this internet appendix, we report the results of some additional analyses as well as the complete version of Tables 7, 8 and 9.

JEL Classification: G21; G32; Q51
Keywords: Environmental Regulations; Business Risk; Bank Loan Contracting

Table 7
Potential Channels

Panel A: Without US Firms

No. of Syndicate Participants		Leverage		Altman-Z		Credit Rating	
EPS	-1.012**	EPS	-0.038***	EPS	-0.089***	EPS	0.124**
	(-2.32)		(-4.37)		(-3.29)		(2.29)
Firm Size	-1.060	Firm Size	-0.106	Firm Size	0.088**	Firm Size	-0.104***
	(-1.54)		(-0.53)		(2.57)		(-6.80)
Operating Profit	5.710**	Operating Profit	-0.199***	Operating Profit	6.963***	Operating Profit	-5.082***
	(2.28)		(-3.03)		(19.66)		(-13.03)
Leverage	-0.807	Market/Book	0.003***	Leverage	-1.308***	Leverage	1.687***
	(-0.83)		(4.87)		(-12.43)		(10.00)
Asset Tangibility	0.267	Sales	0.000	Cash	0.565***	Asset Tangibility	-0.331**
	(0.33)		(0.45)		(2.80)		(-2.59)
Loan Amount	0.011	R&D	-0.003	FCF	-0.021	Cash	1.917***
	(1.53)		(-0.72)		(-0.07)		(6.69)
Loan Maturity	0.009	FCF	-0.309***	Market/Book	-0.003	Market/Book	0.006*
	(0.03)		(-4.38)		(-1.44)		(1.91)
Term Loan	-2.666**	CASH	-0.472***	Asset Tangibility	-0.364***	Political Stability	-0.175
	(-2.36)		(-10.56)		(-4.34)		(-1.30)
GDP growth%	0.037	Dividend	-0.018*	R&D	-0.017	Anti-Corruption	0.099
	(0.28)		(-1.69)		(-0.65)		(0.55)
Inflation Rate	0.160	Constant	0.491***	HHI	0.140**	Constant	3.403***
	(1.11)		(15.53)		(2.39)		(8.86)
Political Stability	2.692**			GDP growth%	0.014		
	(2.49)				(1.64)		
Anti-Corruption	3.857***			Inflation Rate	0.003		
	(2.73)				(0.52)		
Constant	-6.275			Political Stability	0.124**		
	(-1.44)				(1.99)		
				Anti-Corruption	0.034		
					(0.37)		
				Constant	1.652**		
Loan Type & Purpose FE	Yes				(2.45)		
Year FE	Yes	Year FE	Yes	Year FE	Yes	Year FE	Yes
Industry FE	Yes	Industry FE	Yes	Industry FE	Yes	Industry FE	Yes
Country FE	Yes	Country FE	Yes	Country FE	Yes	Country FE	Yes
Observations	5,473	Observations	5,048	Observations	1,462	Observations	4,601
Adj. R^2	0.183	Adj. R^2	0.244	Adj. R^2	0.875	Adj. R^2	0.529

Panel B: With US Firms

No. of Syndicate Participants		Leverage		Altman-Z		Credit Rating	
EPS	-1.533***	EPS	-0.021**	EPS	-0.091***	EPS	0.127***
	(-4.29)		(-2.36)		(-4.21)		(2.61)
Firm Size	-0.672	Firm Size	-0.141	Firm Size	0.023	Firm Size	-0.122***
	(-0.98)		(-0.69)		(0.66)		(-6.77)
Operating Profit	7.783***	Operating Profit	0.040	Operating Profit	7.457***	Operating Profit	-4.819***
	(10.89)		(0.68)		(54.01)		(-15.72)
Leverage	0.816	Market/Book	-0.001**	Leverage	-2.069***	Leverage	1.897***
	(1.51)		(-2.47)		(-39.46)		(24.18)
Asset Tangibility	0.714**	Sales	0.000	Cash	-0.442***	Asset Tangibility	-0.225***
	(2.47)		(0.61)		(-4.20)		(-3.03)
Loan Amount	0.019***	R&D	-0.013	FCF	0.241*	Cash	1.668***
	(3.29)		(-1.17)		(1.94)		(9.35)
Loan Maturity	1.910***	FCF	-0.438***	Market/Book	-0.001	Market/Book	-0.013***
	(6.83)		(-10.39)		(-0.52)		(-4.82)
Term Loan	-1.989***	CASH	-0.625***	Asset Tangiblity	-0.254***	Political Stability	-0.035
	(-3.97)		(-36.81)		(-3.81)		(-0.32)
GDP growth%	-0.121	Dividend	-0.009*	R&D	-0.196**	Anti-Corruption	0.111
	(-0.95)		(-1.84)		(-1.99)		(0.74)
Inflation Rate	0.160	Constant	0.414***	HHI	0.077	Constant	0.127***
	(1.18)		(23.39)		(1.31)		(2.61)
Political Stability	3.124***			GDP growth%	0.002		
	(3.72)				(0.23)		
Anti-Corruption	4.824***			Inflation Rate	0.007		
	(3.78)				(0.98)		
Constant	-6.696**			Political Stability	0.128**		
	(-2.23)				(2.47)		
				Anti-Corruption	0.024		
					(0.33)		
				Constant	1.922***		
					(14.04)		
Year FE	Yes	Year FE	Yes	Year FE	Yes	Year FE	Yes
Industry FE	Yes	Industry FE	Yes	Industry FE	Yes	Industry FE	Yes
Country FE	Yes	Country FE	Yes	Country FE	Yes	Country FE	Yes
Observations	33,272	Observations	35,386	Observations	28,677	Observations	15,678
Adj. R^2	0.0762	Adj. R^2	0.171	Adj. R^2	0.607	Adj. R^2	0.416

This table reports the regression results analyzing the potential channels through which EPS affects loan spreads. Dependent variables are the *number of participants in a loan syndicate*, *leverage*, *modified Altman-Z*, and *Credit ratings* in Models (1), (2), (3), and (4), respectively. All control variables, their sources, and definitions are described in Appendix A. Panel A excludes US firms from the sample. Panel B includes US firms. All models include loan type and purpose dummies, year, industry, and country fixed effects. The numbers in parentheses are *t*-statistics. Standard errors are clustered by country-year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8

Subsample Analyses

Panel A: Without US Firms	Financial Constraint		Env. Litigation Risk		Bank- vs Market-Based		First half vs second half	
	High	Low	High	Low	Bank-Based	Mkt-Based	Prior 2002	Post 2002
EPS	0.186***	-0.004	0.191***	-0.020	0.279***	0.100**	-0.214	0.105**
	(4.53)	(-0.08)	(4.62)	(-0.40)	(2.74)	(2.39)	(-1.29)	(2.08)
Borrower Characteristics								
Firm Size	0.060	-0.710**	0.077	-2.039	0.238***	-0.084	0.070*	-0.722**
	(0.87)	(-2.48)	(0.83)	(-1.55)	(7.41)	(-1.45)	(1.66)	(-2.55)
Operating Profit	-1.418***	-2.279***	-1.566***	-1.853***	-1.400***	-1.856***	-2.494***	-1.523***
	(-5.84)	(-5.92)	(-4.88)	(-8.24)	(-3.87)	(-8.50)	(-6.73)	(-6.90)
Leverage	0.643***	0.682***	0.551***	0.747***	1.012***	0.565***	0.661***	0.648***
	(7.18)	(4.80)	(4.46)	(8.40)	(6.11)	(6.96)	(4.82)	(6.94)
Asset Tangibility	-0.138	-0.328***	-0.297***	-0.117	-0.281**	-0.237***	-0.375***	-0.176**
	(-1.57)	(-3.27)	(-2.93)	(-1.25)	(-2.12)	(-2.97)	(-2.78)	(-2.35)
Loan Characteristics								
Loan Amount	0.000	-0.002	-0.004**	0.000	0.000	-0.001	0.000*	-0.001
	(0.17)	(-1.33)	(-2.35)	(1.06)	(0.25)	(-0.35)	(1.78)	(-0.85)
Loan Maturity	0.091***	0.123***	0.148***	0.071***	0.117***	0.107***	0.118***	0.078***
	(3.52)	(3.53)	(4.80)	(2.66)	(2.74)	(4.64)	(2.84)	(3.17)
Term Loan	0.711***	0.139	0.352**	0.197	0.752***	0.158	0.150	0.481***
	(3.07)	(1.05)	(2.12)	(0.94)	(4.63)	(1.16)	(0.89)	(3.82)
Country Characteristics								
GDP growth%	-0.038***	-0.023	-0.033***	-0.027**	-0.030***	-0.019	-0.017	-0.029**
	(-3.54)	(-1.43)	(-2.65)	(-2.04)	(-2.90)	(-1.29)	(-0.96)	(-2.17)
Inflation Rate	0.027***	0.059***	0.042***	0.024***	0.049***	0.016*	0.031**	0.066***
	(4.04)	(4.44)	(4.06)	(3.07)	(4.23)	(1.70)	(2.53)	(6.94)
Political Stability	-0.169*	-0.159	-0.287**	-0.118	-0.251	-0.173	-0.638***	-0.085
	(-1.79)	(-1.14)	(-2.50)	(-0.94)	(-1.52)	(-1.54)	(-3.22)	(-0.63)
Anti-Corruption	0.028	-0.155	-0.017	-0.282*	-0.211	-0.572***	0.315	-0.173
	(0.22)	(-0.77)	(-0.12)	(-1.88)	(-0.90)	(-3.73)	(0.96)	(-0.95)
Constant	4.010***	4.922***	4.380***	6.021***	3.147***	6.009***	4.210***	4.859***
	(9.12)	(10.97)	(10.74)	(13.85)	(6.56)	(17.21)	(5.53)	(11.58)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,343	2,273	2,660	2,956	1,741	3,823	1,630	3,986
Adj. R^2	0.632	0.639	0.630	0.629	0.674	0.604	0.545	0.497
p-value of χ^2 test of Coeff diff		0.00		0.00		0.02		0.02

Panel B: With US Firms	Financial Constraint		Env. Litigation Risk		Bank- vs Market-Based		First half vs second half	
	High	Low	High	Low	Bank-Based	Mkt-Based	Prior 2002	Post 2002
EPS	0.219***	0.062	0.201***	0.172***	0.279***	0.178***	0.125	0.104**
	(5.65)	(1.30)	(5.32)	(3.89)	(2.74)	(4.53)	(0.74)	(2.59)
Borrower Characteristics								
Firm Size	-0.012	-0.763**	-0.040	-2.871**	0.238***	-0.135*	0.051	-1.178***
	(-0.23)	(-2.47)	(-0.42)	(-2.15)	(7.41)	(-1.77)	(1.37)	(-3.96)
Operating Profit	-1.726***	-2.665***	-1.951***	-2.392***	-1.400***	-2.213***	-2.049***	-2.299***
	(-18.16)	(-15.25)	(-12.74)	(-20.68)	(-3.87)	(-17.84)	(-15.29)	(-14.45)
Leverage	0.561***	0.232***	0.661***	0.626***	1.012***	0.621***	0.581***	0.646***
	(19.89)	(6.10)	(14.17)	(21.10)	(6.11)	(18.63)	(12.02)	(14.96)
Asset Tangibility	-0.211***	-0.022	-0.185**	-0.242***	-0.281**	-0.205***	-0.354***	-0.127***
	(-7.50)	(-0.33)	(-2.46)	(-8.74)	(-2.12)	(-5.61)	(-8.32)	(-4.41)
Loan Characteristics								
Loan Amount	-0.000	-0.005**	-0.006**	-0.000	0.000	-0.014	0.000	-0.002
	(-0.70)	(-2.22)	(-2.34)	(-1.08)	(0.25)	(-1.22)	(0.36)	(-1.51)
Loan Maturity	-0.028	-0.008	-0.016	-0.019	0.117***	-0.031	-0.022	0.012
	(-1.28)	(-0.29)	(-0.48)	(-0.82)	(2.74)	(-1.17)	(-0.50)	(0.54)
Term Loan	0.150***	0.161**	0.105	0.161***	0.752***	0.108**	0.121***	0.262**
	(3.04)	(2.47)	(1.54)	(2.90)	(4.63)	(2.58)	(2.68)	(2.45)
Country Characteristics								
GDP growth%	-0.009	-0.006	-0.010	-0.008	-0.030***	0.025	0.032	-0.028**
	(-0.79)	(-0.42)	(-0.86)	(-0.62)	(-2.90)	(1.46)	(1.65)	(-2.07)
Inflation Rate	0.025***	0.055***	0.053***	0.018**	0.049***	0.025*	0.009	0.065***
	(3.27)	(4.37)	(5.19)	(2.21)	(4.23)	(1.87)	(0.57)	(6.38)
Political Stability	-0.388***	-0.205**	-0.397***	-0.356***	-0.251	-0.443***	-0.777***	-0.447***
	(-4.63)	(-2.12)	(-5.03)	(-3.56)	(-1.52)	(-4.63)	(-2.98)	(-4.26)
Anti-Corruption	-0.022	-0.309**	-0.133	-0.253*	-0.211	-0.454***	0.846***	-0.073
	(-0.17)	(-2.49)	(-1.14)	(-1.94)	(-0.90)	(-3.45)	(3.30)	(-0.55)
Constant	5.248***	5.564***	5.225***	5.536***	3.147***	5.801***	4.396***	5.325***
	(20.01)	(21.13)	(19.25)	(21.79)	(6.56)	(22.10)	(7.79)	(18.64)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,273	14,275	12,906	20,642	1,741	31,755	12,656	20,892
Adj. R^2	0.442	0.478	0.448	0.459	0.608	0.448	0.474	0.439
p-value of χ^2 test of Coeff diff		0.00		0.41		0.19		0.00

In this table, we compare the effect of EPS between the pairs of categories. In all models, the dependent variable is *Ln(Spread)*. In the first two columns, we use the median of the Kaplan-Zingales Index (1997) to split samples into firms with high and low financial constraints. In the next two columns, firms in industries with the percentage of environmental litigation cases more than (below) the sample average are categorized as a high (low) risk. Columns 5 and 6 compare the impact of EPS on loan spreads between bank-based and market-based economies. Classification of countries is based on Demirguc-Kunt and Levine (2001). For the countries that are not in that classification, we use the classification introduced by Levine (2002). In the last two columns, we split the sample in the midpoint of the sample period. From 1991 to 2002 and from 2003 to 2014. Panel A excludes US firms from the sample. Panel B includes US firms. All control variables are defined in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. Numbers in parentheses are *t*-statistics computed using standard errors that are clustered at the country-year level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9

Long-Term and Short-Term Effects of Environmental Policy Stringency on Cost of Bank Loan

Panel A: Without US Firms	(1)	(2)	(3)	(4)	(5)
EPS_{t-1}	0.098**				0.357*
	(2.53)				(1.92)
EPS_{t-2}		0.177***			0.074
		(3.44)			(0.65)
EPS_{t-3}			0.042		-0.100
			(0.86)		(-0.75)
EPS_{t-4}				-0.031	0.160
				(-0.69)	(1.05)
Borrower Characteristics					
Firm Size	-1.756***	-2.168***	-1.805***	-2.039***	-1.372
	(-10.50)	(-6.29)	(-4.84)	(-4.35)	(-0.85)
Operating Profit	0.646***	1.152***	0.786***	1.072***	0.806
	(8.57)	(6.82)	(4.74)	(5.02)	(1.12)
Leverage	-0.209***	-0.306**	-0.250*	-0.078	-0.048
	(-3.49)	(-2.10)	(-1.96)	(-0.41)	(-0.10)
Asset Tangibility	-0.011	0.006	-0.991	-0.012	5.245
	(-0.12)	(0.01)	(-1.65)	(-0.03)	(1.14)
Loan Characteristics					
Loan Amount	0.000	-0.020**	-0.003	-0.032**	-0.012
	(0.21)	(-2.35)	(-1.20)	(-2.47)	(-0.65)
Loan Maturity	0.020	0.011	-0.029	-0.054	-0.111
	(0.71)	(0.23)	(-0.60)	(-0.91)	(-0.79)
Term Loan	0.381***	0.418***	0.404***	0.312**	0.757*
	(9.24)	(5.11)	(3.81)	(2.52)	(1.76)
Country Characteristics					
GDP growth %	-0.031***	-0.036**	-0.026	0.008	-0.022
	(-2.60)	(-2.07)	(-1.36)	(0.59)	(-0.71)
Inflation Rate	0.032***	0.010	0.081***	0.023	-0.016
	(5.12)	(0.79)	(4.66)	(1.31)	(-0.33)
Political Stability	-0.144*	-0.148	0.101	0.018	0.130
	(-1.68)	(-0.93)	(0.67)	(0.13)	(0.18)
Anti-Corruption	-0.135	-0.508***	-0.365*	-0.072	-1.129
	(-1.21)	(-2.70)	(-1.77)	(-0.31)	(-1.39)
Constant	5.392***	6.169***	5.055***	5.176***	5.057***
	(16.67)	(11.62)	(9.36)	(7.60)	(3.20)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes
Observations	3,296	803	775	647	154
Adj. R^2	0.567	0.625	0.614	0.585	0.611

Panel B: With US Firms	(1)	(2)	(3)	(4)	(5)
EPS_{t-1}	0.198***				0.183*
	(5.71)				(1.69)
EPS_{t-2}		0.103**			-0.005
		(2.30)			(-0.07)
EPS_{t-3}			0.129***		0.045
			(3.14)		(0.46)
EPS_{t-4}				-0.013	-0.018
				(-0.28)	(-0.18)
Borrower Characteristics					
Firm Size	-2.181***	-2.694***	-2.613***	-2.871***	-3.670***
	(-19.64)	(-17.80)	(-15.31)	(-12.89)	(-12.88)
Operating Profit	0.589***	0.640***	0.649***	0.685***	0.709***
	(19.42)	(17.87)	(17.31)	(12.44)	(8.80)
Leverage	-0.218***	-0.190***	-0.180***	-0.122**	-0.170*
	(-5.21)	(-3.75)	(-3.43)	(-2.40)	(-1.91)
Asset Tangibility	-0.093	-0.786	-1.540*	-0.540	-2.334
	(-1.29)	(-0.62)	(-1.86)	(-1.04)	(-0.56)
Loan Characteristics					
Loan Amount	-0.001	-0.084**	-0.009**	-0.108**	-0.065*
	(-1.03)	(-2.37)	(-2.06)	(-2.18)	(-1.83)
Loan Maturity	-0.047	0.038	0.006	0.016	0.091***
	(-1.36)	(1.48)	(0.23)	(0.68)	(3.00)
Term Loan	0.412***	0.414***	0.424***	0.404***	0.488***
	(18.83)	(11.26)	(11.02)	(14.31)	(8.19)
Country Characteristics					
GDP growth %	-0.003	-0.021	-0.002	0.012	-0.015
	(-0.28)	(-1.40)	(-0.16)	(0.73)	(-0.61)
Inflation Rate	0.034***	0.022	0.088***	0.039**	0.064**
	(4.51)	(1.49)	(4.84)	(2.27)	(2.16)
Political Stability	-0.322***	-0.366***	-0.258**	-0.179	-0.573**
	(-4.63)	(-2.88)	(-2.34)	(-1.26)	(-2.28)
Anti-Corruption	-0.141	-0.350**	-0.215	-0.262	-0.548
	(-1.43)	(-2.01)	(-1.43)	(-1.31)	(-1.65)
Constant	5.015***	5.175***	4.655***	5.332***	4.783***
	(21.12)	(17.29)	(15.92)	(15.92)	(6.70)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes
Observations	20,193	7,183	7,220	6,604	1,883
Adj. R^2	0.494	0.570	0.554	0.578	0.626

This table presents the long-term and short-term impact of environmental regulation on the cost of bank loans. The dependent variable, *SPREAD,* is the average ln(spread) of all loans issued to a firm in a given year. *EPS* is the score ranging from 0 to 6 where the higher the number, the more stringent regulations are in a country. Panel A excludes US firms from the sample. Panel B includes US firms. Definitions of all control variables are provided in Appendix A. All loan-level variables are averaged across loans issued in a given year to an individual firm. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. The numbers in parentheses are *t*-statistics. Standard errors are clustered by year and country. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A.1

Environmental Policy Stringency Index by Country

Country:	Australia	Belgium	Brazil	Canada	China	Denmark	Finland	France	Germany	Greece	Hungary	Ireland	India	Indonesia
Year														
1990	0.50	0.67	—	0.38	0.25	0.90	0.83	0.71	1.21	0.65	0.35	0.52	0.40	0.38
1991	0.50	0.67	—	0.38	0.44	1.58	1.00	0.71	2.13	0.73	0.48	0.48	0.40	0.38
1992	0.50	0.71	—	0.71	0.52	2.13	1.25	0.71	1.88	0.77	0.52	0.52	0.40	0.38
1993	0.75	0.77	—	0.50	0.52	2.23	1.31	0.77	1.94	1.02	0.52	0.58	0.40	0.38
1994	0.50	0.77	—	0.50	0.52	2.23	1.27	0.81	1.90	1.48	0.52	0.58	0.40	0.38
1995	0.50	0.77	0.42	0.50	0.52	1.98	1.27	0.81	1.81	1.73	0.52	0.58	0.46	0.44
1996	0.46	0.77	0.42	0.46	0.52	1.98	1.52	1.23	1.85	1.69	0.52	0.73	0.46	0.44
1997	0.46	0.77	0.42	0.65	0.52	1.98	1.77	1.15	1.94	1.69	0.52	0.73	0.46	0.44
1998	0.77	0.77	0.42	0.65	0.52	2.56	1.52	1.23	1.98	1.69	0.56	0.77	0.46	0.44
1999	1.02	0.77	0.42	0.65	0.52	2.40	1.52	1.31	1.98	1.69	0.52	0.77	0.46	0.44
2000	0.98	0.85	0.42	0.90	0.52	2.60	1.60	1.40	2.06	1.52	0.85	0.85	0.56	0.44
2001	1.09	1.10	0.54	0.90	0.52	2.74	1.35	1.56	2.06	1.52	1.69	0.81	0.56	0.44
2002	1.21	1.21	0.63	0.90	0.65	2.11	1.98	1.56	2.54	1.77	1.98	0.85	0.60	0.44
2003	1.21	1.17	0.58	1.58	0.85	2.09	2.48	1.56	2.54	1.77	2.13	1.42	0.60	0.44
2004	1.17	1.98	0.42	1.58	0.85	2.59	2.48	2.13	2.67	1.73	2.33	1.46	0.60	0.44
2005	1.55	2.45	0.42	1.54	0.85	3.13	2.44	2.71	3.05	1.84	2.63	1.88	0.67	0.44
2006	2.01	2.40	0.42	2.17	0.77	3.16	3.15	3.28	3.00	1.84	2.59	2.23	0.67	0.50
2007	2.01	2.20	0.42	3.27	0.77	2.83	2.82	2.86	2.67	1.92	2.30	1.71	0.63	0.50
2008	2.26	2.34	0.42	3.31	0.81	2.96	3.08	2.90	2.64	1.83	2.55	2.05	0.63	0.50
2009	2.69	2.58	0.42	3.85	0.98	4.07	3.25	3.69	3.06	2.08	2.66	2.16	1.13	0.50
2010	2.50	2.60	0.42	3.35	1.10	4.03	3.21	3.15	3.02	2.33	2.77	2.22	1.20	1.17
2011	3.34	2.53	0.38	3.67	1.35	3.98	3.48	3.70	3.14	2.33	2.68	2.43	1.26	1.17
2012	3.72	2.47	0.38	3.42	2.04	3.85	3.43	3.57	2.92	2.13	2.63	2.05	1.30	1.17
2013	4.07	—	0.38	3.36	1.99	—	—	3.50	3.11	—	—	—	1.30	1.08
2014	2.67	—	0.38	3.28	2.10	—	—	3.54	3.07	—	—	—	1.28	1.08
2015	3.17	—	0.54	3.28	2.16	—	—	3.58	3.13	—	—	—	1.82	1.08

Country:	Italy	Japan	South Korea	South Africa	Netherlands	Norway	Poland	Russia	Spain	Sweden	Switzerland	Turkey	UK	USA
Year														
1990	0.96	1.13	0.50	0.44	1.67	0.60	0.65	—	0.79	0.90	2.00	0.46	0.96	0.58
1991	1.00	1.13	0.63	0.44	1.42	1.15	0.79	—	0.96	0.69	2.00	0.21	0.96	0.88
1992	1.42	1.13	0.63	0.48	1.17	1.33	0.83	—	0.96	1.69	2.00	0.46	0.96	0.63
1993	1.48	1.13	0.69	0.48	1.23	1.19	0.88	0.33	1.02	1.25	2.06	0.46	1.02	0.75
1994	1.48	1.23	0.69	0.48	1.27	0.98	0.88	0.33	1.44	1.29	2.06	0.46	0.81	1.00
1995	1.48	1.31	0.69	0.48	1.27	1.02	0.88	0.33	1.44	1.04	2.06	0.50	0.81	1.17
1996	1.48	1.33	0.75	0.48	1.23	1.02	0.88	0.33	1.56	1.04	2.06	0.50	0.81	1.13
1997	1.56	1.33	0.75	0.48	1.52	1.06	0.88	0.52	1.56	1.04	2.06	0.50	0.81	1.17
1998	1.56	1.33	0.75	0.52	1.56	1.06	0.92	0.52	1.73	1.25	2.06	0.50	0.81	1.21
1999	1.56	1.52	0.81	0.48	1.52	1.02	0.92	0.52	2.06	1.21	2.06	0.50	0.81	1.21
2000	1.48	1.58	0.81	0.44	1.35	1.15	0.92	0.52	2.15	2.15	1.94	0.65	0.94	1.17
2001	1.35	1.58	1.10	0.44	1.74	1.10	1.19	0.52	2.19	2.06	1.94	0.65	0.94	1.17
2002	1.35	1.58	1.10	0.44	1.78	1.67	1.19	0.52	2.19	2.58	1.94	0.69	1.10	1.30
2003	1.42	1.65	2.02	0.44	2.20	1.42	1.19	0.65	2.19	2.43	1.94	0.69	1.73	1.30
2004	1.49	1.90	2.33	0.44	1.90	1.42	1.27	0.65	2.75	2.75	1.69	0.88	1.73	1.05
2005	2.22	1.67	2.90	0.40	2.80	1.88	2.13	0.65	2.96	2.71	2.38	0.83	2.23	1.09
2006	2.72	1.63	2.96	0.52	2.80	2.13	2.26	0.65	2.96	3.03	2.13	1.50	2.29	2.13
2007	2.34	1.69	2.96	0.52	2.64	2.05	2.08	0.65	2.75	2.70	2.13	1.50	1.95	2.34
2008	2.6	1.69	3.38	0.48	3.23	2.34	2.26	0.60	2.70	2.92	2.67	1.50	2.40	2.47
2009	2.73	1.73	3.52	1.52	3.69	3.19	2.96	0.60	3.00	3.34	3.19	1.54	2.58	2.93
2010	2.84	2.03	3.52	1.75	4.13	3.19	2.96	0.60	2.72	3.09	3.33	2.06	3.62	2.68
2011	2.79	2.96	3.44	1.71	3.51	3.19	2.96	0.60	2.85	3.23	3.29	2.21	3.47	2.47
2012	2.77	3.50	2.63	0.71	3.63	3.26	2.58	0.60	2.22	3.10	3.29	1.83	3.29	3.17
2013	3.21	3.08	2.70	0.71	—	—	—	0.85	—	—	—	1.92	3.77	2.67
2014	3.21	3.08	2.74	0.71	—	—	—	0.85	—	—	—	1.92	3.72	2.58
2015	3.28	3.17	3.07	0.71	—	—	—	0.92	—	—	—	1.92	3.83	2.69

Table A.2
Extension of Table 4

	Panel A: Without US Firms				***Panel B: With US Firms***			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EPS	0.105**	0.132***	0.124***	0.070*	0.203***	0.200***	0.198***	0.194***
	(2.48)	(3.25)	(2.90)	(1.78)	(4.33)	(4.67)	(4.18)	(4.84)
Borrower Characteristics								
Firm Size		0.122**				0.070		
		(2.24)				(1.48)		
Operating Profit		-1.722***				-2.061***		
		(-9.36)				(-18.54)		
Leverage		0.674***				0.651***		
		(8.46)				(24.80)		
Asset Tangibility		-0.258***				-0.264***		
		(-3.92)				(-7.58)		
Loan Characteristics								
Loan Amount			-0.000				-0.001	
			(-0.77)				(-1.54)	
Loan Maturity			0.098***				-0.046**	
			(4.27)				(-1.97)	
Term Loan			0.469***				0.118**	
			(3.79)				(2.55)	
Country Characteristics								
GDP growth%				-0.031***				-0.004
				(-2.86)				(-0.30)
Inflation Rate				0.020***				0.020***
				(3.29)				(2.88)
Political Stability				-0.237**				-0.385***
				(-2.51)				(-4.87)
Anti-Corruption				-0.184				-0.199*
				(-1.57)				(-1.78)
Constant	4.711***	4.597***	3.769***	6.013***	5.010***	4.947***	5.070***	5.424***
	(38.82)	(32.44)	(16.03)	(21.02)	(97.49)	(101.41)	(46.43)	(27.29)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,347	6,297	6,101	5,851	42,630	42,246	41,063	35,131
Adj. R^2	0.517	0.550	0.526	0.491	0.352	0.436	0.359	0.358

In this table, we regress loan spread on EPS without including the control variables and sequentially add them, building up to the specification reported in Table 4.

Table A.3
Extension of Table 5

	Panel A: Without US Firms				***Panel B: With US Firms***			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	-0.293***	-0.256**	-0.304***	-0.324***	-0.655***	-0.586***	-0.641***	-0.527***
	(-2.66)	(-2.15)	(-2.75)	(-2.72)	(-13.29)	(-13.56)	(-13.40)	(-8.28)
Post	0.629***	0.729***	0.669***	0.411***	0.348***	0.421***	0.372***	0.245***
	(4.85)	(4.89)	(3.68)	(3.39)	(26.18)	(34.13)	(25.21)	(5.33)
Treated*Post	0.348***	0.329***	0.361***	0.239***	0.524***	0.466***	0.517***	0.438***
	(6.10)	(5.67)	(6.13)	(3.64)	(8.36)	(7.73)	(8.27)	(8.01)
Borrower Characteristics								
Firm Size		0.117**				0.075		
		(2.11)				(1.47)		
Operating Profit		-1.718***				-2.062***		
		(-9.17)				(-18.60)		
Leverage		0.634***				0.642***		
		(8.19)				(24.34)		
Asset Tangibility		-0.244***				-0.251***		
		(-3.69)				(-7.24)		
Loan Characteristics								
Loan Amount			-0.000				-0.001	
			(-0.87)				(-1.55)	
Loan Maturity			0.100***				-0.044*	
			(4.37)				(-1.85)	
Term Loan			0.413***				0.111**	
			(3.07)				(2.38)	
Country Characteristics								
GDP growth%				-0.029***				-0.007
				(-2.75)				(-0.62)
Inflation Rate				0.020***				0.021***
				(3.31)				(3.18)
Political Stability				-0.122				-0.232***
				(-1.27)				(-3.31)
Anti-Corruption				-0.101				-0.100
				(-0.84)				(-1.01)
Constant	4.938***	4.835***	4.075***	5.520***	5.128***	5.062***	5.183***	5.456***
	(34.20)	(30.41)	(15.30)	(18.92)	(120.86)	(125.04)	(50.29)	(29.96)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,347	6,297	6,101	5,851	42,630	42,246	41,063	35,131
Adj. R^2	0.522	0.554	0.531	0.493	0.356	0.439	0.363	0.361

In this table, we estimate our DiD model without including the control variables and sequentially add them, building up to the specification reported in Table 5.

Table A.4

EPS and Cost of Bank Loans Using Matched Sample

	Without US firms		With US firms	
	Top-Bottom 20%	Top-Bottom 30%	Top-Bottom 20%	Top-Bottom 30%
EPS	2.979***	0.210*	0.116*	0.122**
	(4.23)	(1.96)	(1.73)	(2.55)
Borrower Characteristics				
Firm Size	0.323	-0.459*	-1.143***	-0.348***
	(0.55)	(-1.81)	(-3.11)	(-4.34)
Operating Profit	-0.094	-1.129**	-2.647***	-2.692***
	(-0.11)	(-2.13)	(-5.84)	(-10.47)
Leverage	1.624***	1.508***	0.564***	0.614***
	(3.05)	(6.49)	(7.08)	(10.73)
Asset Tangibility	0.039	-0.137	-0.231***	-0.254***
	(0.08)	(-0.64)	(-4.07)	(-3.06)
Loan Characteristics				
Loan Amount	-0.054*	0.002	-0.045	-0.011
	(-1.87)	(1.65)	(-1.23)	(-0.94)
Loan Maturity	0.176	0.145***	0.005	-0.044
	(1.63)	(3.01)	(0.10)	(-1.14)
Term Loan	0.410	0.522**	0.050	0.084
	(1.53)	(2.48)	(0.27)	(0.73)
Country Characteristics				
GDP growth%	-0.068	-0.013	-0.025	-0.055***
	(-0.82)	(-0.31)	(-1.01)	(-3.04)
Inflation Rate	-0.203	0.096**	0.055***	0.064***
	(-1.31)	(2.02)	(3.05)	(4.70)
Political Stability	0.605	0.056	-0.493***	-0.249**
	(0.56)	(0.25)	(-3.36)	(-2.34)
Anti-Corruption	0.754	-0.184	-0.426**	-0.195
	(0.37)	(-0.55)	(-2.27)	(-1.25)
Constant	-9.703**	3.548***	6.162***	5.857***
	(-2.29)	(4.82)	(16.96)	(19.98)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes
Observations	423	1,349	8,725	17,781
Adj. R^2	0.735	0.658	0.529	0.502

While these environmental regulations are imposed on firms by governments and in that sense can be viewed as exogenous to companies, an argument can be made that firms in countries that make their environmental regulations more stringent might be fundamentally different from others, and therefore we may face selection bias. To address this concern, in the spirit of propensity score matching, we conduct our analysis on a matched sample. Using a set of observable covariates, including cash, FCF, sales growth, firm size, leverage, 2 digit industry SIC code, market to book ratio, firm age, dividend dummy, R&D, and operating profit, we matched firms associated with EPS scores in the top 30th and 20th percentiles of EPS distribution with those in the bottom 30th and 20th percentiles. Conducting the analysis on the matched sample, we confirm our earlier finding that stronger environmental regulation is associated with a higher cost of bank loans (results reported in Appendix E). Matching variables include cash, FCF, sales growth, asset size, leverage, industry, market-to-book ratio, age of the company, dividend, R&D, and operating cash flow. We use a logit model for our matching and then use the matched sample to conduct our analysis and verify previous results.

Table A.5

Credit Rating: Only US firms	
EPS	0.151***
	(3.73)
Firm Size	-1.299***
	(-3.48)
Operating Profit	-2.578***
	(-9.83)
Leverage	0.790***
	(6.55)
Asset Tangibility	0.667**
	(2.41)
Cash	1.078***
	(4.63)
Market/Book	0.000
	(0.09)
Political Stability	-0.145***
	(-3.86)
Constant	4.362***
	(34.99)
Year FE	Yes
Industry FE	Yes
Firm FE	Yes
SE Cluster	Firm
Observations	11,077
Adj. R^2	0.854

Dependent variable is credit rating index for U.S. firms that ranges from 1(highest rating quality) to 9(lowest rating quality). Definitions of all control variables are provided in Appendix A. Year, industry, and country dummies are included but not reported for brevity. The numbers in parentheses are *t*-statistics. Standard errors are clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A.6

	Financial Constraint without Oil & Gas			
	Without US Firms		***With US Firms***	
	High	Low	High	Low
EPS	0.179***	-0.028	0.224***	0.037
	(4.31)	(-0.49)	(5.83)	(0.77)
Borrower Characteristics				
Firm Size	0.061	-0.704**	-0.009	-0.761**
	(0.90)	(-2.45)	(-0.18)	(-2.56)
Operating Profit	-1.334***	-2.329***	-1.793***	-2.838***
	(-5.02)	(-5.24)	(-17.19)	(-15.34)
Leverage	0.647***	0.716***	0.569***	0.275***
	(7.07)	(4.61)	(19.23)	(7.21)
Asset Tangibility	-0.153	-0.244**	-0.198***	-0.052
	(-1.64)	(-2.38)	(-7.12)	(-0.88)
Loan Characteristics				
Loan Amount	-0.000	-0.002	-0.000	-0.005**
	(-0.07)	(-1.25)	(-0.76)	(-2.24)
Loan Maturity	0.087***	0.120***	-0.029	-0.009
	(3.25)	(3.14)	(-1.30)	(-0.30)
Term Loan	0.708***	0.248**	0.176***	0.228***
	(3.04)	(2.17)	(3.52)	(2.70)
Country Characteristics				
GDP growth%	-0.039***	-0.025	-0.010	-0.010
	(-3.58)	(-1.50)	(-0.88)	(-0.74)
Inflation Rate	0.026***	0.059***	0.023***	0.052***
	(3.94)	(4.38)	(3.17)	(4.17)
Political Stability	-0.166*	-0.185	-0.378***	-0.192*
	(-1.72)	(-1.27)	(-4.53)	(-1.91)
Anti-Corruption	0.009	-0.133	-0.023	-0.359***
	(0.07)	(-0.62)	(-0.19)	(-2.74)
Constant	4.186***	4.694***	5.209***	5.587***
	(9.06)	(9.83)	(19.53)	(19.26)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Loan Type & Purpose FE	Yes	Yes	Yes	Yes
Observations	3,197	2,037	18,377	13,065
Adj. R^2	0.575	0.548	0.449	0.490
p-value of χ^2 test of Coeff diff		0.00		0.00

This table reports the result of a subsample analysis that excludes Oil & Gas Industry and compares the effect of EPS between firms with high and low financial constraints. All control variables are defined in Appendix A. Year, industry, country, loan type, and loan purpose dummies are included but not reported for brevity. Numbers in parentheses are *t*-statistics computed using standard errors that are clustered at the country-year level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.